Exhibit No.:	
Issues:	Calculation of Weather Normals
Witness:	Curt Wells
Sponsoring Party:	MO PSC Staff
Type of Exhibit:	Direct Testimony
Case No.:	GR-2007-0208
Date Testimony Prepared:	May 4, 2007

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

DIRECT TESTIMONY

OF

CURT WELLS

LACLEDE GAS COMPANY

CASE NO. GR-2007-0208

Jefferson City, Missouri
May 2007

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-2007-0208

AFFIDAVIT OF CURT WELLS

STATE OF MISSOURI)
) **ss**
COUNTY OF COLE)

Curt Wells, of lawful age, on his oath states: that he has participated in the preparation of the following Direct Testimony in question and answer form, consisting of 7 pages of Direct Testimony to be presented in the above case, that the answers in the following Direct 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.

Curt Wells

Subscribed and sworn to before me this 2nd day of May, 2007.

Dawn L. Hake
Notary Public

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

DAWN L. HAKE
My Commission Expires
March 16, 2009
Cole County
Commission #05407643

My commission expires_____

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Q. Please state your name and business address.

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

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

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

Q. Please review your educational background and work experience.

A. I have a Bachelor's degree in Economics from Duke University, a Master's degree in Economics from The Pennsylvania State University, and a Master's degree in Applied Economics from Southern Methodist University. I have been employed by the Commission since February, 2006. Prior to joining the Commission, I completed a career in the U.S. Air Force, which included assignments as a navigator in weather reconnaissance aircraft, and later in the Purchasing/Contracting area as Contract Negotiator and Administrator, Contracting Policy Manager, Installation Purchasing Department Chief, and Contracting Program Manager.

Q. Have you filed testimony in prior cases?

A. Yes. My previous testimony is listed in Schedule CW-1.

EXECUTIVE SUMMARY

Q. What is the purpose of your testimony?

A I will explain my calculations of actual and normal Heating-Degree-Day (HDD) and Water Heating-Degree-Day (WHDD) variables, which I furnished to Staff witnesses James A. Gray, and Dr. Henry E. Warren.

Q. How is your testimony organized?

A. I will first discuss Heating-Degree-Days (HDD): Definition, Selection of Weather Station, and Weather Variables. I will then discuss Water-Heating-Degree-Days (WHDD): Definition, Source of Data, and Adjustments. Attached Schedule CW-2 provides specific calculations of HDD variables for the St. Louis-Lambert International Airport weather station. Schedule CW-3 provides corresponding WHDD values for the St Louis area. Additional detail is included in my workpapers, which will be provided to the company.

DEFINITION OF HEATING DEGREE DAYS

Q. What are Heating Degree Days?

A. Degree days are weather measures that were originally devised to evaluate energy demand and consumption. Degree days are the difference between the daily average air temperature and the base level of 65 degrees Fahrenheit (°F). Cooling Degree Days are the excess of the average air temperature over the base level and are used to examine the relationship between temperature and electric usage for residential air conditioning. Heating Degree Days are the excess of the base level over the average air temperature and are used to examine the relationship between temperature levels and the amount of natural gas customers use for residential heating.

Q. How are HDD calculated?

A. HDD are calculated as the number of degrees by which the daily average temperature is below 65 °F, but are set equal to zero when the daily average temperature is above 65 °F, based on the assumption that no heating occurs when the daily average temperature (TAVG) is greater than 65 °F. TAVG is the average of the day's maximum (TMAX) and minimum temperatures (TMIN).

Q. What is the source of your data on TMAX and TMIN?

A. The TMAX and TMIN data were compiled from National Oceanic and Atmospheric Administration (NOAA) information.

SELECTION OF WEATHER STATION

Q. Which weather station did you use in this rate case?

A. I used the weather station at St. Louis-Lambert International Airport (STL).

Q. Why did you select this weather station?

A. This is the weather station that the Staff selected in the past Laclede Gas Company (Laclede or Company) rate cases, Case No. GR-2001-629 and Case No. GR-2002-356, as being the most representative station with the most consistent daily temperature data for Laclede's service territory. In her Direct testimony in this case, Laclede witness Patricia Krieger, also used this station in her calculations.

WEATHER VARIABLES FOR HDD

Q. What time interval did you use in determining normal values for your weather variables?

A. I conformed to the 30 year time period used by NOAA and the World Meteorological Organization (WMO) to calculate normal daily weather variables. As stated by NOAA, "A climate normal is defined, by convention, as the arithmetic mean of a

climatological element computed over three consecutive decades (WMO, 1989)." NOAA applies this concept to temperature by calculating thirty-year temperature normals as monthly average maximum temperature and monthly average minimum temperature, using the Fahrenheit scale.

Q. What period is NOAA currently using for calculating its thirty-year temperature normals?

A. NOAA uses the three most recent consecutive decades, which are currently the 30 years from January 1, 1971 through December 31, 2000. International convention has established that three-decade periods are appropriately long and uniform time frames for the calculation of normals. The choice of this 30 year period by Staff is based on previous Staff analysis, Commission decisions, and these standards for normal weather variables established by NOAA and the WMO.

Q. What weather variables did you develop for the present rate case?

A. I developed the daily actual HDD, the daily normal HDD, and the monthly peak-day normal HDD that were used by Mr. Gray and Dr. Warren to weather normalize the Company's sales and revenues. Calendar month summaries of actual, normal, and peak HDD for the test year are presented for STL in Schedule CW-2.

Q. How did you calculate daily HDD for the test year?

A. I calculated daily HDD ("actual HDD") using the above formula and the daily TMAX and TMIN from NOAA's Midwestern Regional Climate Center.

Q. How did you calculate adjusted daily HDD for each of the days in the 30-year period, January 1, 1971 through December 31, 2000?

A. I first tabulated daily TMAX and TMIN for each day in these 30 years for STL, as well as for selected alternates where data were missing. Because NOAA only adjusts the monthly average temperatures, I adjusted actual daily TMAX and TMIN for these 30 years so that the monthly averages of the adjusted daily TMAX and TMIN were equal to the adjusted monthly average TMAX and TMIN that NOAA uses to calculate the monthly station normals over the same period. Adjusted daily TAVG and HDD were then calculated using the adjusted TMAX and TMIN as discussed above. The details of the tabulation and adjustment processes are shown in my workpapers.

Q. How did you determine the daily normal HDD used by Mr. Gray and Dr. Warren?

A. I determined the daily normal HDD by averaging the adjusted daily HDD for each calendar date, without respect to the year. For example, the 30 observations of actual HDD for January 1st of each year were averaged to determine the normal HDD for January 1st.

Q. How did you calculate the normal peak-day HDD for the 12 monthly normal peak days in the test year?

A. I calculated the normal HDD value for January's coldest day as the average of the HDD of the 30 coldest days over all the January days in the 30 years of the normals period, and assigned that value to the average coldest January day. The normal HDD values for the coldest day in each of the other months were calculated in the same way. I also attached a summary of the monthly peak day normal HDD in Schedule CW-2.

DEFINITION OF WATER HEATING DEGREE DAYS

Q. What is a Water Heating Degree Day?

A. Water Heating Degree Days are used to examine the relationship between temperature and natural gas usage for residential water heating. Water Heating Degree Days are based on how far the daily inlet water temperature departs from the base level of 140 °F.

Q. How are WHDD calculated?

A. WHDD are calculated as the number of degrees the daily average inlet water temperature is below 140 °F, based on the assumption that, on average, water heaters are set at 140 °F.

SOURCE OF WATER TEMPERATURE DATA

Q. What is the source of your data daily water temperatures?

A. Prior Staff analysis has shown that Missouri River water temperatures (RWT) serve as a reliable proxy for inlet water temperature in the St. Louis area. Staff acquired daily RWT for the period January 1, 1986 through December 31, 2006 from the Missouri River intake at Howard Bend by the City of St. Louis Department of Public Utilities.

ADJUSTMENTS

Q. Were these data sufficient to calculate actual and normal daily WHDD?

A. No. Calculation of normals requires daily data for the 30-year period 1971-2000. Therefore, it was necessary to estimate the missing values between January 1, 1971 and December 31, 1985.

Q. How were the missing observations estimated?

A. I applied a regression analysis to determine the relationship between the daily air temperature (TAVG) and water temperature data for the period January 1986 through December 2006. I then used this estimated relationship to calculate daily RWT for the missing observations.

Q. What other adjustments were necessary?

A. Since the temperature of bodies of water responds only incrementally to changes in air temperature, the current day's water temperature is correlated with the previous day's water temperature, as well as the previous day's air temperature. Water temperature is also affected by the hours of daylight. I corrected for the correlation by applying a first order auto regression function, and added a variable to account for length of day. The calculations are detailed in my workpapers. A summary of test year and normal Water Heating Degree Day values and monthly peaks are shown in Schedule CW-3.

Q. Does this conclude your Direct Testimony?

A. Yes, it does.

TESTIMONY FILED BEFORE THE MISSOURI PUBLIC SERVICE COMMISSION

Case Number	Company	Issue
ER-2006-0315	Empire District Electric	Revenue
ER-2006-0314	Kansas City Power & Light Company	Calculation of Normal Weather, Revenue
GR-2006-0387	ATMOS Energy Corporation	Calculation of Normal Weather
GR-2006-0422	Missouri Gas Energy	Calculation of Normal Weather
ER-2007-0002	Union Electric d/b/a AmerenUE	Calculation of Normal Weather, Large Customer Annualization
GR-2007-0003	Union Electric d/b/a AmerenUE	Calculation of Normal Weather
ER-2007-0004	Aquila, Inc	Calculation of Normal Weather, Revenue

St. Louis International Airport, Missouri, Monthly Summary Statistics
Actual Heating Degree-Days (HDD) and Normal Heating Degree-Days (NHDD)
For The 12 Calendar Months Beginning October 01, 2005 And Ending September 30, 2006

		TOTAL HDD BY MONTH			PEAK DAY HDD		
YEAR	MONTH	OBSERVED TOTALS HDD	NORMAL TOTALS NHDD	**ADJUSTMENT, ACTUAL TO NORMAL**	OBSERVED COLDEST DAY HDD	NORMAL COLDEST DAY NHDD	**ADJUSTMENT, ACTUAL TO NORMAL**
2005	10	248	244	**(3)**	20.00	25.56	**5.56**
2005	11	502	594	**93**	38.50	41.75	**3.25**
2005	12	1025	964	**(60)**	50.00	61.14	**11.14**
2006	1	704	1099	**395**	32.50	63.27	**30.77**
2006	2	833	837	**5**	54.50	58.36	**3.86**
2006	3	577	602	**25**	36.50	43.90	**7.40**
2006	4	140	285	**145**	22.00	28.78	**6.78**
2006	5	99	75	**(23)**	16.50	14.66	**(1.84)**
2006	6	0	5	**5**	0.00	4.39	**4.39**
2006	7	0	0	**0**	0.00	0.19	**0.19**
2006	8	0	1	**1**	0.00	0.54	**0.54**
2006	9	43	44	**1**	9.50	13.56	**4.06**
12 MONTHS		**4168**	**4751**	**583**	**54.50**	**63.27**	**8.77**

City of St. Louis, Missouri River Intake @ Howard Bend, Monthly Summary Statistics
Actual Water Heating Degree-Days (WHDD) and Normal Water Heating Degree-Days (NWHDD)
For The 12 Calendar Months Beginning October 1,2005 And Ending September 30, 2006

		TOTAL WHDD BY MONTH			PEAK DAY WHDD		
YEAR	**MONTH**	OBSERVED TOTALS WHDD	NORMAL TOTALS NWHDD	**ADJUSTMENT, ACTUAL TO NORMAL**	OBSERVED COLDEST DAY HDD	NORMAL COLDEST DAY NHDD	**ADJUSTMENT, ACTUAL TO NORMAL**
2005	10	2235.6	2387.4	**152**	81.0	91.7	**11**
2005	11	2539.8	2667.5	**128**	93.6	103.1	**10**
2005	12	3119.4	3058.4	**(61)**	104.4	108.6	**4**
2006	1	2991.6	3181.0	**189**	99.0	108.5	**10**
2006	2	2728.8	2814.6	**86**	102.6	108.0	**5**
2006	3	2752.2	2842.2	**90**	93.6	105.4	**12**
2006	4	2242.8	2455.0	**212**	82.8	95.4	**13**
2006	5	2196.0	2244.2	**48**	77.4	84.2	**7**
2006	6	1701.0	1910.0	**209**	61.2	74.5	**13**
2006	7	1609.2	1803.4	**194**	55.8	68.4	**13**
2006	8	1600.2	1835.0	**235**	59.4	69.6	**10**
2006	9	1893.6	1972.2	**79**	70.2	80.7	**11**
12 MONTHS		**27610.2**	**29171.0**	**1561**	**981**	**1098**	**117**