

FILED³

AUG 19 1999

**Missouri Public
Service Commission**

Exhibit No.:

Issue:

Weather Normalized
Sales

Witness:

Henry E. Warren

Sponsoring Party:

MO PSC Staff

Type of Exhibit:

Surrebuttal Testimony

Case No.:

GR-99-315

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

SURREBUTTAL TESTIMONY

OF

HENRY E. WARREN, PhD

LACLEDE GAS COMPANY

CASE NO. GR-99-315

Jefferson City, Missouri
August 1999

1 **SURREBUTTAL TESTIMONY**

2 **OF**

3 **HENRY E. WARREN**

4 **LACLEDE GAS COMPANY**

5 **CASE NO. GR-99-315**

6
7 Q. Please state your name and business address.

8 A. My name is Henry E. Warren and my business address is P. O. Box 360,
9 Jefferson City, Missouri 65102.

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

11 A. I am employed by the Missouri Public Service Commission (PSC or
12 Commission) as a Regulatory Economist in the Gas Department of the Utility Operations
13 Division.

14 Q. Are you the same Henry E. Warren that filed Direct and Rebuttal Testimony in
15 GR-99-315 in the matter of Laclede Gas Company's tariff to revise natural gas rate
16 schedules?

17 A. Yes, I am.

18 Q. What is the purpose of your Surrebuttal Testimony?

19 A. I will address the Rebuttal Testimony of Company witness Ms Patricia A.
20 Krieger on the weather normalization of gas sales.

21 Q. Which parts of the Rebuttal Testimony of Ms Krieger would you like to
22 discuss?

1 A. First, I wish to comment on the statements she makes on p. 25 line 24 through
2 p. 27 line 2, where she attempts to characterize her problems with Staff's water heating
3 normalization. Ms Krieger states:

4 Staff's methodology is premised on the following assumptions:

5 1) River water temperature correlated with ambient temperature equates to
6 the temperature of water when entering water heaters throughout the Company's
7 service territory; and

8 2) A desired hot water setting on a water heater of 140 F equates to the
9 actual settings throughout the Company's service territory.

10 Neither of these assumptions can be verified. In many instances, river
11 water travels several miles underground before entering households throughout
12 the Company's service territory. Water pipes are buried below the freeze line.
13 Additionally, it has not been verified that water-heating requirements change if
14 either the river water or ambient temperature changes a few degrees. The
15 Company makes the assumption that water heating requirements will be greater in
16 a winter month than in a summer month, but we dare not to quantify the
17 difference in those requirements between temperature reading, for example, at
18 10 F versus 12 F. While the Company can establish a reasonable seasonal
19 relationship, it is invalid to assume that incremental water heating requirements
20 can be determined for each degree of temperature change. Staff also assumes that
21 its calculation of this incremental value can be applied to customer classifications
22 other than the classification from which such values were derived.

23
24 Q. Do you find her statements about the assumptions in the Staff methodology
25 consistent with her own methodology and the methodology used by the Gas Research
26 Institute (GRI) and the U.S. Department of Energy (DOE) as detailed in your 1994 report
27 *Evaluation of Selected Methodologies for Quantifying Gas Use for Residential and*
28 *Commercial Water Heating* (Report).

29 A. No, these statements give the appearance that Ms Krieger is unfamiliar with
30 the assumptions behind the Laclede NAF (Normal Adjustment Factor) as well as those of
31 the GRI-DOE methodology. She states on page 24 lines 19-25:

32 The seasonal increase in water heating load has been supported over the
33 years by special studies of Laclede's customers wherein monthly usages have
34 been analyzed and patterned to determine an appropriate relationship between
35 seasonal requirements.

Surrebuttal Testimony of
Henry E. Warren

1 This statement indicates that the seasonal increase in water heating load is the conclusion
2 of years of special studies by Laclede. She is deficient in her presentation of both the
3 derivations of the Laclede NAF and the GRI-DOE methodology which, on these two
4 points -- water temperature and water heater temperature, are similar to my study.

5 The Company's response to Data Request (DR) 26 in Case No. GR-92-165,
6 which I have attached as Schedule 1-1 to my Surrebuttal testimony, contained the
7 development of the NAF by Laclede Gas Co. (Laclede Study). Also attached to my
8 Surrebuttal testimony is Schedule 1-2, which contains a copy of page 9 from the response
9 to DR 26. The title on the page is *Water Heating Analysis*. The first column heading is
10 *July-90* this column contains the 12 months from July 1990 through June 1991. The next
11 column heading is *St. Louis County Average Water Temperatures* contains average
12 monthly water temperatures at a location in the St. Louis County water system. The next
13 column heading is *Temp Rise to 140°*; this is the monthly water heating temperature
14 differential. The next column heading is *Therms Used For Water Heating @ .307569*;
15 these are the monthly estimated therms per customer. The screening process described
16 on page 1 of the DR response determines the customers. It is obvious that Laclede
17 assumes the water temperatures in the gas water heaters of its customers to be 140° F and
18 that the water temperatures from St. Louis County are appropriate as a measure of water
19 temperature throughout its service territory. The temperature of water in St. Louis
20 County is not likely very different than the temperature in the Missouri River.

21 Also, just as Laclede's use of Heating Degree Days, base 65° F (HDD) computed
22 at Lambert - St. Louis International Airport (Lambert), does not imply that every
23 customer in the Laclede service area has an exterior temperature identical to that of

Surrebuttal Testimony of
Henry E. Warren

1 Lambert or that their homes are heated precisely to 65 ° F; the use of Water Heating
2 Degree Days, base 140° F (WHDD), computed at the temperature of water at the
3 Missouri River intake for St. Louis, does not imply that the water entering every home is
4 the same as the river or that every water heater temperature is exactly 140 ° F. In the
5 regression between monthly therms per customer for water heating customers and
6 WHDD, the coefficient of WHDD is statistically significant and the r^2 is high. The
7 regression analysis produces a ratio referred to as r^2 , which is an indication of the
8 goodness of fit of the equation. The value of the r^2 ratio ranges from 0.00 to 1.00, with
9 1.00 being a perfect fit. This high r^2 is similar to the result of the regression of monthly
10 therms per space heating customer and HDD. Ms Krieger's rebuttal seems deficient the
11 concepts of statistical hypothesis and regression analysis.

12 The Laclede assumptions about water temperature and water heater temperatures
13 in Schedule 1-2 are the same assumptions that are made in my derivation of the rate of
14 gas use per WHDD in my Report and Direct Testimony using Missouri River water
15 temperatures from Mr. Patterson. My Report also evaluates a GRI-DOE methodology
16 used in a GRI-DOE study where 140 ° F is used as the standard household water heating
17 temperature. The GRI-DOE study uses *Well Temperatures* in 17 major U. S. cities. So
18 the GRI-DOE study also measures the difference between water at its source and 140 ° F
19 as the water-heating differential. So, my assumptions are not substantially different than
20 those of Laclede or GRI-DOE and my conclusions are similar as well. I addressed these
21 assumptions in my 1994 Report in response to the Commission Order in Case No.
22 GR-92-165.

1 Q. In lines 25-27 on page 26 and lines 1-2 on page 27 of her Rebuttal testimony
2 (reproduced on page 2 above in lines 18-20), Ms Krieger apparently rejects Staff's
3 quantitative relationship between changes in water heating requirements and river water
4 temperature. Is this consistent with the Laclede NAF Study or the GRI-DOE
5 methodology?

6 A. No, as can be seen in Schedule 1-2, the Laclede Study enumerates the monthly
7 water heating temperature differential and monthly estimated average therms per
8 customer used for water heating. These range from a differential of 58° F and a usage of
9 17.8 therms in August to a differential of 105° F and 32.3 therms in usage in January. As
10 can be seen on the third line from the bottom of the page, Laclede estimates the
11 therms/month per temperature rise per month to be 0.307569 (Schedule 1-2). From the
12 1994 Report, the GRI-DOE method produces a monthly estimate of approximately
13 0.2555 therms/month per monthly temperature rise for a typical family. I used Laclede
14 monthly gas sales data from an updated screened sample for 1992-93 similar to the data
15 in Schedule 1-2 to estimate the monthly linear relationship between WHDD per day and
16 therms per day used for water heating for Residential and Commercial customers as
17 stated in my Direct testimony and shown in Schedules 2-2 and 2-1 of my Direct
18 testimony.

19 Q. Do you wish to comment on Ms Krieger's Rebuttal testimony from lines 25-27
20 on page 26 and lines 1-2 on page 27 (reproduced in lines 20 - 22, page 2 above)?

21 A. Yes, in a 1982 study of gas used for water heating Laclede states, "Because of
22 the very small sample (5 accounts) in industrial, we have disregarded the findings and
23 recommend the use of the commercial information as representative of industrial also."

Surrebuttal Testimony of
Henry E. Warren

1 Thus, Laclede believes results from one class can be applied to another. This is
2 demonstrated in Ms Krieger's work papers for her Direct testimony where she applies the
3 same NAF adjustment (135%) to all GS classes (residential, commercial, and industrial)
4 across all divisions.

5 Q. Do you wish to comment on Ms Krieger's statement on page 28 lines 7-11 of
6 her Rebuttal testimony? i. e.,

7 ...the Company believes it is not appropriate to weather normalize water
8 heating usage because a supportable methodology does not exist to attempt to
9 quantify these incremental values. It is appropriate only to deduct some
10 reasonable estimate of baseload before normalizing spaceheating requirements.
11

12 A. Yes, Laclede's failure to recognize a methodology to normalize water heating
13 usage is a result of its failure to comply with the Commission Order in Case No.
14 GR-92-165 for the Company to "...work with Staff to determine appropriate procedures
15 for estimating and normalizing monthly water heating use."

16 Laclede needs to be given specific procedures and a schedule to implement the
17 procedures for the Order to be implemented. An end-use study needs to be conducted
18 according to recognized procedures. This would provide information for the
19 quantification of water heating use and water temperatures, space heating use and HDD,
20 and possibly other major uses of gas. Detailed information on space heating patterns of
21 the customer classes could augment the recommendation of Staff witness James A. Gray
22 in his rebuttal testimony "that the Commission approve Staff's regression methodology .."
23 Regression results could be compared to end-use results to verify the estimated regression
24 coefficients.

25 Q. Does this conclude your Surrebuttal Testimony?

26 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 HENRY E. WARREN

STATE OF MISSOURI)

)


ss.

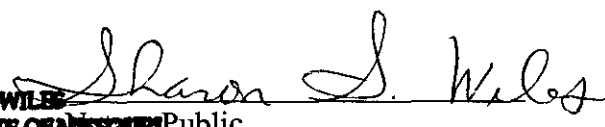
COUNTY OF COLE)

Henry E. Warren, is, of lawful age, on his oath states: that he has participated in the preparation of the foregoing Surrebuttal Testimony in question and answer form, consisting of 6 pages to be presented in the above case; that the answers in the foregoing Surrebuttal 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.



HENRY E. WARREN

Subscribed and sworn to before me this 18th day of August 1999.


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

My Commission Expires: _____

LACLEDE GAS COMPANY
CASE NO. GR-99-315

No. 26

DATA INFORMATION REQUEST
LACLEDE GAS COMPANY
CASE NO. GR-92-165

Requested From: Mark Waltemire
Date Requested: 04/10/92
Information Requested:

Please provide supporting workpapers/analyses for the 135% factor-up of non-weather sensitive usage per Schedule 3, pages 3 through 18.

Requested By: PHIL LOCK

Information Provided: See attached. Please return computer runs when you have completed your review.

The attached information provided to the Missouri Public Service Commission Staff in response to the above data information request is accurate and complete, and contains no material misrepresentations or omissions, based upon present facts of which the undersigned has knowledge, information or belief. The undersigned agrees to immediately inform the Missouri Public Service Commission Staff if, during the pendency of Case No. GR-92-165 before the Commission, any matters are discovered which would materially affect the accuracy or completeness of the attached information.

If these data are voluminous, please (1) identify the relevant documents and their location (2) make arrangements with requestor to have documents available for inspection in the LACLEDE GAS COMPANY office, or other location mutually agreeable. Where identification of a document is requested, briefly describe the document (e.g. book, letter, memorandum, report) and state the following information as applicable for the particular document: name, title, number, author, date of publication and publisher, addresses, data written, and the name and address of the person(s) having possession of the document. As used in this data request the term "document(s)" includes publication of any format, workpapers, letters, memoranda, notes, reports, analyses, computer analyses, test results, studies of data, recordings, transcriptions and printed, typed or written materials of every kind in your possession, custody or control within your knowledge. The pronoun "you" or "your" refers to LACLEDE GAS COMPANY and its employees, contractors, agents or others employed by or acting in its behalf.

Signed By: _____

Date Response Received: 4/13/92 ARW

Prepared By: W. J. R. L. Shown

Schedule 1-1

LACLEDE GAS COMPANY
CASE NO. GR-99-315

Water Heating Analysis

	St. Louis County Average Water Temperatures	Temperature Rise to 140 °	Therms Used For Water Heating @ .307569	Jul/Aug Level	
Jul-90	82 °	58 °	17.8	35.9	Therms
Aug-90	81 °	59 °	18.1	x 6	
Sep-90	79 °	61 °	18.8	215.4	
Oct-90	63 °	77 °	23.7		
Nov-90	55 °	85 °	26.1		
Dec-90	42 °	98 °	30.1		
Jan-91	35 °	105 °	32.3		
Feb-91	40 °	100 °	30.8		
Mar-91	50 °	90 °	27.7		
Apr-91	60 °	80 °	24.6		
May-91	69 °	71 °	21.8		
Jun-91	80 °	60 °	18.5		
			<u>290.3</u>		Therms

Estimated annual usage for water heating	290.3	Therms
Divided by July / August annualized usage for water heating	215.4	Therms
= Indicated Water Heating NAF	<u>1.348</u>	NAF

For Water Heating

$$\text{Therms / Month} = \frac{(2,400 \text{ Gals.} \times \text{Temperature Rise} \times 8.33 \text{ Lbs. per Gal})}{(65\% \text{ water heater efficiency} \times 100,000 \text{ BTU})}$$

$$= 0.307569 \text{ Therms / } 1^{\circ} \text{ change in water temperature}$$

Based on 2,400 Gallons Hot Water Per Month Usage
Assumes 65% Water Heating Efficiency.