Exhibit No.:	
Issues:	*Weather Normalized Sales; Customer Billing; Service Area*
Witness:	*James A. Gray*
Sponsoring Party:	*MO PSC Staff*
Type of Exhibit:	*Direct Testimony*
Case No.:	*GR-99-315*

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

DIRECT TESTIMONY

OF

JAMES A. GRAY

LACLEDE GAS COMPANY

CASE NO. GR-99-315

Jefferson City, Missouri
June 1999

DIRECT TESTIMONY

OF

JAMES A. GRAY

LACLEDE GAS COMPANY

CASE NO. GR-99-315

Q. Please state your name and business address.

A. My name is James A. Gray. My business address is P. O. Box 360, Jefferson City, Missouri 65102.

Q. By whom are you employed and in what capacity?

A. I am employed by the Missouri Public Service Commission (Commission) as a Regulatory Economist in the Tariffs/Rate Design Section of the Commission's Gas Department.

Q. How long have you been with the Commission?

A. I have been employed with the Commission for nineteen years.

Q. Please state your educational background.

A. I received a Bachelor of Science degree in Psychology as well as one in General Studies from Louisiana State University, and I received a Master of Science degree in Special Education from the University of Tennessee. Additionally, I completed several courses in research and statistics at the University of Missouri - Columbia.

Q. Please state your professional qualifications.

A. Prior to being employed by the Commission, I was a Research Analyst for two and a half years with the Missouri Department of Mental Health where I conducted

statistical analyses. In 1980, I began my employment with the Commission as a Statistician in the Depreciation Department where I prepared studies and submitted testimony regarding depreciation rates, trended original cost, and trended original cost less depreciation.

Beginning in 1989 as a member of the Economic Analysis Department, I have submitted testimony on weather normalized sales for natural gas, water, and electric utilities. In addition, I have reviewed residential electric load forecasts in electric utility resource plans. The residential electric load forecasts also included detailed end-use studies and marketing surveys.

Since December of 1997, I have been in the Tariffs/Rate Design Section of the Commission's Gas Department where my duties have been to review tariffs and applications of natural gas utilities.

Q. Please list all the cases in which you have submitted prepared, written testimony before this Commission.

A. The cases in which I have submitted prepared, written testimony are enumerated in Schedule 1, attached to my testimony.

Q. What is the purpose of your testimony?

A. My testimony will address the following areas: (1) to support Staff's weather normalized adjustment of natural gas sales for the General Service (GS) rate classes of Laclede Gas Company (Laclede or Company) for the test year ending December 31, 1998; (2) to recommend a minimum statistical sample size for Staff's customer billing review; and (3) identifying and listing the service areas of Laclede to be listed in its tariff.

WEATHER NORMALIZED SALES

Q. What GS rate classes did you study?

A. I studied the GS – residential (RES), GS – commercial (COM), and the GS – industrial (IND) rate classes of Laclede. Staff witness Daniel I. Beck will address the weather normalized sales of Laclede's Large Volume Service (LVS) rate class.

Q. What divisions and districts of Laclede did you study?

A. I studied four Laclede divisions which consist of the Laclede Division, Missouri Natural Division, Midwest Division, and the St. Charles Division. In addition, I studied Missouri Natural's Franklin County District separately from Laclede's four divisions, allowing me to analyze five district/division combinations.

Q. Please identify the Staff witnesses who utilized the results of your weather adjusted volumes.

A. I provided the results of my weather normalized sales volumes to Staff witness Henry E. Warren, PhD for his allocation of the weather normalized sales to the rate blocks, to Staff witness Daniel I. Beck, for his cost-of-service and rate design studies, and to Staff witness Arlene S. Westerfield of the Commission's Accounting Department, for her customers' growth annualization and revenue calculations.

Q. Why is it important to adjust test year natural gas sales for normal weather?

A. Since rates are based on natural gas usage during the test year, it is important to remove the influence of abnormal weather. If natural gas usage levels reflect the influence of abnormal weather, rates will be distorted by these deviations from normal weather conditions during the test year.

Weather sensitive natural gas sales increase during colder weather, because of space heating and, somewhat, because of water heating. In Missouri, the space heating season is usually from mid-November through mid-March. My adjustments to test year sales set the test year natural gas volumes at the levels that would be experienced under normal weather conditions.

Q. How does your analyses adjust test year weather sensitive sales if the test year is warmer or colder than normal?

A. If the test year is warmer than normal, weather adjusted natural gas sales for the test year would be increased to reflect a normal year. Conversely, if the test year is colder than normal, weather adjusted natural gas sales for the test year would be decreased to reflect a normal year. Thus, my weather normalized sales volumes adjust the test year natural gas sales to normal weather conditions.

Q. What weather data for the test year did you use in your analyses?

A. Staff witness Dennis Patterson provided me with daily actual and daily normal heating degree days(HDD) for air temperatures as well as HDD for water heating degree days (WHDD) temperatures. Mr. Patterson's testimony discusses the calculations of HDD and WHDD.

Q. What volumetric measure of natural gas usage did you use in your analyses?

A. Laclede provided all natural gas volumes in therms.

Q. What is a therm of natural gas?

A. A therm is 100,000 British thermal units (Btu), which is the quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit. A therm is approximately one hundred cubic feet (Ccf) of natural gas.

Q. What is the source of your test year billed natural gas usage data?

A. Laclede provided monthly natural gas sales in therms and numbers of customers for each billing cycle, by rate class and division for the test year. Also, Laclede provided me with separate billing cycle data for Missouri Natural Division's Franklin County District.

Q. What is a billing cycle?

A. The Company schedules groups of customers' natural gas meters to be read at intervals, approximately every thirty days (a billing month). Since there are approximately twenty-one working days in a month, customers are usually grouped into one of twenty-one billing cycles.

The number of days between meter readings varies among the billing cycles within a billing month. Moreover, individual billing cycles may exhibit month to month variations in the number of days between scheduled meter readings, due to holidays and variations in the number of days and weekdays of the test year's calendar months.

Schedule 2, attached to this testimony, shows how the twenty-one billing cycles' scheduled meter reading dates are staggered for the billing month of February 1998. The billing month of February starts on February 6, 1998, and ends March 9, 1998.

Q. What steps are involved in adjusting natural gas volumes for normal weather?

A. My weather normalization analyses consists of two steps. The first step is the subtraction of natural gas volumes for water heating from total test year natural gas volumes. The second step is the analysis of the remaining test year natural gas volumes for space heating usage.

Q. What Staff analyses did you use to subtract water heating usage from total test year natural gas volumes?

A. Dr. Warren studied the relationship between natural gas usage for water heating and WHDD. Dr. Warren also estimated that Laclede's RES customers use 0.01159 therms for a change of one WHDD and COM customers use 0.04590 therms for a change of one WHDD.

Dr. Warren's studies did not sample IND customers. So, I used the results of his study of COM customers for Laclede's IND customers. In my opinion, the water heating characteristics of the IND customers would be closer to the COM customers rather than the water heating characteristics of the RES customers.

To estimate RES test year natural gas water heating usage, I multiplied Dr. Warren's estimated 0.01159 times Mr. Patterson's daily average WHDD and the number of customers for each billing cycle of the test year. To estimate the COM and IND test year natural gas water heating usage, I used the same formula, but instead of multiplying by 0.01159, I used Dr. Warren's estimated 0.04590 therms per WHDD which applied to COM customers. These calculations estimated natural gas water heating usage in therms for the test year.

Then I subtracted the estimated water heating usage from total test year natural gas volumes. The subtraction removed the estimated water heating natural gas usage from the test year natural gas volumes, allowing me to study the space heating natural gas volumes separately. After I studied and normalized space heating natural gas volumes separately, I added the normalized natural gas usage for space heating and the normalized

natural gas usage for water heating together again for my total estimated weather normalized natural gas sales for the test year.

Q. Once you removed estimated water heating natural gas volumes from total test year volumes, how did you go about analyzing space heating natural gas volumes for the test year?

A. For my analyses, I calculated two sets of twelve billing month averages by district/division and by rate class. One set of these averages was daily average natural gas usage in therms and another set was daily average HDD. The billing month averages were calculated from the data on numbers of customers, natural gas usage in therms, and summed HDD from approximately twenty-one billing cycles for each billing month by district/division and by rate class.

Q. Why did you sum Mr. Patterson's daily HDD by billing cycle?

A. The Company's customer billing records are based on a billing cycle. The Company records contain scheduled meter reading dates, numbers of customers, and natural gas usage in therms for each billing cycle.

So, I summed the daily HDD for the dates encompassing each billing cycle. This allowed me to match the daily HDD by billing cycle with the Company's customer billing records.

I also provided the summed HDD by billing cycle to Mr. Beck for his weather normalization of the Large Volume Service (LVS) rate classes. Therefore, Mr. Beck and I used the same summed HDD by billing cycle for the test year.

Q. How does the twelve billing month weighted averages of HDD reflect different customer levels among the different billing cycles throughout the test year?

A. The numbers of customers in each billing cycle in the test year were used to weight the billing month daily average HDD. Therefore, the billing cycles with the most customers contributed the most to the billing month daily average HDD.

Schedule 3, attached to this testimony shows the number of customers, therms used, and HDD for the billing month of February 1998 for Laclede Division's COM customers. Note that the customer numbers vary from 967 for billing cycle number 18 to 2,623 customers for billing cycle number 1. Also, the HDD vary from 677.5 for billing cycle number 9 to 966 HDD for billing cycle number 2. This shows that there are significant differences between billing cycles within a billing month. This demonstrates the need to carefully average the HDD for the billing months of the test year.

Q. How did you average billing month usage in therms?

A. I calculated twelve values representing daily usage per customer for each month of the test year, ending December 31, 1998. I divided each cycle's usage by the number of customers and the number of days in each billing cycle. This reflects natural gas usage for a billing cycle on a daily basis. Therefore, all billing cycles in a billing month are equated regardless of the variations in the number of days between meter readings among the billing cycles within a billing month. Then I averaged each billing cycle's daily usage per customer over each billing month.

Q. How did you quantify the response of natural gas sales to HDD?

A. My studies estimated the change in usage in therms to a change in HDD based on the two sets of twelve monthly billing month averages of average daily usage in therms per customer and the customer weighted average daily HDD. These two sets of

billing month averages (usage and weather) were used to study the relationship between colder weather and space heating natural gas usage in therms.

I used regression analysis to estimate the relationship for each of the GS rate classes in Laclede's four divisions and the Franklin County District. Regression analysis describes the relationship between daily space heating sales per customer in therms to the daily HDD.

Q. What are advantages to using regression?

A. The main advantage is that regression is easily understood and interpreted. Regression develops quantitative measures that describe relationships.

The regression equation calculates a straight line that best fits the relationship. The slope of the best fitting straight line estimates a change in the daily natural gas usage per customer whenever the daily average HDD change one HDD. For example in my analyses, the slope of the best fitting regression line for Laclede Division's RES is 0.147858. This means that for every change of one HDD, that a Laclede Division RES customer's estimated usage will change approximately 0.147858 therms per day.

Also, regression calculates a measure of the goodness of fit. The measure is an *r squared* (r^2). The r^2 ranges from 0.00 to 1.00, with 1.00 being a perfect fit.

Q. How closely did your regression results match actual average daily natural gas sales per customer for the billing months in the test year?

A. Schedules 4-1 through 4-5, attached to this testimony, show the regression lines and each billing month's actual average daily natural gas sales per customer plotted against the billing month's actual average daily HDD. The steeper the slopes of the

regression lines, the greater the estimated change in space heating usage in therms for a change of one HDD.

The plots demonstrate that the regression lines fit the data very closely. Moreover, all of Staff r^2 *values* were above 0.8844, which also indicates a good fit.

Q. Up to this point, is your daily estimated usage therms based on any normal values?

A. No, the estimated daily usage per therm per customer was based on actual HDD and the actual number of days in each billing cycle for the test year. I used the estimated relationship between HDD and space heating usage in therms to adjust the test year actual HDD to the normal HDD provided to me by Mr. Patterson.

For the estimated water heating daily usage, I used the estimated relationship between WHDD and water heating usage in therms, developed by Dr. Warren, to adjust test year actual WHDD to the normal WHDD provided to me by Mr. Patterson.

Q. How did you adjust monthly natural gas volumes to normal?

A. The first step is to equalize each billing cycle's annual total normal HDD and WHDD over the test year. I added or subtracted a few days to make each billing cycle normally have 365 days, the number of calendar days in the test year. The adjustments set each billing cycle to the same number of normal HDD and WHDD. Failure to equalize the normal HDD and WHDD in the test year, will result in some billing cycles having the wrong annual or total number of normal HDD and WHDD for the test year.

Once each billing cycle has the proper normal HDD and WHDD, the next step is to calculate each billing cycle's differences between normal and actual (normal - actual) for HDD and WHDD. For my analyses of estimated space heating usage, the differences

are multiplied times the appropriate estimate from the regression results. For water heating usage, the differences between normal and actual WHDD, are multiplied times one of Dr. Warren's estimates.

The resulting billing cycles' adjustments were summed for each billing month. Then the monthly adjustments in therms were added to total monthly natural gas sales for the test year. Therefore, my adjustment to test year sales included a water heating adjustment based on the studies of Dr. Warren and a space heating adjustment based on my studies.

Q. Was the weather adjustment for test year space heating the largest adjustment to test year natural gas volumes?

A. Yes, as I stated earlier, test year space heating usage usually predominates.

Q. What were the results of your weather normalized sales studies?

A. My analyses resulted in an increase to test year natural gas sales because the weather during the test year was warmer than normal. My analyses reflect an approximate 16.5 percent increase from actual test year natural gas sales for the GS rate classes. These increases do not include Staff's customers' growth annualization.

Q. Were you able to weather-adjust natural gas sales for all the Company's GS rate classes?

A. No, since the IND customers in the Franklin County District did not exhibit any weather sensitivity, no adjustments for normal weather were made for those customers.

Q. What results did you provide to Ms. Westerfield for her customers' growth annualization and revenue calculations?

A. I provided monthly normalized natural gas usage in therms per customer by district/division and by rate class. These results are contained in Schedule 5, attached to my testimony.

Q. Are your normalized sales stated in daily usage per customer equivalent to what a typical customer would use?

A. No, I did not select typical customers. Laclede provided me with all bills rendered during the test year. The data include partial bills, such as final bills or new customers receiving service in the middle of the month. Also, billing adjustments to a current or prior months are included in the data.

After I calculated weather normalized sales, I divided each billing month's weather normalized sales by each billing month's customer levels. This states my weather normalized volumes on a monthly usage per customer basis. After calculating its customers' growth annualization, the Commission's Accounting Department can multiply its customer levels times my weather normalized sales per customer. Therefore, stating the results of my studies on a monthly per customer basis facilitates calculating total test year weather normalized sales for the test year.

Q. How did you estimate daily peak therms per customer by rate class and by district/division for each month of the test year?

A. Mr. Patterson provided me with thirteen HDD and WHDD calculated from his estimated peak (coldest) day for each month as well as for the test year. I used Mr. Patterson's thirteen values of HDD and WHDD for all Laclede's rate classes in each division or district. Mr. Patterson's testimony discusses how he calculated his estimated peak days.

My regression studies estimated a change in space heating natural gas usage per customer for a change of one HDD. Also, Dr. Warren estimated a change in water heating usage per customer for a change of one WHDD. So, I used Dr. Warren's study results and my studies results to estimate the natural gas usage in therms per customer on the peak (or coldest day) of each month and for the entire year (annual). Schedule 6, attached to this testimony, shows the estimated daily peak natural gas usage in therms per customer by district/division, rate class, and billing month. This information was provided to Mr. Beck.

Q. How did you estimate daily peak natural gas usage in therms per customer by month for IND customers in the Franklin County District that was not weather-adjusted?

A. Since those customers did not exhibit any weather sensitivity, I did not adjust their test year natural gas volumes for Mr. Patterson's estimated peak or coldest day. Therefore, I used the test year actual natural gas usage in therms per customer by billing month as my estimate of daily peak natural gas usage in therms per customer.

STATISTICAL SAMPLING FOR A CUSTOMER BILLING REVIEW

Q. Why does your testimony address statistical sampling?

A. I recommend a minimum sample size to be utilized by Staff to estimate the percentage of natural gas bills read on time and calculated correctly.

Q. Please identify the Staff witness who utilized the results of your recommended sample size.

A. I provided the results of my recommended minimum sample size to Staff witness Thomas M. Imhoff for his natural gas billing review.

Q. Why does the Staff want to use a sample?

A. Laclede renders approximately 820,200 natural gas bills each month and a sample saves time and effort. Due to the large numbers of natural gas customers, it is not feasible to calculate each customer's natural gas bills for the test year..

A properly designed sample can make very reliable estimates for a billing review of Laclede's natural gas bills. Sample size selection is not an exact science, but a scientific basis for estimation. If the sample is properly selected, there is little to be gained by large, extravagant sample sizes.

Q. What is the major objective of any survey sample?

A. It is to secure a representative sample. The sample should be selected in such a manner that the sample has approximately the same characteristics of the population relevant to the research in question. Then the sample can be used to make an estimate (inference) about the characteristics of the total number of Laclede's natural gas bills.

Q. What is the difference between the statistics you used in reporting your weather adjusted sales for the test year and these sampling statistics?

A. The statistics that I used in my weather normalized sales described (descriptive statistics) the conditions that existed during the test year. Whereas in inferential statistics, an inference is made from a sample (part of the population) to the whole population. In my weather normalized sales studies, I did not need individual billing information and I was able to use readily available billing cycle totals for the test year. No inference was made from a sample to the entire population. Instead I had all the bills (all the population) for the test years readily summed.

The mathematics and assumptions, concerning such things as how the actual points around the regression line are distributed, are less rigorous in descriptive statistics.

For example, descriptive statistics is less concerned with how the actual data points "line up" or scatter around the best fitting regression line.

Q. In your opinion, what is usually the most economical, reliable statistical sample?

A. It is a simple random sample.

Q. What is a simple random sample?

A. A simple random sample is with each member of the population, relevant to the research question, having equal probability of being selected. In this type of sampling technique (design), every one of Laclede's natural gas bills should have the same chance of being selected as any other natural gas bill.

If the sample is randomly selected from all of Laclede's natural gas bills, generally approved statistical calculations or techniques can be used on the sample. This is because most statistical theories and techniques rely upon the simple mathematical properties of a simple random sample.

Q. Generally what determines the desired sample size?

A. The sample size depends upon the similarity (homogeneity) in some relevant characteristics of the company's natural gas bills for the test year. The more similar (homogeneous) the company's natural gas bills are, the smaller the sample size required. That is, the recommended sample size generally depends upon the homogeneity of all of the Company's natural gas bills. This means that if the similarity of the natural gas bills do not change and the number of actual customers were doubled or tripled instantly, my recommended sample size would not change.

Q. How was the sample drawn from Laclede's billing records?

A. Laclede's billing system lists each customer by a customer number. The customer numbers are consecutive from 1 to 820,200. Mr. Imhoff used a random number generating function from Excel to generate two random sample sizes for the months of December 1998 and February 1999. Therefore, the customer numbers were randomly drawn from the customer numbers for those two months of the test year.

Q. Was Staff's objective to sample certain months of the test year?

A. Yes, Staff has requested a purposive sample by choosing certain months, December 1998, and February 1999. The sample results can only be used to estimate the total natural gas bills for the chosen, purposive months.

Q. Did Mr. Imhoff select equal number of customers from each selected month?

A. Yes, Staff wanted to split the sample size in half and randomly select the same number of customers from each month. This is a proportional random sample with half of the sample being drawn from December 1998 and with the other half of the sample being drawn from the customer numbers in February 1999.

Q. How is Staff gaining access to the sample data for its natural gas billing review?

A. Laclede was instructed to furnish the natural gas billing information for those selected customer numbers and months for Mr. Imhoff's natural gas bill review. As each natural gas bill is randomly selected, it is removed from the list, only for the month in which the customer's bill was selected, and another natural gas bill is randomly selected. This selection process is a simple random sample without replacement.

Q. Is it important to determine what type of information Staff wants to sample from all of Laclede's natural gas bills?

A. Yes, there are different mathematical calculations or formulae for estimating a number or characteristic from a sample versus an estimate of the percentage or proportion of the sample having their bills calculated correctly.

Q. Does Staff want to estimate the percentage of the customer bills?

A. Yes, Staff wants to ascertain if a customer's bill is calculated either correctly or incorrectly. It is a twofold (binomial for a large sample size) population of customer bills since there are only two possibilities. From the percentage of customers in a sample having their bills calculated correctly, an estimate (inference) can be made about all the percentage of the Company's natural gas bills that have received correctly calculated bills.

Q. Were any prior studies to estimate the percentage of RES customers who had their RES natural gas bills calculated correctly?

A. Yes, Staff has conducted two reviews of Laclede's RES natural gas bills. On March 18, 1998, Staff released a RESIDENTIAL GAS BILL REVIEW. That report utilized a sample size of 1,465 and concluded the following:

> *NOTE: Staff's review consisted of such a small sample number because Laclede did not provide access to its bills except utilizing a company computer. Each bill had to be printed from a company computer screen rather than saved to a computer disk that would have allowed Staff to bring the information back to the office. (RESIDENTIAL GAS BILL REVIEW, page 5)

Because of the concerns stated in that report, I did not give any weight to the results of that RES natural gas billing review. Also, I was unable to determine how the sample in that review was selected. The sample should be a random sample with all RES customers having an equal chance of being selected for each month under review.

Usually to conduct a random sample, the surveyor needs complete access to all RES customer bills so that each customer bill has an equal chance of being included in the sample.

The second Staff review of Laclede's RES natural gas bills was conducted by Mr. Imhoff based on billing data obtained from Laclede in Case No. GR-98-374. In that billing review, Staff calculated that 99% of RES natural gas bills had been read on time and computed correctly and 1%, incorrectly. Laclede had provided Staff with Laclede's randomly selected RES customer bills. Laclede generated the random bills by using a computer selection routine, developed by Laclede, then the selected sample was given to Staff for its review.

In statistics, estimates of sample sizes can be based on information obtained from earlier pilot studies or other solid estimates. I primarily used the percentages from the RES natural gas bill review performed by Mr. Imhoff in Case No. GR-98-374 as a starting estimate to determine my recommended minimum sample size.

Q. Do you recommend that the results of the last sample Mr. Imhoff, in Case No. GR-98-374, analyzed be added to the new, proposed sample?

A. No, the samples are of two different time frames (test years).

Q. Can Staff begin sampling, and then later determine that it "needs" to increase its sample size?

A. No, for the survey to be a valid statistical survey, the surveyor cannot start sampling then calculate some mathematical numbers "along the way" to determine if more bills need to be surveyed. All of my estimates are calculated before any sampling is started.

Q. What sample size considerations should be made about the percentages or proportions?

A. Typically, the largest sample sizes is required when the estimated percentages "correct" and "incorrect" (twofold population) are both near 50%. This is because the relevant population is most dissimilar (inhomogeneous) being split evenly. If one percentage were 85% and the other percentage were 15%, then the relevant population is not split evenly, but it is more similar in one aspect. As I stated earlier, the more similar the population is on the relevant research question, the smaller the sample size required.

Q. What two additional statistical values did you select?

A. I selected two additional values: (1) the percent prediction error and (2) the confidence level. I determined that I was willing to allow Staff's sample to be within 2% (above and below) the true overall average of all customers that have their natural gas bills being computed correctly. This is the percent prediction error, which my sample design would tolerate.

Next, I selected a statistical value representing the 95% confidence level. The 95% confidence level is the one most often chosen in sample design. It is difficult to precisely estimate a value with an extremely high level of confidence. This is because very high confidence levels, for any given sample size, will widely estimate about the true value. Most samples are willing to sacrifice some confidence in order to obtain a closer (narrower) estimate. The 95% confidence level is a good compromise.

Q. Briefly explain how the tolerable percent error and confidence level would qualify or restrict Staff's recommended sample size to estimate the percentage of all customers with correctly calculated natural gas bills?

A. Generally, I am recommending a sample size to select a sample at random from all of Laclede's natural gas customers to estimate the percentage of all customers having their natural gas bills computed correctly with numerical qualifications. These numerical qualifications are that the calculated average sample percentage is within 2% (2% above and 2% below) of all the natural gas customers for the months of December 1998 and February 1999 at a certain calculated level of confidence, e.g., 95%. The 2% is a tolerable percent error or sometimes referred to as an interval of plus or minus 2 above and below the percent obtained from the sample.

For example, if the average sample percentage obtained was 85% and the calculated confidence interval from the sample were plus or minus 2% (+/- 2%) at the 95% confidence level, that would mean that 95% of the time that the true percentage of all customers would be between two percentages. This means that the results from the desired sample size would be expected to be between 83% and 87%, 95% of the time.

Q. Did you perform any studies to verify that Staff's sample achieved the +/- 2% prediction error or the 95% confidence level?

A. No, the statistics are calculated after the sample is actually selected and the mathematical values are calculated. I did not verify that a 95% confidence level was attained. My recommended minimum sample size is only to theoretically achieve an average percentage from Staff's sample that would be within 2% of the true percentage for all Laclede natural gas bills, 95% of the time.

Q. What is your recommended minimum sample size to estimate the percentage of Laclede's correctly calculated natural gas bills?

A. I recommend a minimum sample size of 96. The formulae and derivations of the recommended minimum sample size are in Schedule 7, attached to this testimony.

SERVICE AREAS IN THE TARIFF

Q. How does Laclede's current Commission approved tariff describe Laclede's service areas?

A. P.S.C. MO. No. 5 Consolidated, Second Revised Sheet Nos. 1 and R-1 describe the service areas of Laclede by division. St. Charles Gas Company Division is authorized to provide service to "All Areas and Communities Served in St. Charles County, Missouri." Midwest Missouri Gas Company Division is authorized to provide service to "All Areas and Communities Served in the Northern One-Half of Jefferson County, Missouri." The communities and areas in St. Charles County or Jefferson County are not explicitly described in Laclede's tariff. Schedule 8, attached to this testimony, shows P.S.C. MO. No. 5 Consolidated, Second Revised Sheet No. R-1, which contains the descriptions of Laclede's Commission authorized service area. In my opinion, the most vague descriptions are for St. Charles Gas Company Division followed by Midwest Missouri Gas Company Division.

Q. Briefly describe how Laclede received its Certificates of Public Convenience and Necessity (CCN) for St. Charles County.

A. On April 24, 1964, the Commission in its Report and Order (Order) in Case No. 15,234, granted St. Charles Gas Corporation, predecessor of Laclede, a CCN to serve the unincorporated areas of St. Charles County. The 1964 Order does not define the service territory in metes and bounds.

Q. Are you aware of any problems caused by the vague descriptions of Laclede's Commission authorized service areas?

A. Yes, I have been involved, as a Staff witness, with competing CCN applications filed by Union Electric Company d/b/a AmerenUE (AmerenUE) and Laclede in consolidated Case Nos. GA-99-107 and GA-99-236. Both Commission regulated natural gas utilities filed competing applications to provide natural gas service to unincorporated areas south of the City of Wentzville, Missouri (Wentzville).

Q. In your opinion, how could a problem of overlapping of service areas be minimized?

A. The tariffs of Commission regulated utilities should contain clear descriptions of Commission authorized service areas.

Q. Did you state in your Rebuttal Testimony in Case Nos. GA-99-107 and GA-99-236 that you would address the poor descriptions of Laclede's service areas in its tariff sheets in this rate case?

A. Yes, I stated the following:

> Q. Does Staff plan to address the inadequate description of companies' service territories contained in their current tariff?
> A. Yes, Staff will be reviewing the companies' tariff in future rate cases to insure their service areas are more explicitly defined. (Gray, Rebuttal Testimony in Case Nos. GA-99-107 & GA-99-236, page 19, lines 16-19)

Q. Did Laclede witness Michael R. Spotanski in his Rebuttal Testimony in Case Nos. GA-99-107 and GA-99-236 state that the boundaries of the service areas of AmerenUE and Laclede need to be defined by the Commission?

A. Yes, Mr. Spotanski stated:

> Companies such as Laclede and UE need to know with specificity the boundaries of their respective service areas so that plans may be made and infrastructure developed to meet the requirements without unnecessary, undesirable and expensive duplication of efforts. (Spotanski, Rebuttal Testimony in Case Nos. GA-99-107 & GA-99-236, page 3, lines 19-21)

Q. Why are more precise or clearer service area descriptions necessary?

A. In my opinion, better service area descriptions, as I have recommended in this case would help in reducing confusion about the boundaries of adjoining utilities. I have previously stated the following reasons:

> 1. Safety related issues. If a person notices a gas leak in a neighborhood, that person might not know to which utility to report the gas leak;
> 2. Rate confusion. Neighbors might have different rates for natural gas. This can create confusion to customers regarding rate increases and decreases. That may in turn require additional involvement by the governmental entities involved;
> 3. Construction crews for the city and developers should be able to contact the proper utility for location of facilities (underground, etc.), which could reduce hazards related to construction, and;
> 4. The utilities need to plan their facilities for the future. It may reduce future duplication of facilities and allow both natural gas suppliers to plan their distribution systems in a reasonable and cost-effective manner, knowing that all new customers in the designated areas will be served by one supplier.
> 5. As population growth causes utility boundaries to encroach upon one another, each utility cannot be sure that its investment in facilities will be secure. This inhibits planning for future growth. To insure an orderly, well-planned environment, utility boundaries should be reasonably defined. It may also reduce future territorial disputes. (Gray, Rebuttal in Case Nos. GA-99-107 and GA-99-236, page 16, line 22 to page 17, line 14)

Q. How does the Staff currently prefer the tariff to reflect any explicit definition of a regulated utility's service areas?

A. Staff prefers to have all communities listed by Missouri county along with township, section, and range numbers by Missouri county. Schedules 9-1 and 9-2, attached to this testimony, contain a good example of describing Commission authorized service areas.

Q. Does Staff's recommendations seek to deny Laclede any of its current Commission authorized service area?

A. No, Staff is requesting that Laclede explicitly define its current service areas in order to minimize future territorial disputes. In my opinion, the lack of explicitly defined service areas is a problem that might occur again with population growth and the associated extension of natural gas service to new customers in adjoining service areas.

RECOMMENDATIONS

Q. Would you please summarize your recommendations?

A. Yes, first, I recommend that the Commission utilize the results of my sales volumes adjustments for normal weather including the weather adjusted normalized usage per customer shown in Schedule 5 and my estimated daily usage per customer for peak demand usage shown in Schedule 6, attached to this testimony.

Second, I recommend that the Commission adopt my recommended sample size provided to Mr. Imhoff as being a reasonable minimum sample size to ascertain what percent of Laclede's natural gas bills have been read on time and calculated correctly.

Third, I recommend that Laclede's tariff more explicitly define its Commission authorized service areas, including the following provisos. The tariff's service area descriptions should list all communities served by Company Division or Missouri county. For unincorporated areas, including any rural farm tap customers, the authorized service

areas for each Missouri county should be defined by township, section, and range numbers as depicted on Schedules 9-1 and 9-2. The service area descriptions ordered in Case Nos. GA-99-107 and GA-99-236, should be incorporated into any revision to Laclede's service area descriptions in this case. I recommend that my proposed changes to the service area descriptions in Laclede's tariff sheets nos. 1 and R-1 be completed by February 26, 2000, which is two months after the operational law date in this case.

Q. Does this conclude your Direct Testimony?

A. Yes, it does. However, my Schedules 5 and 6 will be updated to reflect recent revisions by Mr. Patterson and Dr. Steve Qi Hu, a consultant appearing on behalf of the Staff.

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the matter of Laclede Gas Company's Tariff to Revise Natural Gas Rate Schedules	))))	Case No. GR-99-315

AFFIDAVIT OF JAMES A. GRAY

STATE OF MISSOURI)
) ss.
COUNTY OF COLE)

James A. Gray, is, of lawful age, on his oath states: that he has participated in the preparation of the foregoing Direct Testimony in question and answer form, consisting of 25 pages to be presented in the above case; that the answers in the foregoing Direct Testimony were given by him; that he has knowledge of the matters set forth in such answers; and that such matters are true and correct to the best of his knowledge and belief.

James A Gray
JAMES A. GRAY

Subscribed and sworn to before me this 25th day of June 1999.

SHARON S WILES
NOTARY PUBLIC STATE OF MISSOURI
COLE COUNTY
MY COMMISSION EXP. AUG. 23,2002

Sharon S. Wiles
Notary Public

My Commission Expires: _____

Laclede Gas Company

Case No. GR-99-315

Summary of Cases in Which Prepared Testimony Was Submitted by

James A. Gray

Missouri Public Service Company	GR-81-312
Missouri Public Service Company	ER-82-39
Missouri Public Service Company	GR-82-194
Laclede Gas Company	GR-82-200
St. Louis County Water Company	WR-82-249
Missouri Public Service Company	ER-83-40
Kansas City Power & Light Company	ER-83-49
Osage Natural Gas Company	GR-83-156
Missouri Public Service Company	GR-83-186
The Gas Service Company	GR-83-225
Laclede Gas Company	GR-83-233
Missouri Water Company	WR-83-352
Missouri Cities Water Company	WR-84-51
Le-Ru Telephone Company	TR-84-132
Union Electric Company	ER-84-168
Union Electric Company	EO-85-17
Kansas City Power & Light Company	ER-85-128
Great River Gas Company	GR-85-136
Missouri Cities Water Company	WR-85-157
Missouri Cities Water Company	SR-85-158
United Telephone Company of Missouri	TR-85-179
Osage Natural Gas Company	GR-85-183
Kansas City Power & Light Company	EO-85-185
ALLTEL Missouri, Inc.	TR-86-14
Sho-Me Power Corporation	ER-86-27
Missouri-American Water Company, Inc.	WR-89-265 **
The Empire District Electric Company	ER-90-138 **
Associated Natural Gas Company	GR-90-152
Missouri-American Water Company, Inc.	WR-91-211 **
United Cities Gas Company	GR-91-249 **
Laclede Gas Company	GR-92-165 **
St. Joseph Light & Power Company	GR-93-42 **
United Cities Gas Company	GR-93-47 **
Missouri Public Service Company	GR-93-172 **
Western Resources, Inc.	GR-93-240 **
Laclede Gas Company	GR-94-220 **
United Cities Gas Company	GR-95-160 **
The Empire District Electric Company	ER-95-279 **
Laclede Gas Company	GR-96-193 **
Missouri Gas Energy	GR-96-285 **
Associated Natural Gas Company	GR-97-272 **
Union Electric Company	GR-97-393 **
Missouri Gas Energy	GR-98-140 **
Laclede Gas Company	GR-98-374 **
Union Electric Company	GA-99-107
Laclede Gas Company	GA-99-236
St. Joseph Light & Power Company	GR-99-42 **

** Concerns Weather Normalized Sales

Schedule 1

Laclede Gas Company
Case No. GR-99-315

Scheduled Meter Read Dates by Billing Cycle

Applicable to All Rate Classes

February 1998

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 Cycle 18 Read January Billing Month	3 Cycle 19 Read January Billing Month	4 Cycle 20 Read January Billing Month	5 Cycle 21 Read January Billing Month Ends	6 Cycle 1 Read February Billing Month Starts	7
8	9 Cycle 2 Read	10 Cycle 3 Read	11 Cycle 4 Read	12 Cycle 5 Read	13 Cycle 6 Read	14
15	16 Holiday	17 Cycle 7 Read	18 Cycle 8 Read	19 Cycle 9 Read	20 Cycle 10 Read	21
22	23 Cycle 11 Read	24 Cycle 12 Read	25 Cycle 13 Read	26 Cycle 14 Read	27 Cycle 15 Read	28

March 1998

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 Cycle 16 Read February Billing Month	3 Cycle 17 Read	4 Cycle 18 Read	5 Cycle 19 Read	6 Cycle 20 Read	7
8	9 Cycle 21 Read February Billing Month Ends	10 Cycle 1 Read March Billing Month Starts	11 Cycle 2 Read	12 Cycle 3 Read	13 Cycle 4 Read	14
15	16 Cycle 5 Read	17 Cycle 6 Read	18 Cycle 7 Read	19 Cycle 8 Read	20 Cycle 9 Read	21
22	23 Cycle 10 Read	24 Cycle 11 Read	25 Cycle 12 Read	26 Cycle 13 Read	27 Cycle 14 Read	28
29	30 Cycle 15 Read	31 Cycle 16 Read				

Note: February Billing Month Starts February 6, 1998 and ends March 9, 1998

Laclede Gas Company
Case No. GR-99-315

Total Customers, Usage in Therms, and Heating Degree Days by Billing Cycle

Laclede Division's General Service – Commercial

February 1998

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 Cycle 18 Cust = 22,635 Therms = 3,959,769 Heat deg day = 890	3 Cycle 19 Cust = 24,906 Therms = 4,221,916 Heat deg day = 893.5	4 Cycle 20 Cust = 24,439 Therms = 4,007,494 Heat deg day = 910	5 Cycle 21 Cust = 24,523 Therms = 4,144,772 Heat deg day = 917	6 Cycle 1 Cust = 2,623 Therms = 2,147,092 Heat deg day = 916.5	7
8	9 Cycle 2 Cust = 1,719 Therms = 894,593 Heat deg day = 966	10 Cycle 3 Cust = 2,005 Therms = 2,150,923 Heat deg day = 874	11 Cycle 4 Cust = 1,500 Therms = 1,454,338 Heat deg day = 849	12 Cycle 5 Cust = 1,788 Therms = 2,177,480 Heat deg day = 839.5	13 Cycle 6 Cust = 1,031 Therms = 706,315 Heat deg day = 827	14
15	16 Holiday	17 Cycle 7 Cust = 980 Therms = 950,738 Heat deg day = 873	18 Cycle 8 Cust = 967 Therms = 598,774 Heat deg day = 778.5	19 Cycle 9 Cust = 1,257 Therms = 1,261,876 Heat deg day = 766	20 Cycle 10 Cust = 1,261 Therms = 969,251 Heat deg day = 761	21
22	23 Cycle 11 Cust = 1,171 Therms = 1,405,877 Heat deg day = 790.5	24 Cycle 12 Cust = 1,586 Therms = 951,483 Heat deg day = 766.5	25 Cycle 13 Cust = 1,260 Therms = 1,055,853 Heat deg day = 684.5	26 Cycle 14 Cust = 1,588 Therms = 872,218 Heat deg day = 677.5	27 Cycle 15 Cust = 1,152 Therms = 586,436 Heat deg day = 679.5	28

March 1998

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2 Cycle 16 Cust = 1,108 Therms = 770,640 Heat deg day = 739	3 Cycle 17 Cust = 1,454 Therms = 1,155,882 Heat deg day = 745	4 Cycle 18 Cust = 1,359 Therms = 1,077,240 Heat deg day = 708	5 Cycle 19 Cust = 1,258 Therms = 1,018,285 Heat deg day = 708.5	6 Cycle 20 Cust = 1,414 Therms = 1,188,125 Heat deg day = 700.5	7
8	9 Cycle 21 Cust = 1,366 Therms = 969,814 Heat deg day = 751.5	10 Cycle 1 Cust = 2,626 Therms = 1,686,328 Heat deg day = 768.5	11 Cycle 2 Cust = 1,720 Therms = 1,183,120 Heat deg day = 736.5	12 Cycle 3 Cust = 2,008 Therms = 1,748,813 Heat deg day = 763.5	13 Cycle 4 Cust = 1,498 Therms = 1,251,348 Heat deg day = 765.5	14
15	16 Cycle 5 Cust = 1,782 Therms = 2,103,913 Heat deg day = 825	17 Cycle 6 Cust = 1,028 Therms = 686,996 Heat deg day = 813.5	18 Cycle 7 Cust = 977 Therms = 591,085 Heat deg day = 741	19 Cycle 8 Cust = 967 Therms = 495,901 Heat deg day = 741.5	20 Cycle 9 Cust = 1,254 Therms = 1,213,779 Heat deg day = 747.5	21
22	23 Cycle 10 Cust = 1,254 Therms = 925,192 Heat deg day = 797.5	24 Cycle 11 Cust = 1,171 Therms = 1,398,865 Heat deg day = 759.5	25 Cycle 12 Cust = 1,539 Therms = 885,488 Heat deg day = 753.5	26 Cycle 13 Cust = 1,309 Therms = 1,134,554 Heat deg day = 742.5	27 Cycle 14 Cust = 1,590 Therms = 930,758 Heat deg day = 731.5	28
29	30 Cycle 15 Cust = 1,169 Therms = 694,897 Heat deg day = 714.5	31 Cycle 16 Cust = 1,109 Therms = 746,365 Heat deg day = 634.5				

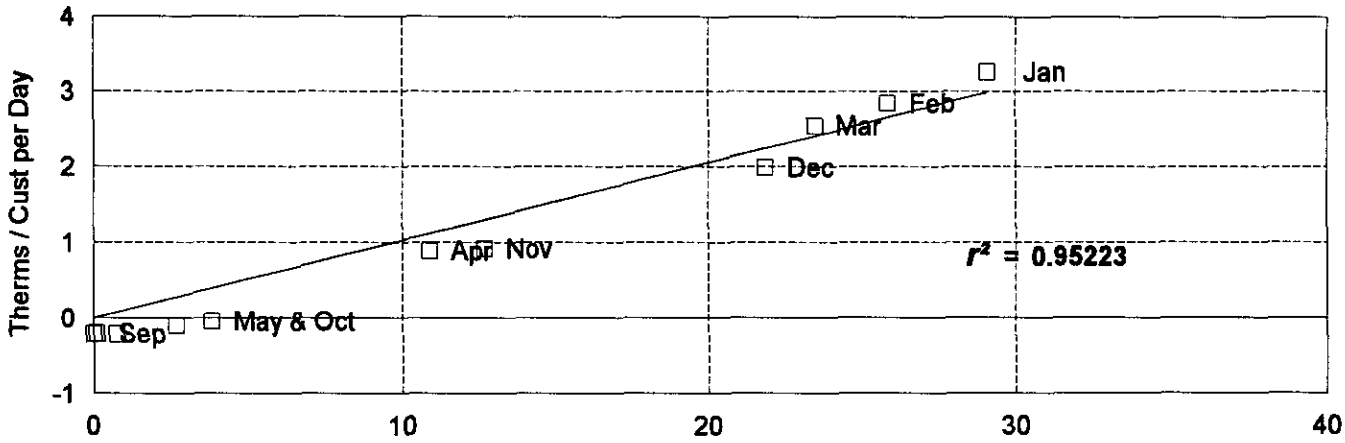
Note: February Billing Month Starts February 6, 1998 and ends March 9, 1998

Laclede Gas Company
Case No. GR-99-315

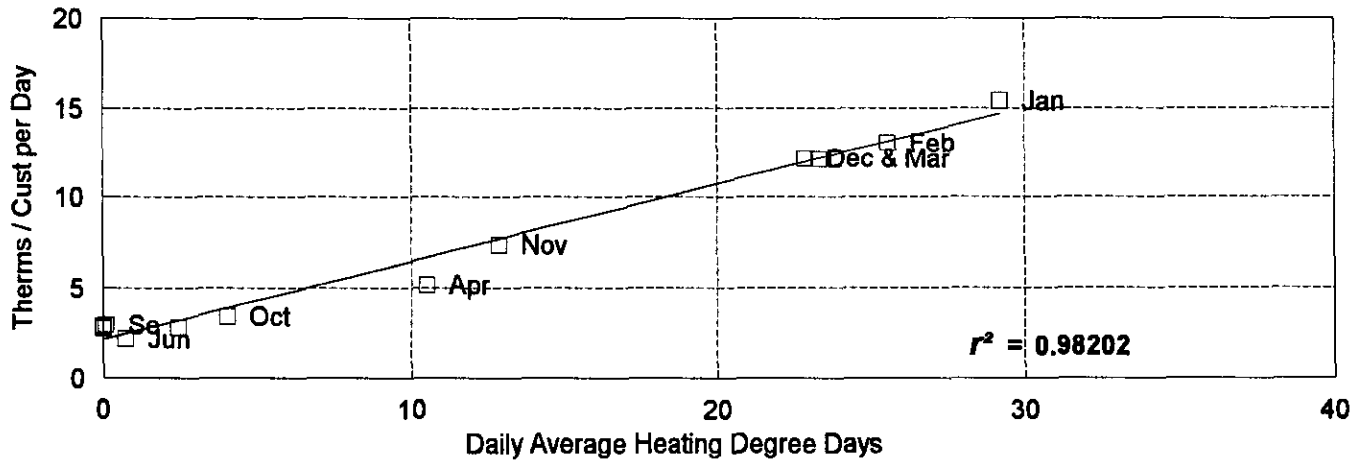
Plots of Billing Month Actual & Estimated Usage vs. Heating Degree Days

Franklin County District

General Service - Residential



General Service - Commercial

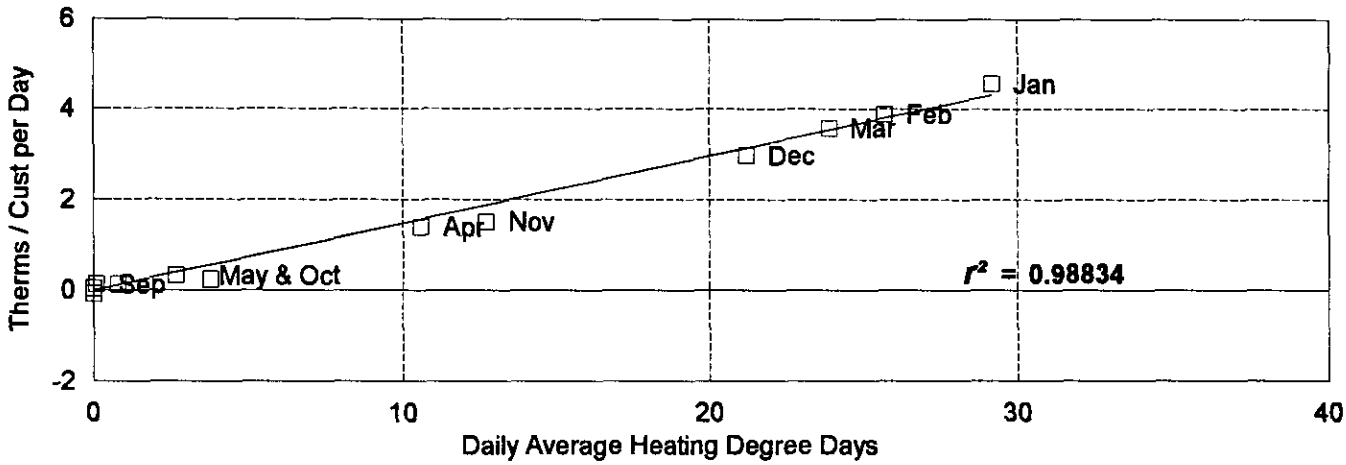


Laclede Gas Company
Case No. GR-99-315

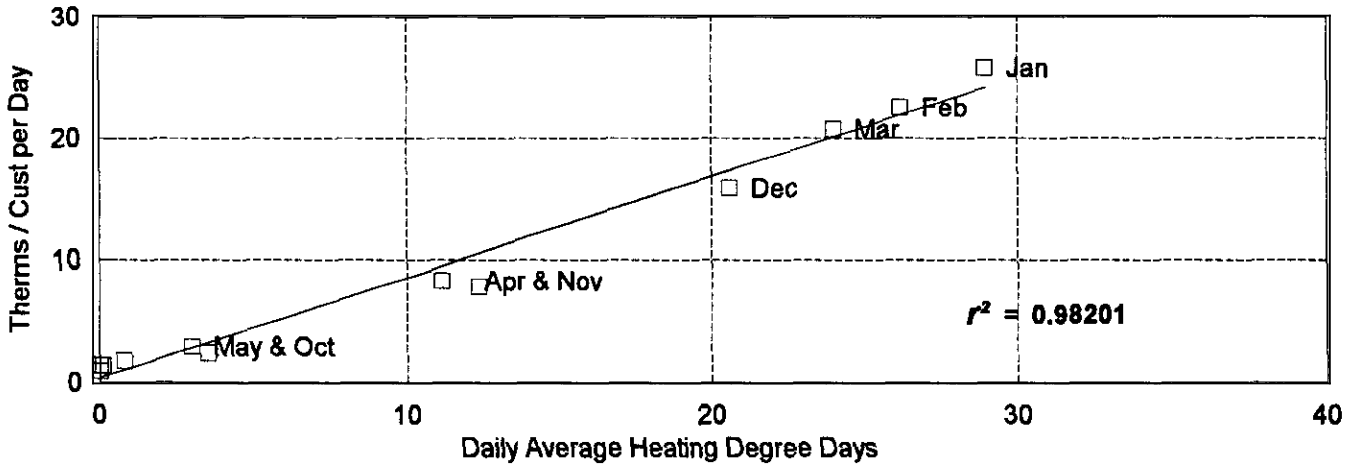
Plots of Billing Month Actual & Estimated Usage vs. Heating Degree Days

Laclede Division

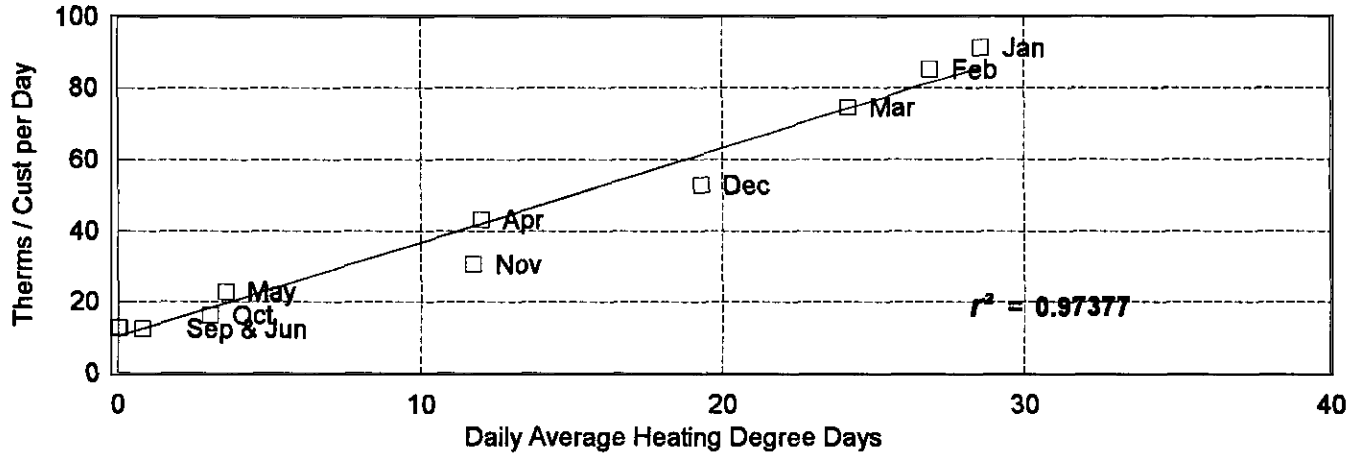
General Service - Residential



General Service - Commercial



General Service - Industrial

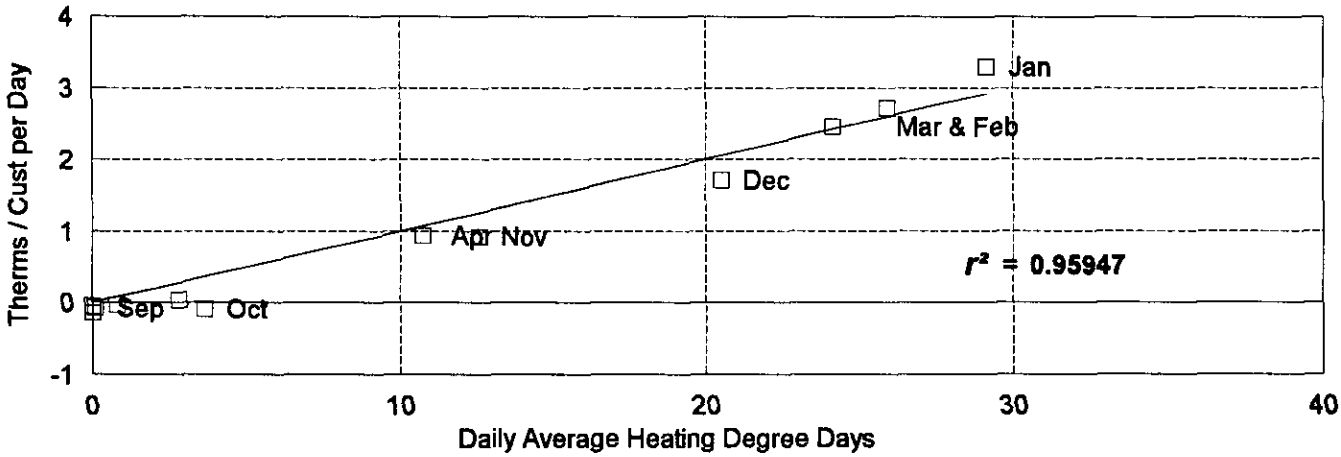


Laclede Gas Company
Case No. GR-99-315

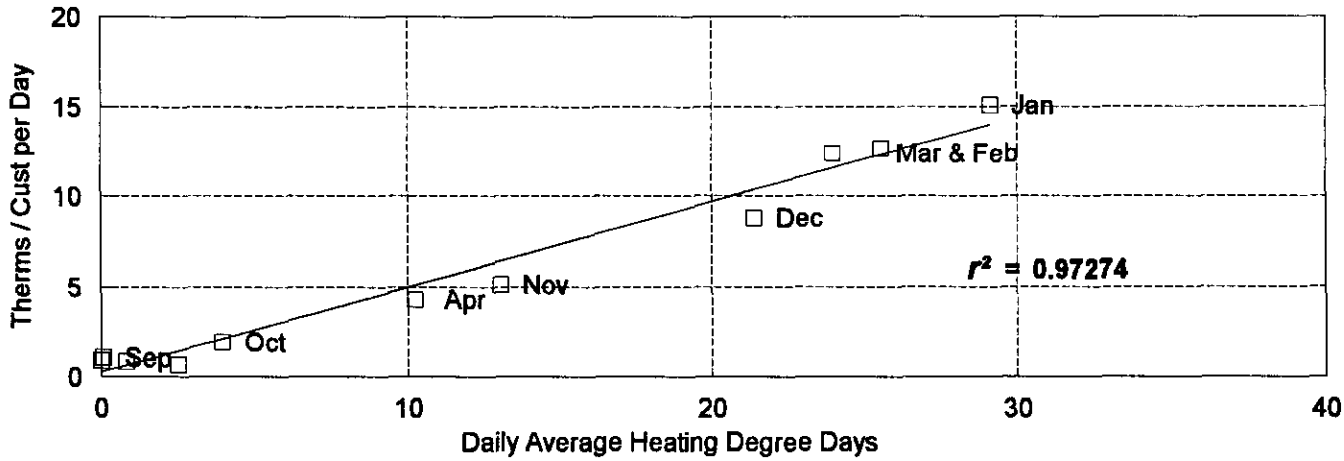
Plots of Billing Month Actual & Estimated Usage vs. Heating Degree Days

Midwest Division

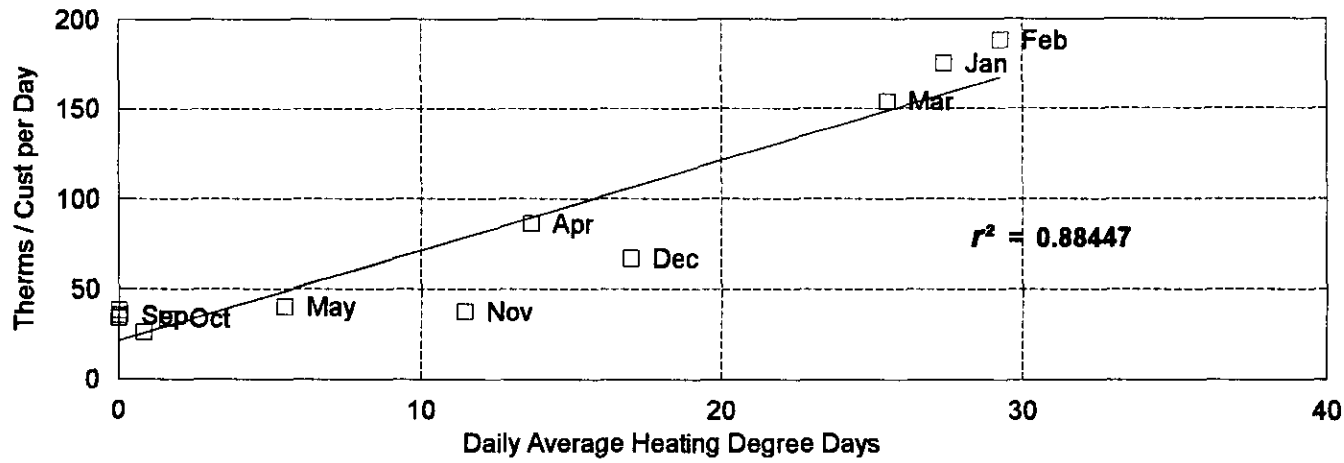
General Service - Residential



General Service - Commercial



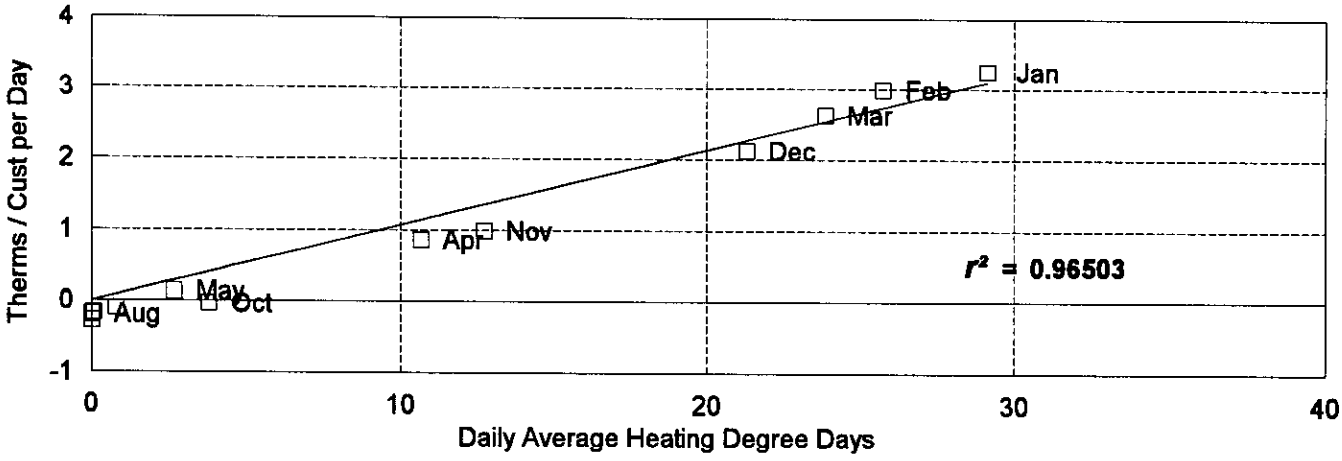
General Service - Industrial



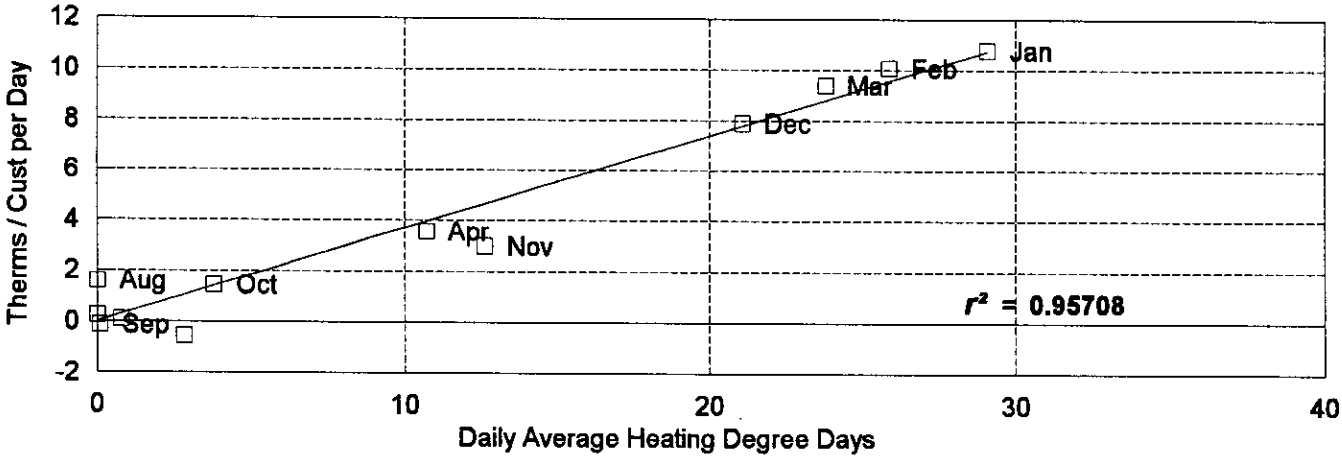
Laclede Gas Company
Case No. GR-99-315

Plots of Billing Month Actual & Estimated Usage vs. Heating Degree Days

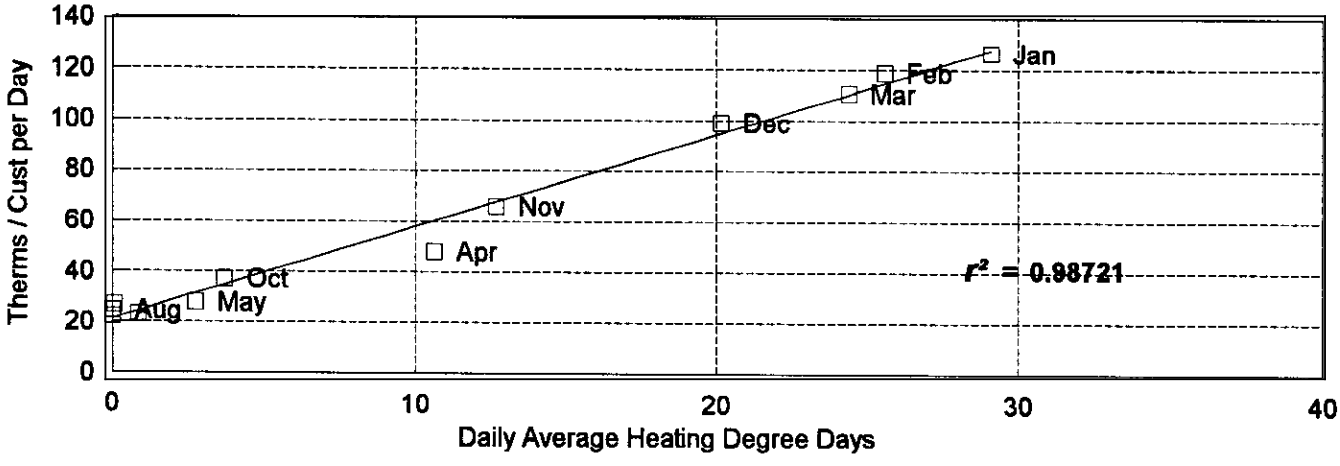
Missouri Natural Division
(Excluding Franklin County District)
General Service - Residential



General Service - Commercial



General Service - Industrial

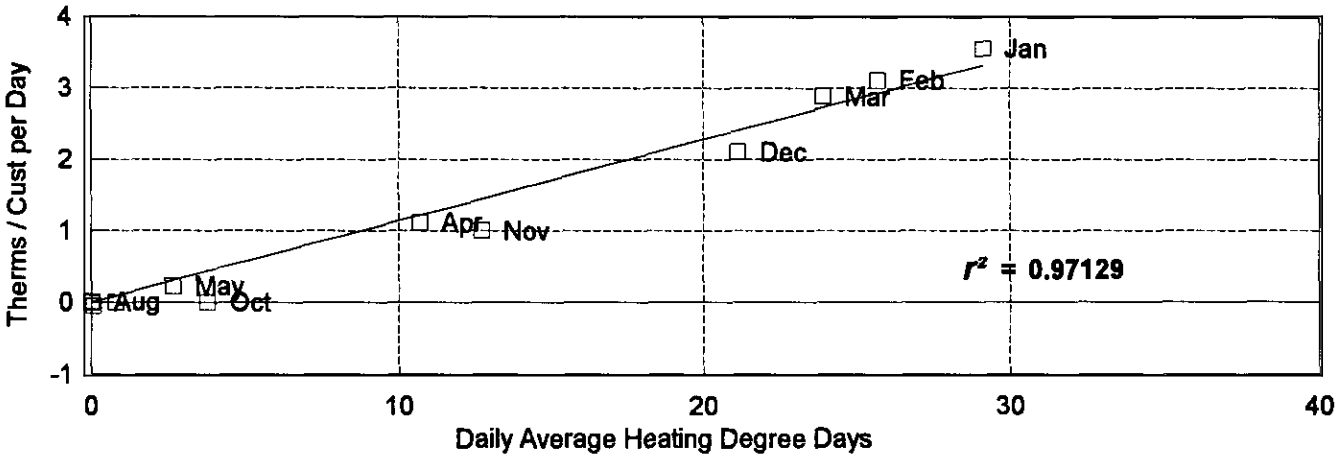


Laclede Gas Company
Case No. GR-99-315

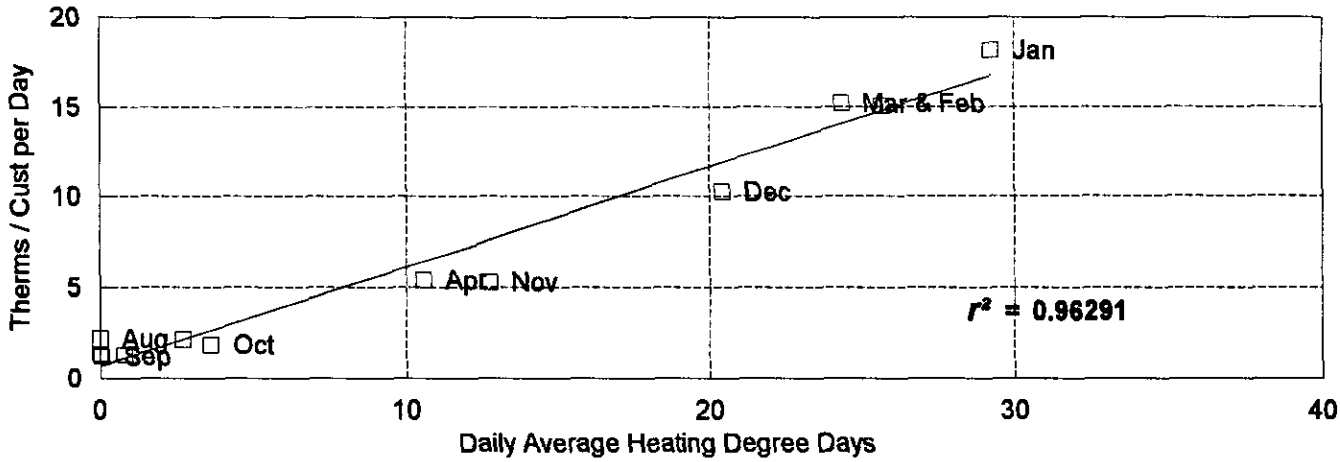
Plots of Billing Month Actual & Estimated Usage vs. Heating Degree Days

St. Charles Division

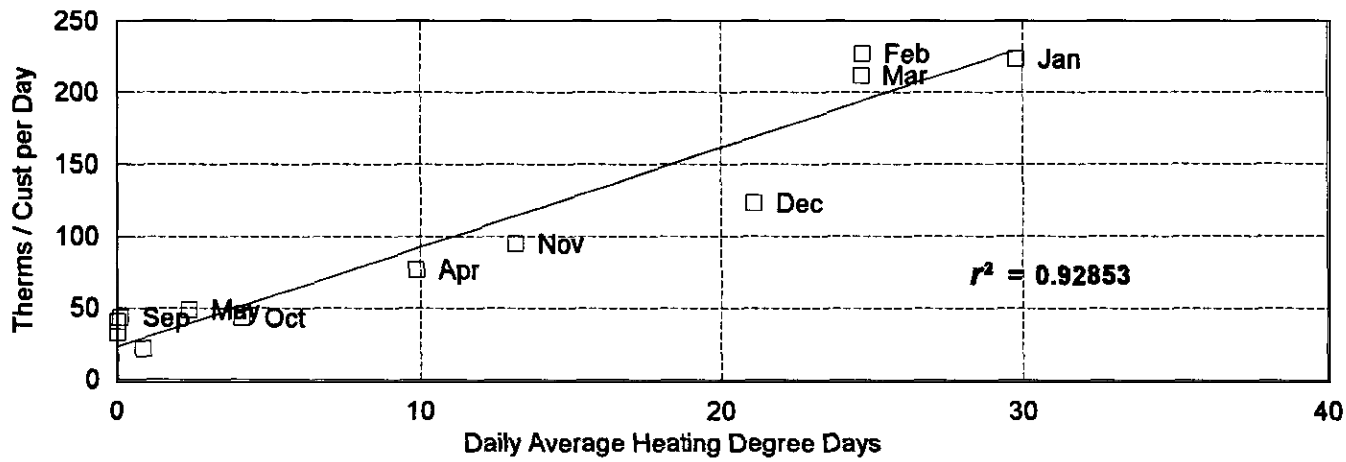
General Service - Residential



General Service - Commercial



General Service - Industrial



Laclede Gas Company
Case No. GR-99-315

Weather Normalized Billing Month Usage In Therms per Customer
For the Test Year of January 1, 1998 - December 31, 1998

General Service - Residential

	Franklin County District	Laclede Division	Midwest Division	Missouri Natural Division	St. Charles Division
Jan 98	164.5643	215.9079	165.8705	165.5587	176.4448
Feb	145.5406	189.7013	143.4004	152.3247	157.8912
Mar	108.6751	138.1672	105.6486	111.2176	117.9222
Apr	64.4574	83.8090	67.0530	64.3868	72.8440
May	29.0199	44.6046	33.4563	36.7389	39.8234
Jun	16.7910	26.6133	22.5784	20.0252	22.9448
Jul	15.9981	24.7086	18.9658	13.9928	22.9934
Aug	12.6869	16.8555	17.3302	13.4700	18.9139
Sep	18.1222	29.1997	21.6154	19.3450	22.8308
Oct	29.4241	40.8956	27.7192	30.1527	31.5213
Nov	67.5851	88.9226	65.7516	69.3591	70.2383
Dec 98	120.7557	164.1146	113.6975	126.9804	128.8529

General Service - Commercial

	Franklin County District	Laclede Division	Midwest Division	Missouri Natural Division	St. Charles Division
Jan 98	722.5590	1,160.4253	733.3837	574.2117	859.9094
Feb	640.4958	1,009.9503	646.9183	536.3216	733.3198
Mar	488.1950	751.5499	491.6593	413.5508	570.8615
Apr	304.2153	430.4558	288.0105	257.0425	332.7097
May	215.5006	236.2297	152.4321	108.3216	199.9041
Jun	154.0486	145.9381	112.7902	95.9859	129.0153
Jul	181.9298	140.4197	120.0915	97.0607	137.5524
Aug	152.0389	99.5300	98.5373	118.9380	134.8063
Sep	188.4166	144.8319	132.7735	88.6562	135.8217
Oct	226.3906	218.9530	181.6782	162.4969	185.1061
Nov	387.6225	426.6281	312.5415	238.2431	325.1305
Dec 98	613.8161	833.5802	531.8879	480.4216	595.6839

General Service - Industrial

	Franklin County District	Laclede Division	Midwest Division	Missouri Natural Division	St. Charles Division
Jan 98		3,706.9052	7,455.9710	5,120.9895	8,918.8007
Feb	N / A	3,268.2325	6,538.6112	4,577.1434	8,706.3980
Mar		2,416.6794	4,947.5536	3,330.4617	6,078.8789
Apr		1,595.8016	3,352.8447	1,865.7215	3,107.7925
May	N / A	915.0693	1,380.4893	1,113.2172	1,937.6504
Jun		463.2529	958.9621	730.3556	687.2799
Jul		509.9477	1,267.5337	854.2181	1,123.7088
Aug	N / A	421.1456	1,109.3233	756.0685	1,217.3565
Sep		512.1675	1,135.4772	969.0613	1,544.9081
Oct		739.5924	1,322.9507	1,421.6561	1,737.7569
Nov	N / A	1,246.6432	1,536.9413	2,422.5087	3,706.8827
Dec 98		2,454.9170	3,564.8632	4,188.1831	5,539.7309

Schedule 5

Laclede Gas Company
Case No. GR-99-315

Estimated Daily Peak Demand in Therms per Customer
For the Test Year of January 1, 1998 - December 31, 1998

General Service - Residential

	Franklin County District	Laclede Division	Midwest Division	Missouri Natural Division	St. Charles Division
Jan 98	7.7746	10.6399	7.6185	8.0261	8.4964
Feb	7.1311	9.7142	6.9904	7.3578	7.7819
Mar	5.2841	7.0817	5.1862	5.4419	5.7369
Apr	3.8143	5.0205	3.7486	3.9202	4.1182
May	2.2764	2.8641	2.2444	2.3280	2.4244
Jun	1.0540	1.1560	1.0484	1.0629	1.0797
Jul	0.7313	0.7313	0.7313	0.7313	0.7313
Aug	0.7394	0.7466	0.7390	0.7401	0.7412
Sep	1.7994	2.2382	1.7755	1.8379	1.9099
Oct	3.2804	4.3066	3.2246	3.3705	3.5389
Nov	5.0065	6.7315	4.9126	5.1579	5.4411
Dec 98	6.9510	9.4695	6.8138	7.1720	7.5854
Annual	7.7746	10.6399	7.6185	8.0261	8.4964

General Service - Commercial

	Franklin County District	Laclede Division	Midwest Division	Missouri Natural Division	St. Charles Division
Jan 98	34.3009	57.4848	35.1932	28.4371	40.5049
Feb	31.6192	52.3487	32.2359	26.1205	37.0669
Mar	23.9332	37.8295	23.7827	19.4507	27.2752
Apr	17.8328	26.5846	17.1047	14.1155	19.5895
May	11.4499	14.8216	10.1177	8.5327	11.5487
Jun	6.3793	5.5254	4.5726	4.0905	5.1760
Jul	5.0533	3.3119	3.1469	2.8965	3.5765
Aug	5.0887	3.4102	3.1894	2.9226	3.6313
Sep	9.4904	11.5661	8.0127	6.7659	9.1899
Oct	15.6335	22.8184	14.7294	12.1492	16.9073
Nov	22.7996	36.0636	22.5781	18.4111	25.9467
Dec 98	30.8753	51.0432	31.4289	25.4601	36.1499
Annual	34.3009	57.4848	35.1932	28.4371	40.5049

General Service - Industrial

	Franklin County District	Laclede Division	Midwest Division	Missouri Natural Division	St. Charles Division
Jan 98	58.1558	183.1124	342.7664	257.8942	467.5686
Feb	111.8873	166.5779	311.6207	235.0845	424.2824
Mar	94.2667	120.3254	224.6911	171.3619	303.5532
Apr	46.7307	85.1894	158.9303	123.0731	212.3457
May	23.5434	48.4409	90.1543	72.5694	116.9575
Jun	15.7146	19.5212	36.0802	32.8463	41.9821
Jul	13.6934	13.1859	24.4616	24.2419	25.9734
Aug	14.3906	13.5760	25.2258	24.7927	27.0484
Sep	15.8361	39.1671	73.1659	59.9823	93.5588
Oct	23.8683	74.1463	138.5595	108.0240	184.2244
Nov	46.1300	115.6233	216.2251	165.0433	291.9599
Dec 98	83.2651	162.6644	304.3642	229.7352	414.2481
Annual	111.8873	183.1124	342.7664	257.8942	467.5686

Laclede Gas Company
Case No. GR-99-315

Recommended Minimum Sample Size
For a Simple Random Sample to Estimate a Proportion (Percentage) of Natural Gas Bills

For the Billing Months of December 1998 and February 1999

Estimates Based on a Previous Gas Billing Review :		
p = estimated percent of customers having their bills rendered correctly	=	99%
q = estimated percent of customers having bills rendered incorrectly	=	1%
Desired Values :		
Largest Percent Prediction Error willing to tolerate :		
d = margin of error (plus or minus)	=	2%
(in the estimate of the percent of customers having their gas bills read correctly)		
95% Confidence Level Value :		
z = abscissa of the normal curve that cuts off 5% of the area at the tails	=	1.96
Formulae :		
V = variance of the sample = d^2 / z^2	=	0.00010412
Sample Size Formula :		
n = (p times q) / V	=	**96**
(rounded up to next highest whole customer number)		

Schedule 7

P.S.C. MO. No. 5 Consolidated, Second Revised Sheet No. R-1

CANCELLING P.S.C. MO. No. 5 Consolidated, First Revised Sheet No. R-1

Laclede Gas Company (Name of Issuing Corporation or Municipality) For All Areas Served by All Company Divisions (Community, Town or City)

RECEIVED
DEC 4 1992
MISSOURI
Public Service Commission

LACLEDE GAS COMPANY

STANDARD RULES AND REGULATIONS

APPLYING TO THE FOLLOWING TERRITORIES:

LACLEDE GAS COMPANY DIVISION

City of St. Louis and St. Louis County, Missouri

ST. CHARLES GAS COMPANY DIVISION

All Areas and Communities Served in St. Charles County, Missouri

MISSOURI NATURAL GAS COMPANY DIVISION

All Areas and Communities Served in Butler, Iron, Jefferson, Madison, St. Francois, and Ste. Genevieve Counties, Missouri plus the Franklin County District. The Franklin County District Service Area Generally Consists of Eastern Franklin County and Northeast Crawford County (Excluding the City of Sullivan) and is Set Out in Detail in the Revised Metes and Bounds Description Filed by the Company on December 4, 1992 in its Application To Relinquish Certificate of Convenience and Necessity.

MIDWEST MISSOURI GAS COMPANY DIVISION

All Areas and Communities Served in the Northern One-Half of Jefferson County, Missouri

FILED
JAN 4 1993
93-177
MO. PUBLIC SERVICE COMM.

DATE OF ISSUE December 3, 1992 (month, day, year) DATE EFFECTIVE January 4, 1993 (month, day, year)

ISSUED BY K. J. Neises, Vice President, 720 Olive St., St. Louis, MO 63101 (name of officer, title, address)

Schedule 8

STATE OF MISSOURI, PUBLIC SERVICE COMMISSION

P.S.C. MO. No. 5 — 6th — ~~(Original)~~ (Revised) — SHEET NO. 1

Cancelling P.S.C. MO. No. 5 — 5th — ~~(Original)~~ (Revised) — SHEET NO. 1

MISSOURI PUBLIC SERVICE
KANSAS CITY, MO 64138

FOR: All Communities and Rural Areas Receiving Natural Gas Service

INDEX
GAS

Gas rate schedules are available to those communities and rural areas where indicated by rate schedule in this index subject to availability provisions of each individual schedule.

Rate schedules applicable in the Southern, Northern and Eastern Systems:

Communities designated as Southern System are as follows:

Clinton	Marshall	Rural Territory
Deerfield	Nevada	Sedalia
Henrietta	Otterville	Smithton
Leeton	Platte City	Tracy
Lexington	Richmond	Weston

Communities designated as Northern System are as follows:

Brookfield	Glasgow	Rural Territory
Brunswick	Keytesville	Salisbury
Bucklin	Laclede	Trenton
Chillicothe	Marceline	Utica
Chula	Meadville	Wheeling

Communities designated as Eastern System are as follows:

Owensville	Rural Territory	Salem
Rolla		

DATE OF ISSUE: January 8, 1998
ISSUED BY: Maurice L. Arnall, Regulatory Services

DATE EFFECTIVE: February 9, 1998

STATE OF MISSOURI, PUBLIC SERVICE COMMISSION

	P.S.C. MO. No.	5	2nd	~~(Original)~~ (Revised)	SHEET NO. 1.1
Cancelling	P.S.C. MO. No.	5	1st	~~(Original)~~ (Revised)	SHEET NO. 1.1

MISSOURI PUBLIC SERVICE
KANSAS CITY, MO 64138

FOR: All Communities and Rural Areas Receiving Natural Gas Service

DESCRIPTION OF AUTHORIZED GAS SERVICE TERRITORY
GAS

COOPER COUNTY

TOWNSHIP	RANGE	SECTIONS
46 North	19 West	33, 34
45 North	19 West	3, 4, 5, 6

DENT COUNTY

TOWNSHIP	RANGE	SECTIONS
35 North	7 West	1, 2, 3, 10, 11, 12, 13, 14, 23, 24, 25, 36
35 North	6 West	18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
35 North	5 West	19, 20, 21, 22, 27, 28, 29, 30, 31, 32, 33, 34
34 North	6 West	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25
34 North	6 West	26, 27, 28, 29, 32, 33, 34, 35, 36
34 North	5 West	3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25
34 North	5 West	26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
34 North	4 West	18, 19, 30, 31
33 North	6 West	1, 2, 3, 4, 5, 8, 9, 10, 11, 12
33 North	5 West	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
33 North	4 West	6, 7

GASCONADE COUNTY

TOWNSHIP	RANGE	SECTIONS
42 North	5 West	21, 22, 27, 28, 29, 31, 32, 33

MORGAN COUNTY

TOWNSHIP	RANGE	SECTIONS
45 North	19 West	7, 8, 9, 10, 17, 18

PETTIS COUNTY

TOWNSHIP	RANGE	SECTIONS
45 North	20 West	1, 2, 3, 4, 9, 10, 11, 12, 13, 14, 15, 16, 17
46 North	20 West	33, 34

PHELPS COUNTY

TOWNSHIP	RANGE	SECTIONS
37 North	7 West	28, 32, 33
36 North	7 West	3, 4, 5, 8, 9, 10, 15, 16, 17, 20, 21, 22, 26, 27, 28, 33, 34, 35

DATE OF ISSUE: August 5, 1997
ISSUED BY: Maurice L. Arnall, Regulatory Services

DATE EFFECTIVE: September 4, 1997