Exhibit No.:
Issue(s): Weather Normalization
Witness: Dennis Patterson
Type of Exhibit: Surrebuttal
Sponsoring Party: MoPSC Staff
Case No.: GR-99-315

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

SURREBUTTAL TESTIMONY

OF

DENNIS PATTERSON

LACLEDE GAS COMPANY

CASE NO. GR-99-315

Jefferson City, Missouri

August, 1999

SURREBUTTAL TESTIMONY

OF

DENNIS PATTERSON

LACLEDE GAS COMPANY

CASE NO. GR-99-315

Q. Please state your name and business address.

A. My name is Dennis Patterson and my business address is Missouri Public Service Commission, P. O. Box 360, Jefferson City, MO 65102.

Q. What is your present position with the Missouri Public Service Commission (Commission)?

A. I am a Regulatory Economist in the Electric Department of the Utility Operations Division.

Q. Are you the same Dennis Patterson who has submitted direct and rebuttal testimony in this case?

A. Yes, I am.

Q. What is the purpose of your surrebuttal testimony?

A. I will address the rebuttal testimony of two Laclede Gas Company (LGC) witnesses: Jay R. Turner, D.Sc., and Mrs. Patricia Krieger.

SURREBUTTAL OF JAY R. TURNER, D.SC.

Q. What points will you address in the testimony of Dr. Turner?

A. I will address Dr. Turner's rebuttal of the techniques used by Steve Qi Hu, PhD., the Staff's climatology consultant, and by Mr. Dennis Patterson of the Staff.

Q. At Page 3, lines 11 through 18 (At 3:11—3:18), Dr. Turner states that NOAA has never used double mass analysis, and that double mass analysis has not been proven "equal or superior in performance" when benchmarked against "the NOAA method." Do you agree with Dr. Turner's statements?

A. No. Dr. Turner has misinterpreted the article by Karl and Williams (1987), and his statements are simply mistaken. The "NOAA method" simply entails the use of data from reference stations to adjust data from the target station. Furthermore, "There are several approaches that can be taken to adjust a station's records ..." (Karl and Williams, 1987, p. 1747). The analyst is not restricted in his choice among legitimate mathematical and statistical treatments of the proper data.

Q. At 3:20—4:05, Dr. Turner states that double mass analysis uses "a reference station" to determine whether changes in temperature are due to exposure changes rather than natural variability, instead of "at the very least, two reference stations" to assure that "presumably non-climatic changes – a bias – indeed occurred at the target station and not the reference station." Do you agree with these statements?

A. No, Dr. Turner's implication that Dr. Hu uses only one reference station is erroneous. Dr. Hu examined dozens of reference stations, and, in fact, used two reference stations for each of the changes that occurred at St. Louis-Lambert International Airport (Lambert Field).

Q. At 4:06—4:12, Dr. Turner states, "Relatively small data sets, such as a few years of data," (because of seasonal effects) "can lead to large uncertainties." Do you agree with this statement?

A. No, because Dr. Turner's implication is that Dr. Hu used two few data points in his analyses. Please note that Dr. Hu uses five years of data as the minimum recommended by Karl and Williams (1987).

Q. At 4:12—4:22, Dr. Turner states: "Furthermore," (Dr. Hu's application of double mass analysis) "does not account for seasonal effects." "... the NOAA approach does address this issue ... on a monthly-specific basis." "... [t]his lack of seasonal differentiation can only be described as a fundamental flaw in the Staff's analysis." Do you agree with these statements?

A. No. Dr. Turner, who is not a climatologist, erred if he believed he has found a flaw in the Staff's analysis. The pattern described as "seasonal differentiation" was addressed by Dr. Hu in his corrections for Time of Observation Bias (TOB). The month-by-month analysis used by NOAA to adjust Lambert Field temperatures was a substitute for TOB adjustments.

Q. At 6:03—6:16, Dr. Turner states: "[t]he Staff's method for selecting reference stations is flawed" because the method did not include "the obvious approach" which is "to compare the two reference stations to each other using a double mass analysis[.]" over the "time the reference stations are being screened." Do you agree with Dr. Turner's statement?

A. No. Dr. Turner is wrong. What should be performed is a comparison of two reference time series with the same homogeneous United States Historical

Climatology Network (USHCN) time series, which will show whether a discontinuity exists in the data from either reference station. Comparison of data from the two reference stations is not capable of showing which station has the discontinuity.

Q. At 9:10—10:2, Dr. Turner state that at Union, "... the sensor was upgraded from a liquid thermometer unit to a digital MMTS unit sometime in the mid-to-late 1980's." Do you agree with this statement?

A. No. Dr. Turner is simply mistaken. According to the corresponding B-44 form in the Union station files, this actually occurred on 12 December 1990. This occurred at the end of the five-year analysis period for the 1988 discontinuity at Lambert Field, where the effect is immaterial.

Q. At 11:9—11:13, Dr. Turner states: "Dr. Hu apparently did not make any investigation of the stations themselves until after the stations were selected in his analysis." Do you agree with this statement?

A. Dr. Turner is correct on this point, but this was unavoidable. An earlier attempt to arrange station visits were rejected by the supervisor at the St. Louis Weather Service Office at the St. Charles Research Park. Consequently, Dr. Hu's weather station visits could not be rescheduled until after the filing date.

Q. At 12:06—13:02, Dr. Turner complains that he has had difficulty finding information in the working papers of Dr. Hu and Mr. Patterson. Do you agree with his statement?

A. I apologize for this difficulty, because the work papers from Dr. Hu and Mr. Patterson are voluminous. However, to my knowledge, Dr. Turner himself has contacted neither Dr. Hu nor myself for clarification.

Q. At 14:03—14:05, Dr. Turner asks: "Can these required characteristics of an actual bias be confirmed through a review of the Staff analysis?" He then replies: "No. It is impossible to do so." Do you agree with these statements?

No. At Schedule 1, the Staff has used double mass analysis to make two comparisons of Lambert Field mean temperatures, dating from 1961 through 1997, with the average of homogeneous mean temperatures at seven United States Historical Climatology Network (USHCN) weather stations. The USHCN temperature series have had inconsistencies removed by the processes that are described in the documentation that has been shared with LGC. The first comparison used monthly averages of NOAA's official daily mean temperatures for Lambert Field. The second comparison used the same official data, but with Dr. Hu's recommended adjustments applied. The Staff has shared this graph and the basic data in my working papers.

Q. What were the results of this comparison?

A. The comparison using unadjusted data clearly shows the changes in slope that were addressed by Dr. Hu, namely at 1978/79, 1988 and 1996. This certainly confirms the existence of the biases, and Dr. Turner's statements are mistaken. In addition, the comparison using adjusted data shows that these slope changes have been removed. This confirms that the biases have been corrected as well.

Q. At 14:05—17:08, Dr. Turner states that Dr. Hu wrongly segmented his double mass analysis comparisons at varying points during the January 1978-October 1979 instrument transition period at St. Louis-Lambert

International Airport, holding that "it is a single event triggering the bias." Do you agree with these statements?

A. No. The weather station at Lambert Field included a set of extreme thermometers and a hygrothermometer that were moved on different dates during the years 1978 and 1979. The extreme thermometers were moved from the former location in January, 1978, but the hygrothermometer was not moved until November, 1979.

The extreme thermometers recorded the maximum and minimum temperatures that would have occurred since the instruments were reset 24 hours previously, while the hygrothermometer measured continuously and was read each hour. In addition, the two sets of instruments were in separate locations in the interim between January, 1978 and November, 1979. The records of daily extremes from the two sets of readings were therefore quite different. Both sets of instruments contributed to the official temperature record from the National Climatic Data Center during the interim. Since there was no discernable single event that might cause a bias, the use of the interim observations is subject to Dr. Hu's judgement as a climatologist

Q. At 17:09—17:14, Dr. Turner complains that "First, Dr. Hu used a six-year time series of monthly data for the 1979 analysis, but only a five-year time series for the 1988 analysis." Do you agree with his complaint?

A. No. Dr. Turner's complaint is mistaken. He has failed again to note that an interim of almost two years occurred between the January, 1978 beginning and the November, 1979 completion of the change of location of all the thermometers at Lambert Field. The additional year for the earlier analysis is the minimum required to properly address this problem.

Q. At 18:05—18:21, Dr. Turner notes that the proper use of the NOAA 30-year normal is that of "*comparison:* (1) to assess the deviation of a given event – such as annual HDD for a given year – from a reference period..." Do you agree with this statement?

A. Yes, of course. The Staff would agree, and would so advise the Commission. Weather normalization should consist of adjusting test year sales to what they would have been in the normalization reference period. In the long run, going forward, this will serve to stabilize rates at an equitable level. Furthermore, in the long run and going forward, this type of normalization should result in "normal" revenue on the average for the regulated utility. However, the purpose of weather normalization is not to predict weather, sales, or revenue for any year.

SURREBUTTAL OF MRS. PATRICIA A. KRIEGER

Q. What points will you address in the testimony of Ms. Krieger?

A. I will address a number of Ms. Krieger's criticisms of the Staff's weather normalization methodology.

Q. Based on Ms. Krieger's statements at 06:21—06:25 versus those at 07:14—07:25, Ms. Krieger describes her belief that Dr. Hu made no adjustment for the 1996 exposure change at Lambert Field in GR-98-274, but made an adjustment of –1.875 F in GR-99-315. Do you agree with this assessment of Dr. Hu's results?

A. No. Ms. Krieger apparently does not understand that Dr. Hu's GR-98-374 (initial) finding of no temperature bias at the ASOS installation dating from June, 1996 does not mean that no adjustment was made for the 1996 exposure change at

Lambert Field. Instead, that finding means that the change from the former instruments to ASOS resulted in the reversal of warming biases that were quantified by the adjustments to prior years (1978 and 1988) made in that same case.

Q. At 08:02—08:05, in reference to the June, 1996 adjustment, Ms. Krieger states that "Dr. Hu's direct testimony is absolutely silent on these changes in result[sic] from those he offered under affidavit approximately ten months ago." Do you agree with this assessment of Dr. Hu's direct testimony?

A. No, I must disagree. It is only necessary to refer Ms. Krieger to that part of Dr. Hu's direct testimony which begins at 05:08 and which ends at 06:07. In particular, it is noted therein that five years of current temperature data were now available to analyze the 1996 exposure change, and that the details had been provided in Dr. Hu's working papers.

Q. At 10:12—10:16, Ms. Krieger states that Dr. Hu only compared data for short periods of time, namely, the five years around the timeframe of the bias. Do you agree that this detracts from Dr. Hu's analysis?

A. No. Ms. Krieger has misunderstood the requirements of the methodology followed by Dr. Hu, as described in Karl and Williams (1987). Her criticism on this point is therefore baseless.

Q. At 10:16—10:19, Ms. Krieger states that "This analysis was performed with piece-meal data ..." Do you agree with this assessment of Dr. Hu's analysis?

A. No. The Karl and Williams (1987) methodology recommends the local treatment of exposure changes because long periods of continuous and consistent

temperature data usually do not exist at any weather station. Once again, this criticism is baseless.

Q. At 10:16—10:19, Ms. Krieger complains that the analysis was performed "with only two reference stations utilized for each period analyzed." Does this detract from Dr. Hu's analysis?

A. No. Ms. Krieger does not understand that Dr. Hu evaluated many more stations before settling on the two that he utilized. This also follows the methodology outlined in Karl and Williams (1987). Therefore, this additional criticism is baseless.

Q. At 10:22—10:26, Ms. Krieger states that "The double mass analyses employed by Dr. Hu in this case ..." (also identified) "for the first time a 1996 bias not identified in Dr. Hu's 1998 analysis." Do you agree with this portion of her statement?

A. No. As in the present case, Dr. Hu's GR-98-274 analysis indicated the reversal of prior warming biases, going forward from May of 1996. Ms. Krieger's statement is therefore mistaken.

Q. At 11:27—12:06, Ms. Krieger states: "a simple review of NOAA station history information available on the Internet, indicates that station changes occurred at both Elsberry, MO and Union, MO during 1988." Do you agree with Ms. Krieger's statement?

A. No. Documents possessed by the Staff and shared with LGC show that Ms. Krieger's alleged 1988 exposure change at Union actually did not occur until the end of 1990, where it could have no significant effect on the Staff's analysis. The 1988

change at Elsberry may indeed have occurred, and the Staff is therefore evaluating whether the use of the Elsberry station is proper for the 1988 exposure change.

Q. At 12:23—12:26, Ms. Krieger notes that data points plotted are not consistent for the maximum and minimum temperatures in all cases, and that the number of months analyzed vary. Does this detract from Dr. Hu's analysis?

A. No. These two variables are not dependent. In addition, it is not statistically necessary that the same number of months be analyzed for each variable or on each side of an exposure change. It is only necessary to have enough observations to meet climatological and statistical concerns.

Q. At 13:01—13:03, Ms. Krieger complains that some data points are missing. Does this detract from Dr. Hu's analysis?

A. No. Dr. Hu uses the measures recommended by Karl and Williams (1987), and removes the points with missing temperatures from the analysis.

13:13—14:08: Ms. Krieger objects because the Staff calculates normal degree days with straightforward arithmetic. Do you agree with her objection?

A. No. Ms. Krieger prefers the results of an approximation devised by H.C.S. Thom in 1954, when NOAA lacked the computer power to make the preferred arithmetical calculations from daily data. Because Thom's method yields inaccurate estimates for the transition months, the Staff prefers to calculate normals directly.

Q. At 14:11—15:10, Ms. Krieger objects because Staff attempts to provide improvement to historical data, stating instead that such things "should be

left to the discretion of NOAA and its resources." Do you agree with Ms. Krieger's statements?

A. No. As Dutcher and Hubbard state where an existing ASOS station was moved at the Lincoln, NE airport: "The NWS has decided that previously recorded ASOS data since November 1992 will not be corrected. It will be the general public's responsibility to apply temperature corrections to the old ASOS data." **(Dutcher, A. and K. Hubbard: "What's Wrong with the Data", THE TRIPOD News & Notes About Automated Weather Station Applications. Lincoln, NE: University of Nebraska-Lincoln, Institute of Agriculture and Natural Resources, Fall, 1994.)** This "responsibility of the general public" extends to the Missouri Public Service Commission and LGC, the weather station at Lambert Field, and the exposure changes that have occurred there.

Q. At 15:13—15:27, Ms. Krieger objects because Staff employs double mass analysis, which does not seem to be described in Karl and Williams (1987). Do you agree with Ms. Krieger's objection?

A. No. In brief, the methodology of Karl and Williams (1987) does not restrict the analyst in the choice of mathematical and statistical tools. I have previously addressed this objection in more detail in my surrebuttal of Dr. Turner's rebuttal testimony at 3:11—3:18.

Q. At 16:01—16:19, Ms. Krieger objects because double mass analysis yields corrections expressed in "thousandths of a degree Fahrenheit, yet NOAA official temperature data is recorded in whole degrees based on sensor

readings that have error tolerance levels greater than some of Dr. Hu's adjustments." Do you agree with Ms. Krieger's objection?

A. No. Ms. Krieger's objection is mistaken. Ms. Krieger is confusing accuracy and bias over a large number of temperature readings with the random error that is present in every individual reading. Although individual temperature readings are read in whole degrees, errors in those readings are random with an expectation of zero if the instrument is accurate and unbiased, and where its readings are compared with those from a calibrated field standard. The mean of a large number of those errors will still be zero. The statistical confidence region about that mean of zero will be tiny. For similar statistical reasons, if an otherwise accurate instrument is biased, the mean of the difference between that accurate instrument and an unbiased accurate instrument will also have a tiny confidence region. Estimates of that average error are also estimates of the bias in the instrument, and should be expressed in small fractions of a degree Fahrenheit in order to avoid bias over the large number of readings that are to be corrected with a compensating adjustment.

Q. At 16:20—18:11, on the stated basis that the Staff may not be impartial, Ms. Krieger objects to the Staff's proposals that normals continue to be based on thirty years of historical data, that adjustments be applied at all to NOAA historical data, that outdated NOAA adjustments be recalculated (to include a new adjustment where none had been calculated before), and finally, with underlined emphasis, that the Staff itself dare to calculate an adjustment for a significant 1996 event that NOAA is not scheduled to address until after the year 2000. Do you agree with Ms. Krieger's objections?

A. No. Ms. Krieger's objections are unfounded. First, the Staff must be impartial with regard to weather adjustments, because the various utilities that use weather data from Lambert Field use the data in different ways. For example, if Lambert Field temperature normals increase, gas companies benefit while gas ratepayers suffer. However, if Lambert Field temperature normals decrease, electric companies benefit while electric ratepayers suffer. The Staff has no interest in penalizing any of these four parties at the expense of any of the others.

Second, the Staff has the "general public's responsibility to apply temperature corrections" mentioned by Dutcher and Hubbard (1994) in my surrebuttal of Ms. Krieger at **14:11—15:10** (above). This responsibility continues to extend to Lambert Field and to all the exposure changes that have occurred there since 1961.

Q. At 17:19—17:23, Ms. Krieger objects because in the calculation of 1961-1990 normals, NOAA calculated adjustments by month for the 1978/79 exposure change at Lambert Field, while the Staff calculated a single adjustment that was not even equal to the mean of these monthly adjustments. Do you agree with her objection?

A. No. NOAA's month-by-month corrections were done that way in an attempt to address time-of-observation bias (TOB) with the methods that were available in 1990. The proper correction is a single correction that addresses only the bias that results from moving or changing the instrument.

Q. At 18:06—18:11, Ms. Krieger objects because the Staff is "effectively recommending that the official data reported by NOAA and utilized by

the scientific community should be abandoned in favor of the Staff's altered data." Do you agree with her objection?

A. No. First, Ms. Krieger does not recognize that the Staff, Dr. Hu, Dr. Turner and LGC are all members of the "scientific community" that has an interest in maintaining unbiased temperature data at Lambert Field. Second, no one suggests that the "official data reported by NOAA" be abandoned. Finally, the Staff has no intention altering the official data. However, both the Staff and LGC have the "general public's responsibility" (Dutcher and Hubbard, 1994) to apply adjustments to that official data when it is necessary to correct a bias therein.

Q. At 18:12—19:5, Ms. Krieger asks, "Do you believe that biases and data inconsistencies should be ignored for ratemaking purposes?" She then details a number of reasons why the Commission should do just that. Do you agree with her reasoning?

A. No, I do not. Apparently, Ms. Krieger would never recommend corrections be applied to official data, no matter what biases they may contain, unless NOAA does so at the end of a decade. By her reasoning, doing otherwise would result in "time-consuming technical battles." However, Ms. Krieger neglects to mention that any attempt by Staff to not apply corrections at Lambert Field would just as surely result in "time-consuming technical battles" with the electric utilities who are harmed if temperature normals are too high. Ms. Krieger's reasoning is therefore quite mistaken.

Q. At 19:06—20:02, Ms. Krieger apparently objects because the Staff's reasons for applying adjustments to official NOAA temperature data are not sufficiently compelling. Do you agree with this objection?

A. No. If Ms. Krieger is only concerned with considerations of the temperature data at Lambert Field and surrounding stations, the highly significant statistical results are sufficiently compelling *per se*. Ms. Krieger's objection is therefore mistaken.

Q. At 20:03—20:24, Ms. Krieger apparently believes that the Staff's adjustments are not based on official NOAA data. Do you agree with this belief?

A. No. The Staff has created no data. The Staff, with the help of a climatologist, has calculated corrections that are to be applied to official data at Lambert Field.

Q. 20:24—21:02, Ms. Krieger states: "Moreover, Staff has substantially revised this data base through adjustments to the NOAA data, that in stark contrast to the 30-year data set approved in the MGE case, rely on weather data sets of three years or less." Do you agree with this statement?

A. No. Ms. Krieger's statement is inaccurate. For example, the Kansas City International Airport weather data used in the MGE rate case, Case No. 96-285, contained adjustments for a 1972 station move. The Commission approved those adjustments as well as the Staff's methodology that was used to apply them to daily data.. Ms. Krieger's statement is mistaken.

Q. At 21:03—22:10: Ms. Krieger believes that 10-year normals are superior to 30-year normals because they may be more predictive. Do you agree with this belief?

A. No. The purpose of weather normalization is <u>not</u> to make predictions. Please see my surrebuttal of Dr. Turner at **18:05—18:21** (above).

Q. At 22:10—22:16, Ms. Krieger states "Certainly, increasing evidence of global warming and recognized urbanization and heat island impacts on weather stations in densely populated areas would suggest that only more recent historical data is relevant for future periods when rates being set in this case are in effect." Do you agree with Ms. Krieger's statement?

A. No. First, global warming is not a great concern. Dr. Hu has addressed the decreased importance of global warming in his rebuttal testimony. Second, urban warming is addressed at Lambert Field each time an exposure change of any kind is addressed, if urbanization is not also occurring at the reference station. There is therefore no compelling reason to abandon the advantages of a thirty-year normal in exchange for the disadvantages of a shorter period normal.

Q. At 22:16—22:22, Ms. Krieger is concerned that "While the Staff attributes a large part of the warming trend observed at Lambert to sensor and exposure changes, the scientific community continues to suggest that similar warming trends being observed across the country are in some way attributable to the effects of global warming and urbanization." Do you agree with Ms. Krieger's concerns?

A. No. There is clearly a difference between a gradual warming trend and a sudden warming bias caused by moving the location of a weather station.

Q. At 22:26—23:14, in support of the 10-year normal, Ms. Krieger states that normals based on the thirty-year period 1961-1990 do not include the nine years 1991 through 1999, that these years include "five of the warmest years of

the century[,]" and that omitting those years ignores "trends such as urbanization and environmental differences." Do you agree with these statements?

A. No. First, Ms. Krieger bases her statement on biased data. In particular, the years 1991 through 1996 contain unadjusted warming biases of nearly two degrees Fahrenheit, which exaggerates the trends that are seen by Ms. Krieger.

Q. At 23:22—23:27, Ms. Krieger states that "Staff should not create alternative data bases by discarding NOAA adjustments or speculatively applying new adjustments prematurely." Do you agree with Ms. Krieger's statement?

A. No. The Staff has the "general public's responsibility to apply temperature corrections" mentioned by Dutcher and Hubbard (1994) in my surrebuttal of Ms. Krieger at **14:11—15:10** (above). This responsibility continues to extend to Lambert Field and to all the exposure changes that have occurred at Lambert Field since 1961.

Q. At 24:012—24:06, Ms. Krieger states that "A ten year normals period based on official NOAA data should be utilized to more appropriately recognize urbanization and warming trends apparent at Lambert, thereby increasing predictiveness and better serving both the ratepayer and the shareholder ..." Do you agree with this statement?

A. No, I continue to disagree with statements of this type. For example, please see my surrebuttal of Ms. Krieger's rebuttal testimony at **22:26—23:14** (above).

Q. At 25:24—26:07, Ms. Krieger states that the Staff assumes: "River water temperature correlated with ambient temperature equates to the temperature of the water when entering water heaters throughout the Company's service territory..." Do you agree with this statement?

A. No. The exact inlet water temperature does not have to be known, the Staff makes no such assumption, and Ms. Krieger's argument is simply wrong. However, through a chain of relationships that are shown to be highly significant, gas sales for the water heating end use are indeed highly correlated with air temperatures at Lambert Field. In his surrebuttal testimony, Staff witness Henry Warren, PhD., shows that gas sales for the hot water end use are highly correlated with Missouri River water temperatures. Based on 13 years of daily temperature data, I showed in my direct testimony that Missouri River water temperatures are in turn correlated with Lambert Field air temperatures at a very high confidence level. Using this highly significant relationship, I then calculated Missouri River water temperatures for 1961-1985. This completes the chain of relationships that is used to calculate normal water heating degree days for the thirty years 1961-1990.

Q. At 27:20—28:04, Ms. Krieger states that the Staff's calculation of water heating degree day normals is based on estimates for 25 years (1961-1985) of the thirty-year normals period (1961-1990), concluding at 28:07 that the normals are therefore "unsupportable." Do you agree with Ms. Krieger's statement and conclusions?

A. No. While her statement is technically correct and the Staff does indeed rely on these estimates, Ms. Krieger's conclusions are wrong. The statistically very strong relationship between Lambert Field air temperatures and Missouri River water temperatures over the 13 years 1986-1998 makes this calculation of normal water heating degree days a reliable one indeed. Please see my surrebuttal of Ms. Krieger's rebuttal at **25:24—26:07** above.

Q. Does this conclude your surrebuttal testimony?

A. Yes, it does.

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 DENNIS PATTERSON

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

Dennis Patterson, of lawful age, on his oath states: that he has participated in the preparation of the foregoing written testimony in question and answer form, consisting of 19 pages of testimony to be presented in the above case, that the answers in the attached written testimony were given by him; that he has knowledge of the matters set forth in such answers; and that such matters are true to the best of his knowledge and belief.

Dennis Patterson

Subscribed and sworn to before me this 19th day of August, 1999.

Joyce C. Neuner
Notary Public

Joyce C. Neuner
Notary Public, State of Missouri
County of Osage
My Commission Exp. 06/18/2001

My commission expires _____

Schedule 1

LACLEDE GAS COMPANY
RATE CASE NO. GR-99-315
ST LOUIS-LAMBERT TEMPERATURES VERSUS AVERAGES OF CONSISTENT AREA
TEMPERATURES FROM US HISTORICAL CLIMATOLOGY NETWORK FILNET DATA
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