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

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

REBUTTAL TESTIMONY

OF

DENNIS PATTERSON

LACLEDE GAS COMPANY

CASE NO. GR-99-315

Jefferson City, Missouri

August, 1999

REBUTTAL TESTIMONY

OF

DENNIS PATTERSON

LACLEDE GAS COMPANY

CASE NO. GR-99-315

Q. Please state your name.

A. My name is Dennis Patterson.

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

A. Yes, I am.

Q. What is the purpose of your rebuttal testimony?

A. I will address the weather normals sponsored by Laclede Gas Company (LGC) witness Patricia Krieger in her direct testimony in the present rate case.

WEATHER NORMALS

Q. What weather normals did Ms. Krieger use in her direct testimony?

A. Ms. Krieger calculated weather normals using a trend of ten year averages of annual heating degree days (HDD) based on temperature observations reported by the National Oceanic and Atmospheric Administration (NOAA) for the St. Louis Lambert International Airport weather station (STL).

Q. What are Staff's disagreement with the weather normals used by Ms. Krieger?

A. The Staff has two disagreements with Ms. Krieger's HDD normals. First, the Staff disagrees with using a 10 year normal. The official period adopted by NOAA for weather normals is 30 years, and it is critical to the ratemaking process that official standards be used. Second, Ms. Krieger's calculations failed to take into account significant observational changes that have occurred at STL. Specifically, in the ten year periods used by Ms. Krieger, the weather station has been moved in January 1988 and May 1996. Since LGC did not make the necessary adjustments for these significant changes, Ms. Krieger's calculations of 10-year averages are incorrect and show an exaggerated trend from 1988 through 1996.

Q. What is the basis of Ms. Krieger's use of a trend of ten-year averages as the basis for normal weather?

A. Ms. Krieger has three reasons for using a trend of ten-year averages. First, she claim that a global warming trend exists which should be taken into account by the Commission in adopting weather normals. Second, she claims that most recent 15-year period is significantly warmer than the 30-year normals published by NOAA. Third, she cites low earning for Laclede over recent years.

Q. What is your response to Ms. Krieger's claim of a global warming trend?

A. I don't believe that it is proper to ask the Commission to decide whether or not there is global warming. Specifically, the scientific community should officially recognize global warming before the Commission adopts a different normal. This official recognition would come through NOAA, and specifically would occur when NOAA adopts a shorter period than 30 years for its weather normals.

Q. What is your response to Ms. Krieger's claim that the most recent 15 years has been warmer than NOAA's thirty year normals?

A. Numerically, this statement is correct. However, a simple numerical calculation is an improper method for testing a hypothesis about whether the weather over the past 15 years is warmer. This is a statistical question that needs to be addressed by statistical comparison of means. To support Ms. Krieger's claim, the statistical test would have to show that heating season HDD from Ms. Krieger's 15-year sample of the most recent heating seasons (1984-85 through 1998-99) were statistically warmer than prior heating seasons. However, consistent HDD data for STL do not support this difference. When a statistical test is performed at the 95% confidence level, heating season HDD from the 15-year period chosen by Ms. Krieger are not statistically different from the group of years that includes 1961 through 1984. Similar results are found when a comparison was made between the most recent 15-year sample and a sample of annual HDD from the years including 1961 through 1990. No statistical support can be found for Ms. Krieger's claim.

Q. How do you respond to Ms. Krieger's testimony of low LGC earnings over recent warmer than normal winters?

A. Ms. Krieger discussed LGC's potential for lost revenues in recent years but, did not discuss the offsetting potential gains that were enjoyed by LGC in years prior to 1984. While the Staff is not unsympathetic to LGC's under earnings experience of recent years, our concern is whether or not it is proper to be continually changing policy on weather normals because of what may be short-run trends in the weather.

Q. Has the Staff evaluated using a 10 year normal?

A. Yes. I have carried out an experiment with annual HDD data for STL from the years including 1961 through 1998. These annual HDD are based on temperatures which include the adjustments sponsored by Dr. Hu in his direct testimony.

Q. How was the experiment set up?

A. The rolling 10-year normal was calculated at the end of each year beginning with 1970, and used as the "normal" to set rates for the following year. This yielded 28 observations of annual revenue for the years 1971 through 1998. The 1961-1990 normal was also used to set alternative rates, 28 times for the years 1971-1998. The two sets of revenues were then used to calculate two 28-year sets of departure from the constant revenue requirement of $100. Then, standard deviations were calculated over the two sets of differences.

Q. What were the results of the experiment?

A. The graph at Schedule 1-1 shows that revenues from the rolling 10-year normals are higher than those from the 30-year normal during warm periods, but lower during cooler periods. But the graph also shows that rates resulting from the 10-year normal may be as much as 6 percent higher and as little as 4 percent smaller than rates resulting from the 30-year normals. The standard deviation of the difference between actual revenues and the constant revenue requirement of $100 is $7.86 for the rates resulting from the 10-year normals (Schedule 1-2). The same standard deviation is $7.66 when the 30-year normal is used (Schedule 1-3). Thus, the 10-year normal is no better (or even slightly worse) than the 30-year normal for rate making. Moreover, it would require annual readjustment of rates to attain this questionable level of utility (See the way that rates vary on Schedule 1-1). The basic data are found on Schedule 1-4.

Q. Would these rates be equitable, because they are based on the current calculation of "normal" weather?

A. No, they would not, because the risk of departure from the 10-year calculation of normal weather is not shared equitably by the utility and the ratepayer. The danger of using such rates lies in the frequency at which rate cases are filed. Potentially, years could elapse after a rate case where rates were set at several percent above the long-term average. The utility could earn revenue well above that which would be earned under the 30-year calculation of normal for such a period of years. Meanwhile, the Staff would have no basis for initiating a complaint case because the rates were "normal" at the time they were established. In fact, if rate cases were not initiated at the correct intervals, the luckless ratepayer could always pay rates that were too high. Of course, the utility could run a similar risk if low rates were initially established. Neither situation would be equitable.

Q. How would you administer the use of a 10-year "normal"?

A. I can think of no equitable way to put it to use. The use of a 10-year "normal" could be acceptable for ratemaking under a requirement that a new rate case be filed every year to account for the change in the 10-year normal. However, this would be single-issue ratemaking. Therefore, such a requirement is not feasible, and the risk of departure from normal weather cannot be shared equitably between the utility and the ratepayer.

Q. Given that Missouri is a test year state, would weather normalization be improved by using a 10-year normal?

A. No. The experiment described above has shown that it would not.

DEFICIENT TEMPERATURE HISTORY

Q. Beginning at Page 14, line 25 of her direct testimony, Ms. Krieger made a number of comparisons between 12-month tabulations of official HDD at STL, and NOAA's published annual normal HDD for each of the tabulations. Were these tabulations and published normals presented accurately?

A. Yes. They were accurate representations of official NOAA weather data and normals. However, they are now meaningless comparisons.

Q. Were these comparisons valid for the purposes of setting rates in the present case?

A. No, they were not. Since the comparisons did show the difference between tabulations of official observations and published normals, they would therefore have illustrated the way rates would have been set using the best information available in those past years. However, neither the official HDD data nor the published normals from Ms. Krieger's tables were valid for use in the present case. Historical HDD from dates prior to June, 1996, would have required adjustments that would have made them consistent with the current thermometer installation at STL (Hu direct at 4:12). In fact, three distinct adjustments would have been required to make all the data consistent since January, 1961 (Ibid.). Thus, none of the data in the tables at Page 12, Page 15, and Page 21 of Ms. Krieger's direct testimony are based on consistent data. Ms. Krieger's calculations were not appropriate for weather normalization in the present case because they were based on official temperature data that did not contain these necessary adjustments.

NORMALS AS PREDICTORS

Q. Does the Staff use HDD normals as predictors?

A. No, it does not. Missouri is a test year state. In Missouri, utility sales data from a test year are adjusted for departures from the normal condition in order to calculate a revenue requirement and a set of rates for a year where the normal condition would have been experienced. Of course, the utility and the ratepayer have equal shares in the risk that any number of upcoming years will experience conditions that are not normal.

It is important to note that normal weather is only one part of the overall normal condition. Departures from normal weather may cause either upward or downward departures from normal annual utility sales, as do departures from normal in other parts of the overall normal condition. Furthermore, it may be expected that the various departures from the overall normal condition will tend to offset one another.

Q. Does this conclude your rebuttal 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 7 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

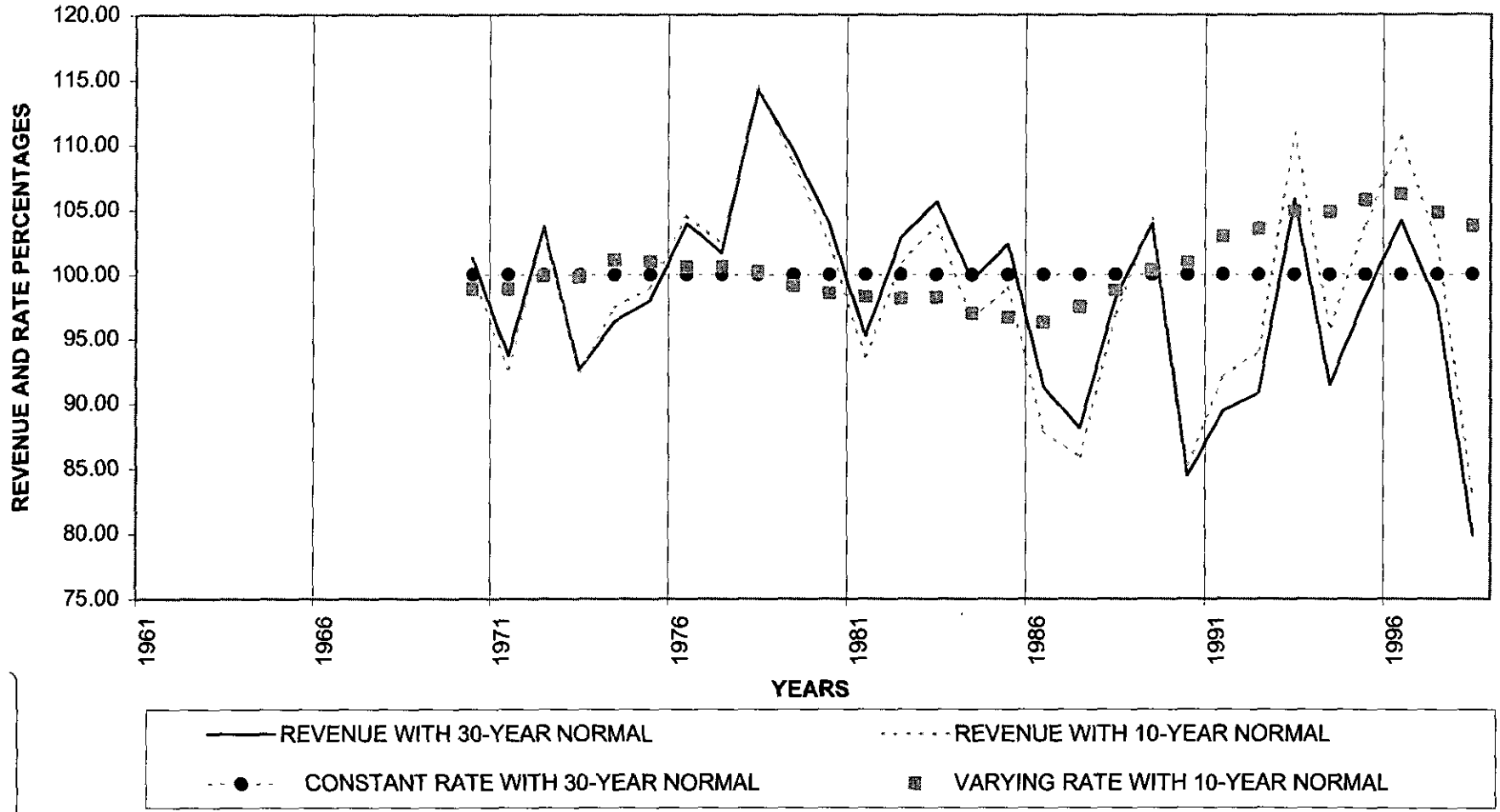
Subscribed and sworn to before me this 5th day of August, 1999.

Joyce C. Neuner
Notary Public, State of Missouri
County of Osage
My Commission Exp. 06/16/2001

Notary Public

My commission expires

LACLEDE GAS COMPANY
RATE CASE NO. GR-99-315
ST LOUIS WEATHER WITH NEW ADJUSTMENTS: RATES & REVENUES:
(30 YEAR NORMALS) VS (10 YEAR NORMALS)



Schedule 1-1

LACLEDE GAS COMPANY
RATE CASE NO. GR-99-315
RATE CALCULATIONS USING 10-YEAR NORMAL WEATHER AND A CONSTANT REVENUE REQUIREMENT OF $100.00

PRICE PER UNIT:	VARIES.
NORMALIZED SALES:	VARIES.
REVENUE REQUIREMENT:	$100.00
NORMAL HDD:	VARIES.
CONSTANT UNITS PER HDD:	0.019628434

CONSISTENT ST LOUIS AND MISSOURI RIVER TEMPERATURES

CALENDAR YEAR	ANNUAL HDD	10-YEAR NORMAL HDD	NORMALIZED SALES	REVENUE REQUIREMENT	RATE(T-1)	VARYING RATE WITH 10-YEAR NORMAL	ACTUAL SALES	REVENUE WITH 10-YEAR NORMAL	REVENUE ADUSTMENT TO $100.00
1961	5308.7								
1962	5241								
1963	5364.9								
1964	4859.8								
1965	4778.5								
1966	5309.3								
1967	4971.7								
1968	5275.2								
1969	5253.2	5151.37	101.11	$100.00					
1970	5160.5	5152.28	101.13	$100.00	$0.99	98.90	101.29	$100.18	-$0.18
1971	4772.3	5098.64	100.08	$100.00	$0.99	98.88	93.67	$92.63	$7.37
1972	5282.6	5102.80	100.16	$100.00	$1.00	99.92	103.69	$103.61	-$3.61
1973	4716.3	5037.94	98.89	$100.00	$1.00	99.84	92.57	$92.43	$7.57
1974	4908	5042.76	98.98	$100.00	$1.01	101.13	96.34	$97.42	$2.58
1975	4991.7	5064.08	99.40	$100.00	$1.01	101.03	97.98	$98.99	$1.01
1976	5294.9	5062.64	99.37	$100.00	$1.01	100.60	103.93	$104.56	-$4.56
1977	5178.4	5083.31	99.78	$100.00	$1.01	100.63	101.64	$102.29	-$2.29
1978	5820.5	5137.84	100.85	$100.00	$1.00	100.22	114.25	$114.50	-$14.50
1979	5578.7	5170.39	101.49	$100.00	$0.99	99.16	109.50	$108.58	-$8.58
1980	5292	5183.54	101.74	$100.00	$0.99	98.54	103.87	$102.35	-$2.35
1981	4850.1	5191.32	101.90	$100.00	$0.98	98.29	95.20	$93.57	$6.43
1982	5238.7	5186.93	101.81	$100.00	$0.98	98.14	102.83	$100.91	-$0.91
1983	5381	5253.40	103.12	$100.00	$0.98	98.22	105.62	$103.74	-$3.74
1984	5069.2	5269.52	103.43	$100.00	$0.97	96.98	99.50	$96.49	$3.51
1985	5215	5291.85	103.87	$100.00	$0.97	96.68	102.36	$98.97	$1.03
1986	4650.5	5227.41	102.61	$100.00	$0.96	96.27	91.28	$87.88	$12.12
1987	4488	5158.37	101.25	$100.00	$0.97	97.46	88.09	$85.86	$14.14
1988	5000.9	5076.41	99.64	$100.00	$0.99	98.76	98.16	$96.95	$3.05
1989	5294.9	5048.03	99.08	$100.00	$1.00	100.36	103.93	$104.30	-$4.30
1990	4300.4	4948.87	97.14	$100.00	$1.01	100.92	84.41	$85.19	$14.81
1991	4556.2	4919.48	96.56	$100.00	$1.03	102.95	89.43	$92.07	$7.93
1992	4626.4	4858.25	95.36	$100.00	$1.04	103.56	90.81	$94.04	$5.96
1993	5391.1	4859.26	95.38	$100.00	$1.05	104.87	105.82	$110.97	-$10.97
1994	4658	4818.14	94.57	$100.00	$1.05	104.84	91.43	$95.86	$4.14
1995	5004.9	4797.13	94.16	$100.00	$1.06	105.74	98.24	$103.88	-$3.88
1996	5306	4862.68	95.45	$100.00	$1.06	106.20	104.15	$110.61	-$10.61
1997	4970	4910.88	96.39	$100.00	$1.05	104.77	97.55	$102.21	-$2.21
1998	4068	4817.59	94.56	$100.00	$1.04	103.74	79.85	$82.84	$17.16

	ANNUAL HDD	NORM HDD	NORM SALES	NORM REV:	RATE (T-1)		SALES	REV	REV ADJ
MAXIMUM	5,820.50	5,291.85	103.87	$100.00	$1.06		114.25	$114.50	$17.16
MINIMUM	4,068.00	4,797.13	94.16	$100.00	$0.96		79.85	$82.84	-$14.50
AVERAGE	5,002.25	5,056.27	99.25	$100.00	$1.01		98.19	$98.75	$1.25
STD DEV:	390.26	148.02	2.91	$0.00	$0.03		7.66	$7.86	$7.86

Schedule 1-2

LACLEDE GAS COMPANY
RATE CASE NO. GR-99-315
RATE CALCULATIONS USING 1961-1990 30-YEAR NORMAL WEATHER AND A CONSTANT REVENUE REQUIREMENT OF $100.00

PRICE PER UNIT:	CONSTANT
NORMALIZED SALES:	100
REVENUE REQUIREMENT:	$100.00
NORMAL HDD:	5094.65
CONSTANT UNITS PER HDD:	0.019628434

CONSISTENT ST LOUIS AND MISSOURI RIVER TEMPERATURES

CALENDAR YEAR	ANNUAL HDD	10-YEAR NORMAL HDD	NORMALIZED SALES	REVENUE REQUIREMENT	RATE (T-1)	CONSTANT RATE WITH 30-YEAR NORMAL	ACTUAL SALES	REVENUE WITH 30-YEAR NORMAL	REVENUE ADUSTMENT TO $100.00
1961	5308.7	5094.65					104.20		
1962	5241	5094.65					102.87		
1963	5364.9	5094.65					105.30		
1964	4859.8	5094.65					95.39		
1965	4778.5	5094.65					93.79		
1966	5309.3	5094.65					104.21		
1967	4971.7	5094.65					97.59		
1968	5275.2	5094.65					103.54		
1969	5253.2	5094.65	100.00	$100.00			103.11		
1970	5160.5	5094.65	100.00	$100.00	$1.00	100.00	101.29	$101.29	-$1.29
1971	4772.3	5094.65	100.00	$100.00	$1.00	100.00	93.67	$93.67	$6.33
1972	5282.6	5094.65	100.00	$100.00	$1.00	100.00	103.69	$103.69	-$3.69
1973	4716.3	5094.65	100.00	$100.00	$1.00	100.00	92.57	$92.57	$7.43
1974	4908	5094.65	100.00	$100.00	$1.00	100.00	96.34	$96.34	$3.66
1975	4991.7	5094.65	100.00	$100.00	$1.00	100.00	97.98	$97.98	$2.02
1976	5294.9	5094.65	100.00	$100.00	$1.00	100.00	103.93	$103.93	-$3.93
1977	5178.4	5094.65	100.00	$100.00	$1.00	100.00	101.64	$101.64	-$1.64
1978	5820.5	5094.65	100.00	$100.00	$1.00	100.00	114.25	$114.25	-$14.25
1979	5578.7	5094.65	100.00	$100.00	$1.00	100.00	109.50	$109.50	-$9.50
1980	5292	5094.65	100.00	$100.00	$1.00	100.00	103.87	$103.87	-$3.87
1981	4850.1	5094.65	100.00	$100.00	$1.00	100.00	95.20	$95.20	$4.80
1982	5238.7	5094.65	100.00	$100.00	$1.00	100.00	102.83	$102.83	-$2.83
1983	5381	5094.65	100.00	$100.00	$1.00	100.00	105.62	$105.62	-$5.62
1984	5069.2	5094.65	100.00	$100.00	$1.00	100.00	99.50	$99.50	$0.50
1985	5215	5094.65	100.00	$100.00	$1.00	100.00	102.36	$102.36	-$2.36
1986	4650.5	5094.65	100.00	$100.00	$1.00	100.00	91.28	$91.28	$8.72
1987	4488	5094.65	100.00	$100.00	$1.00	100.00	88.09	$88.09	$11.91
1988	5000.9	5094.65	100.00	$100.00	$1.00	100.00	98.16	$98.16	$1.84
1989	5294.9	5094.65	100.00	$100.00	$1.00	100.00	103.93	$103.93	-$3.93
1990	4300.4	5094.65	100.00	$100.00	$1.00	100.00	84.41	$84.41	$15.59
1991	4556.2	5094.65	100.00	$100.00	$1.00	100.00	89.43	$89.43	$10.57
1992	4626.4	5094.65	100.00	$100.00	$1.00	100.00	90.81	$90.81	$9.19
1993	5391.1	5094.65	100.00	$100.00	$1.00	100.00	105.82	$105.82	-$5.82
1994	4658	5094.65	100.00	$100.00	$1.00	100.00	91.43	$91.43	$8.57
1995	5004.9	5094.65	100.00	$100.00	$1.00	100.00	98.24	$98.24	$1.76
1996	5306	5094.65	100.00	$100.00	$1.00	100.00	104.15	$104.15	-$4.15
1997	4970	5094.65	100.00	$100.00	$1.00	100.00	97.55	$97.55	$2.45
1998	4068	5094.65	100.00	$100.00	$1.00	100.00	79.85	$79.85	$20.15

	ANNUAL HDD	NORM HDD	NORM SALES	NORM REV:	RATE (T-1)		SALES	REV	REV ADJ
MAXIMUM	5820.50	5094.65	100.00	$100.00	$1.00		114.25	$114.25	$20.15
MINIMUM	4068.00	5094.65	100.00	$100.00	$1.00		79.85	$79.85	-$14.25
AVERAGE	5002.25	5094.65	100.00	$100.00	$1.00		98.19	$98.19	$1.81
STD DEV:	390.26	0.00	0.00	$0.00	$0.00		7.66	$7.66	$7.66

Schedule 1-3

Laclede Gas Company
Rate Case No. GR-99-315
Consistent Weather For Calculation Of Rates And Revenues Using 10-Year and 30-Year Normal Heating Degree Days

CONSISTENT ST LOUIS AIR AND MISSOURI RIVER TEMPERATURES							ROLLING	ROLLING	1961-1990
CALENDAR YEAR	MDT	ANNUAL HDD	ANNUAL CDD	ANNUAL CAT	ANNUAL RWT	ANNUAL WHD	30-YEAR AVERAGE HDD	10-YEAR AVERAGE HDD	NORMAL HDD
1961	53.49	5308.7	1109.2	53.5	57.6	30075			5094.65
1962	54.25	5241	1318	54.2	58.33	29809			5094.65
1963	54	5364.9	1350.9	54.3	58.88	29608			5094.65
1964	55.61	4859.8	1424.4	55.2	59.1	29608			5094.65
1965	55.72	4778.5	1390.5	55.5	59.34	29440			5094.65
1966	53.84	5309.3	1236.8	54.1	58.18	29863			5094.65
1967	54.34	4971.7	1079.2	54.4	58.3	29821			5094.65
1968	54.16	5275.2	1307.3	54.1	58.2	29938			5094.65
1969	54.3	5253.2	1347.2	54.3	58.21	29852			5094.65
1970	54.75	5160.5	1418.5	54.6	58.77	29648		5152.28	5094.65
1971	55.85	4772.3	1432.8	55.6	59.54	29369		5098.64	5094.65
1972	54.21	5282.6	1332.2	54.5	58.36	29880		5102.8	5094.65
1973	55.64	4716.3	1301.3	55.8	59.67	29320		5037.94	5094.65
1974	54.55	4908	1094	54.3	58.42	29777		5042.76	5094.65
1975	54.99	4991.7	1338.7	55	58.9	29603		5064.08	5094.65
1976	53.65	5294.9	1141.5	53.9	57.78	30091		5062.64	5094.65
1977	55.1	5178.4	1563.4	54.9	59.79	29277		5083.31	5094.65
1978	52.97	5820.5	1430.5	52.9	57.89	29969		5137.84	5094.65
1979	53.8	5578.7	1490.8	53.7	58.62	29704		5170.39	5094.65
1980	55.39	5292	1774.58	55.6	59.59	29429		5183.54	5094.65
1981	55.08	4850.1	1229.26	55.2	59.13	29518		5191.32	5094.65
1982	53.9	5238.7	1185.86	53.5	58.1	29893		5186.93	5094.65
1983	54.88	5381	1687.66	55.7	59.8	29275		5253.4	5094.65
1984	55.29	5069.2	1516.31	54.4	58.69	29761		5269.52	5094.65
1985	54.21	5215	1276.13	54.7	59.05	29547		5291.85	5094.65
1986	56.61	4650.5	1588.64	56.4	59.7	29309		5227.41	5094.65
1987	57.15	4488	1623.68	57	60.11	29160		5158.37	5094.65
1988	55.93	5000.9	1682.49	56	60.4	29134		5076.41	5094.65
1989	54	5294.9	1278.09	54.4	59.92	29230		5048.03	5094.65
1990	57.19	4300.4	1447.57	57	61.13	28789	5094.896667	4948.87	5094.65
1991	57.4	4556.2	1781.54	57.1	60.97	28846	5069.813333	4919.48	5094.65
1992	55.3	4626.4	1072.66	55.4	59.69	29394	5049.326667	4858.25	5094.65
1993	53.82	5391.1	1307.62	53.9	57.77	30013	5050.2	4859.26	5094.65
1994	55.93	4658	1344.2	55.7	59.98	29209	5043.473333	4818.14	5094.65
1995	55.26	5004.9	1446.55	55.6	59.21	29487	5051.02	4797.13	5094.65
1996	54.17	5306	1336.23	54	57.95	30029	5050.91	4862.68	5094.65
1997	55.17	4970	1380.5	55.2	58.07	29906	5050.853333	4910.88	5094.65
1998	58.74	4068	1782.5	58.8	61.55	28634	5010.613333	4817.59	5094.65
							9-YEAR AVERAGE 5052.345185	10-YEAR AVERAGE 4884.031	10-YEAR AVERAGE 5094.65
								30-YEAR AVERAGE 5056.266897	30-YEAR AVERAGE 5094.65

Schedule 1-4