BEFORE THE NEBRASKA PUBLIC SERVICE COMMISSION

IN THE MATTER OFBLACK HILLS/ NEBRASKA GAS UTILITYCOMPANY LLC D/B/A BLACK HILLS ENERGY, OMAHA, SEEKING A GENERAL RATE INCREASE FOR BLACK HILLS ENERGY'S RATE AREAS ONE, TWO AND THREE (CONSOLIDATED)	)))))))	**DOCKET NO. NG – _____**

Direct Testimony and Exhibits of Larry W. Loos

Normal Heating Degree Days

December 1, 2009

Larry W. Loos
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EXHIBITS

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. Larry W. Loos, 11401 Lamar, Overland Park, KS 66211.

Q. WHAT IS YOUR OCCUPATION?

A. I am an engineer and consultant employed by Black & Veatch Corporation (Black & Veatch). I currently serve as a Director in Black & Veatch's Enterprise Management Solutions Division.

Q. HOW LONG HAVE YOU BEEN WITH BLACK & VEATCH?

A. Black & Veatch has employed me continuously since 1971.

II. QUALIFICATIONS

Q. WHAT IS YOUR EDUCATIONAL BACKGROUND?

A. I am a graduate of the University of Missouri at Columbia, with a Bachelor of Science Degree in Mechanical Engineering and a Masters Degree in Business Administration.

Q. ARE YOU A REGISTERED PROFESSIONAL ENGINEER?

A. Yes, I am a registered Professional Engineer in the states of Nebraska, Iowa, Colorado, Indiana, Kansas, Louisiana, Missouri, and Utah.

Q. TO WHAT PROFESSIONAL ORGANIZATIONS DO YOU BELONG?

A. I am a member of the American Society of Mechanical Engineers, the National Society of Professional Engineers, the Missouri Society of Professional Engineers, and the Society of Depreciation Professionals.

Q. WHAT IS YOUR PROFESSIONAL EXPERIENCE?

A. I have been responsible for numerous engagements involving gas, electric, and other utility services. Clients served include both investor-owned and publicly owned utilities; customers of such utilities; and regulatory agencies. During the course of these engagements, I have been responsible for the preparation and presentation of studies involving weather normalization, normal degree-days, cost of capital, valuation, depreciation, cost of service, allocation, rate design, pricing, financial feasibility, and other engineering, economic and management matters.

Q. PLEASE DESCRIBE BLACK & VEATCH.

A. Black & Veatch has provided comprehensive construction, engineering, consulting, and management services to utility, industrial, and governmental clients since 1915. We specialize in engineering and construction associated with utility services including electric, gas, water, wastewater, telecommunications, and waste disposal. Service engagements consist principally of investigations and reports, design and construction, feasibility analyses, rate and financial reports, appraisals, reports on operations, management studies, and general consulting services. Present engagements include work throughout the United States and numerous foreign countries. Including professionals assigned to affiliated companies, Black & Veatch currently employs approximately 10,000 people.

Q. HAVE YOU PREVIOUSLY APPEARED AS AN EXPERT WITNESS?

A. Yes, I have. I have filed expert witness testimony before this Commission on several occasions. I have testified before the Federal Energy Regulatory Commission and

regulatory bodies in the states of Colorado, Illinois, Indiana, Iowa, Kansas, Minnesota, Missouri, New York, Pennsylvania, New Mexico, North Carolina, South Carolina, Texas, Utah, and Vermont. I have also presented expert witness testimony before District Courts in Iowa, Colorado, Kansas, Missouri, and Nebraska; and before the Courts of Condemnation in Iowa and Nebraska. I have also served as a special advisor to the Connecticut Department of Public Utility Control.

III. OVERVIEW

Q. FOR WHOM ARE YOU TESTIFYING IN THIS MATTER?

A. I am testifying on behalf of Black Hills/Nebraska Gas Utility Company LLC d/b/a Black Hills Energy Omaha ("Black Hills" or "Company").

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

A. Black Hills asked me to address the issue of the most appropriate basis upon which to weather-normalize test year sales. I apply the results of Dr. Livezey's analysis to determine the normal HDDs which should be used in this case. As I will more fully explain, based on generally accepted ratemaking principles and my studies of recently reported weather conditions in Black Hills' Nebraska service area, it is my opinion that:

1) The National Oceanographic and Atmospheric Administration's (NOAA) traditional published 30-year heating degree-day (HDD) normals are not appropriate for use in this case.

2) Use of a 30-year average as the normal in this case will likely cause hypothetical test period sales to exceed what the Company will actually experience during the period the rates approved by the Commission are in effect.

3) Use of a normal based on a 30-year average in this case will not provide the Company with a reasonable opportunity to earn the rate of return allowed by the Commission.

4) The Commission should adjust base year sales using a "normal" more representative of recent climatic conditions and of conditions more reasonably anticipated during the period rates established in this case will be in effect for the reasons set in the testimony of Dr. Livezey.

5) For the purpose of this case, the Commission should not adjust sales based on use of a 30-year average, but should rely on normal HDDs developed using a 10-year average as described by Dr. Robert Livezey in his direct testimony.

Use of a ten-year average which approximates the "optimum climate normal" (OCN) and the hinge-fit normal heating degree-days will afford the Company a more reasonable opportunity to earn the rate of return allowed in this case. It will create a more symmetrical sharing of weather risk between the Company and its customers.

Q. IS THIS THE FIRST TIME YOU HAVE ADDRESSED THE ISSUE OF NORMAL DEGREE DAYS IN CONNECTION WITH A GAS RATE CASE?

A. No, it is not. I have done so on a number of occasions. Most recently (since 2005), I have done so in rate cases filed with this Commission as well as with regulatory agencies in the states of Colorado, Iowa, Minnesota, Missouri, New Mexico, and Wyoming. In some rate cases in Colorado, Iowa, Michigan, Minnesota, and Missouri, I worked with Dr. Livezey

Q. DO YOU SPONSOR ANY EXHIBITS?

A. Yes, I do. I prepared and sponsor the following seven exhibits:

- Exhibit __ (LWL-1) – Graphical Comparison of Annual HDDs: Actual, NOAA Normal, 30-Year Averages, 10-Year Average, and Hinge-Fit HDDs (Lincoln, Norfolk, Omaha, and three station average)
- Exhibit __ (LWL-2) - Calculation[1] of Annual Hinge-Fit HDDs (Lincoln, Norfolk, Omaha, and three station average)
- Exhibit __ (LWL-3) – Graphical Comparison of Actual and Homogenized[2] HDD (ONDJFMA)[3] – Lincoln, Norfolk, and Omaha weather stations)
- Exhibit __ (LWL-4) – Graphical Comparison of Homogenized HDDs (ONDJFMA, NDJFM, and DJF): Actual, 30-Year Averages, OCN, and Hinge-Fit HDDs (Ten-Station Average)
- Exhibit __ (LWL-5) – Graphical Comparison of Homogenized HDDs (ONDJFMA): Actual, 30-Year Averages, OCN, and Hinge-Fit (Lincoln, Norfolk, Omaha, and three station average)
- Exhibit __ (LWL-6) – Average Difference between Actual and "Normal" HDDs (Lincoln, Norfolk, and Omaha)
- Exhibit ___(LWL-7) – Monthly Normal HDDs

Each of these Exhibits was prepared by me or under my supervision and direction.

IV. BACKGROUND

Q. WHAT IS A HEATING DEGREE DAY?

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[1] A narrative description of the hinge-fit analysis is included in Sheets 6 and 7 of Exhibit __ (LWL-2).

[2] A description of homogenized HDDs (also referred to as synthesized HDDs) is included in Sheet 4 of Exhibit __ (LWL-3).

[3] October, November, December, February, March, and April

A. A heating degree-day is a relative measure of space heating energy requirements. The number of HDDs for any day is the difference between 65 (degrees Fahrenheit) and the average of the high and low temperatures on that day. HDDs are set equal to zero on any day that the average temperature amounts to more than 65. The number of HDDs over any period represents the sum of the HDDs for the days included in that period.

Q. WHY ARE HDDS IMPORTANT IN THE CONTEXT OF A RATE CASE?

A. A natural gas distribution company's throughput[4] is heavily dependent on weather conditions, primarily temperature during the winter period. This dependence has been the subject of a number of studies, some of which I conducted or reviewed. Most of these studies conclude that space-heating requirements (gas requirements) are generally related (proportional) to the number of heating degree-days.

In order to recognize the impact on gas sales due to variations in weather conditions and provide the Company a reasonable opportunity to earn the rate of return allowed by the Commission, for rate case purposes, base year sales, revenues, and gas costs are adjusted to reflect the load during the test period had weather conditions been "normal." By so doing, Commission-approved gas rates are intended to be established so that they take into account reasonably expected weather conditions during the future period of time that the rates will be in effect. The use of an appropriate weather normalization adjustment is critical to providing the utility a reasonable opportunity to earn its allowed rate of return. As I will subsequently demonstrate, use of normal HDDs based on 30-year averages will likely result in an

[4] Throughput represents the total volume of gas a gas distributor delivers to customers during a period. Throughput represents volumes of gas sold by the distributor to customers plus gas transported by the distributor on behalf of customers. I will subsequently use the term "sales" to describe throughput.

overstatement of sales relative to the sales levels actually experienced by the Company during the period the rates will be in effect. As such, use of normals based on 30-year averages will deny the Company a reasonable opportunity to earn the rate of return allowed by the Commission.

Q. WHAT ARE THE "NORMAL" HDDS THE COMMISSION TYPICALLY USES TO ADJUST BASE YEAR SALES?

A. I understand that in recent major gas utility (Aquila/Black Hills and SourceGas) rate cases before the Commission, the period used to normalize weather has not been an issue or has settled. As a result, typical Commission practice is difficult to identify.

Regulatory agencies use a variety of methods to determine normal HDDs. At one extreme, the 30-year average published by NOAA is used, at the other extreme, averages and weighted averages over much shorter and more recent periods are relied on.

Q. IN YOUR OPINION, SHOULD THE COMMISSION RELY ON NORMAL HDDS PUBLISHED BY NOAA?

A. No. I believe the Commission should rely on normals which better reflect current climate conditions than reflected in NOAA's traditional 30-year average ended December 31, 2000.

Q. PLEASE EXPLAIN.

A. The Commission should rely on HDD normals that more accurately reflect conditions reasonably expected to occur during the period that rates will be in effect. Black Hills' witness Dr. Robert Livezey demonstrates, as do I in my analysis, that over the past 25 or so years, normals based on 30-year averages have consistently understated temperatures

(overstated HDDs) actually experienced. Because of this bias, one can only reasonably expect that normals based on 30-year averages will exhibit a cold bias in the immediate future.

My analysis further demonstrates that based on recent experience, normals calculated by using Dr. Livezey's hinge-fit technique better correlate to conditions actually experienced and reasonably anticipated (on average) during the period Commission-approved rates will be in effect. The better the correlation between the normals used in a rate case to set rates and the conditions experienced during the period that rates will be in effect, the better the alignment of test period sales and sales revenues will be with what the Company actually experiences.

A utility must be afforded a reasonable opportunity to earn a fair and reasonable return on its investment. A utility is denied that opportunity if test period sales are overstated due to use of a normal that is biased toward colder conditions than what can reasonably be expected to occur. The Commission cannot set just and reasonable rates if test period sales are overstated due to use of normal HDDs, which have a bias toward colder conditions than what can be reasonably expected to occur.

Q. WHAT DATA DO YOU USE IN YOUR STUDIES?

A. Black Hills' witness Mr. Thomas Sullivan uses data from three NOAA weather stations (Lincoln, Norfolk, and Omaha) to develop the weather normalization adjustment proposed by the Company in this case. In his testimony, Mr. Sullivan describes the basis for his selection of these three stations.

However, because of problems with the continuity of longer-term historical data reported especially from the Lincoln and Omaha stations, I supplement my analysis with data from

seven other area stations located in or near: Auburn, Clarinda, David City, Fairbury, O'Neill, Sioux City, and West Point.

In addition, because of these longer-term historical data problems, I rely on homogenized average monthly temperature data provided by Dr. Livezey from his contacts at the National Climate Data Center (NCDC). I limit my use of this homogenized data, to the identification of underlying climatic trends. Based on these trends, I develop normal HDDs based on actual HDDs recently reported for the three stations.

Further, I base my analysis of actual HDD information on data ended July 31, 2009. The actual annual HDD information I show is for twelve-month periods ended July 31. The HDDs I show using homogenized data are for 3, 5, and 7-month periods ended February 28, March 31, and April 30.

Q. ARE YOU THE ONLY BLACK HILLS WITNESS THAT ADDRESSES WEATHER NORMALIZATION ISSUES?

A. No, I am not. Dr. Robert Livezey, Mr. Thomas Sullivan, and I all address weather normalization issues. Dr. Livezey and I limit our testimony to "normal" HDDs. Mr. Sullivan is responsible for the calculation of the adjustment to normalize test year sales and revenues to the "normal" HDD level I determine.

Dr. Livezey's testimony addresses normal HDDs from a more philosophical and theoretical perspective. He describes recent patterns in temperatures globally, nationally, and regionally. As indicated previously, I applied the results of Dr. Livezey's analysis to determine the normal HDDs which should be used in this case.

Q. PLEASE DESCRIBE THE APPROACH YOU FOLLOWED TO CONDUCT YOUR STUDY OF WEATHER NORMALS.

A. I first compare actual HDDs with NOAA Normals and 30-year average HDDs. Because of my familiarity with the hinge-fit and optimum climate normals (OCN) Dr. Livezey describes in his testimony, I include the hinge-fit and OCN in my comparisons. I show these comparisons graphically in Exhibit __ (LWL-1). In Exhibit __ (LWL-2), I show the calculations underlying the hinge-fit.

V. NOAA NORMALS

Q. HOW DO NOAA NORMALS DIFFER FROM A 30-YEAR AVERAGE?

A. They differ in two respects. First, there is a timing difference. NOAA bases its normals on a 30-year average of HDDs. However, NOAA publishes its 30-year normals once every ten years. This is consistent with World Meteorological Organization convention (thirty-year average calculated once a decade). The NOAA 30-year normals available currently are based on data for the 30-year period ended December 31, 2000. The 30-year average, on the other hand typically represents the average of the most recent 30-years corresponding to the end of the test period. Thus, for the purpose of this rate case, NOAA normals are based on the average HDDs for the 30-year period ended December 31, 2000. The 30-year average is based on the average HDDs for the 30-year period ended July 31, 2009.

Assuming there has been no trend (warming or cooling) in weather conditions since 1971, NOAA normals would approximately equal the 30-year average (as well as shorter period averages) and there would be no problem with using NOAA normals. However, as I show in Exhibit __ (LWL-1), in recent years (particularly evident during the past 10 years),

the number of HDDs are less than during earlier periods. In other words, average temperatures have been rising (HDDs declining).

Q. WHAT IS THE SECOND DIFFERENCE?

A. While NOAA suggests that it bases its published normals on a 30-year average, NOAA also indicates that it makes adjustments and estimations to certain published climate records to make the data "homogeneous" and "serially complete." As a result, the NOAA normal HDDs do not entirely conform to calculated 30-year averages of actual HDDs reported by NOAA. I show the difference in NOAA normals and 30-year average HDDs in Exhibit __ (LWL-1). The adjustments that NOAA makes in order to calculate the NOAA Normals are the same as are reflected in the homogenized data Dr. Livezey was able to supply me.

Q. DO OTHERS SHARE YOUR CONCERN REGARDING USE OF TEMPERATURE NORMALS?

A. Yes. The concern regarding the reasonableness of NOAA Normals has been the subject of a number of presentations. For example, on September 26, 2007, I attended a webcast on utility, regulatory, and climate perspectives regarding "Improving Climate Normals."[5] During this webcast, panelists identified a number of options to NOAA's current method.

Three main issues were discussed. These three issues were:

1) Is the 30-year average representative of the current climate?

[5] Jon Davis, Chair of the American Meteorological Society's Energy Committee hosted this webcast. Tom Karl, Director, and Anthony Arguez of NOAA's National Climatic Data Center (NCDC) served as co-hosts. Other speakers included Matthew Menne of the NCDC; Cynthia Marple, Director of Rates and Regulatory Affairs for the American Gas Association; Don Mason, Ohio Public Utilities Commissioner and Chair of NARUC's Gas Committee; and Robert Livezey, Chief of the NOAA/National Weather Service's Climate Services Division made presentations.

2) What if there is a predominant trend?

3) Are normals obsolete?

These presentations demonstrated that:

1) Except for Florida, the current (2001-06) minimum January temperature experienced in the continental United States (including the Company's service area) was warmer than in the recent past (1971-2000).

2) Except for the east and southeast United States, average temperatures in January through March are warmer today (1975-05) than in the past (1941-75). For southeastern Nebraska and southwestern Iowa, this increase amounts[6] to between 2.7 and 3.6 degrees F, and for Northeastern Nebraska and Northwestern Iowa between 3.5 and 4.5 degrees F. When converted to annual HDDs, these increases in temperature represent a decline in annual HDDs on the order of 500 to 800 HDD over the 30-year period.

3) A number of stakeholder groups are questioning whether NOAA normal HDDs are representative and whether the NOAA normals recognize recently observed climate (temperature) change.

4) Professionals within NOAA itself are questioning the reasonableness of NOAA's current practice.

5) It is highly likely that some change in NOAA's "official" methodology will be made in the near future.

During this webcast, Dr. Livezey described the hinge-fit technique he discusses in his testimony.

[6] See Dr. Livezey's Exhibit __ (REL-1), Page 1761, Figure a

Q. SINCE THIS WEBCAST HAS NOAA ANNOUNCED A CHANGE IN ITS "OFFICIAL" METHODOLOGY?

A. Yes, in part. On June 2, 2009, representative of the NCDC rolled out to representatives of the energy industry a new set of "normals." During this presentation, the NOAA representatives stated that they would continue to publish the traditional NOAA normals (30-year average, once a decade). However, NOAA indicated that it would supplement the traditional normals with 3 alternatives which will be published annually. These three alternatives include a thirty year rolling average, the normal based on the OCN, and the normal based on the hinge-fit. Unfortunately, NOAA plans only to publish normals of the monthly average daily, high, low, and average temperatures.

Q. DOES NOAA USE THE NOAA-PUBLISHED 30-YEAR NORMALS TO FORECAST WEATHER?

A. No. While NOAA's Climate Prediction Center (CPC) publishes long-term forecasts in terms of departure from the 30-year NOAA Normal, the forecast techniques described by the CPC indicate that in preparing its forecasts, the CPC relies on the most recent 10-year trend (average).

The CPC lists eight main factors that influence its seasonal climate forecasts. The first of these eight factors is El Niño and La Niña[7]. The second of these eight factors is trends "approximated by the difference between the most recent 10-year mean of temperature or 15-year mean of precipitation for a given location and time of year and the 30-year climatology

[7] In simple terms, El Niño and La Niña are periodic naturally occurring phenomena that relate to interactions between the equatorial Pacific Ocean surface temperatures and atmosphere. El Niño represents the warm phase, whereas La Niña is the cold phase. El Niño/La Niña cycles affect weather patterns throughout the world.

period (currently 1971-2000)." Thus, the National Weather Service (NOAA) bases its long-range forecasts on the 10-year average temperature, not the 30-year NOAA Normal.

Q. WHAT LONG-TERM FORECASTS OF TEMPERATURE DOES THE CPC PROVIDE?

A. The CPC provides forecasts for 139 geographic areas within the United States. Forecasts are updated monthly for 13 three month periods (Apr, May, and June 2009; May, June, and July 2009, etc). For example, in mid April 2009, CPC published forecasts through the three-month period ending July 2010.

Q. WHAT ARE THE GEOGRAPHIC AREAS IN NEBRASKA?

A. Based on the statistical climate similarity, the CPC divides the country up into 139 climate divisions. Black Hills' Nebraska service area is included in two of these divisions. These divisions are roughly:

1) The northeastern quarter of Nebraska

2) The south central and southeastern portion of Nebraska

Q. WHAT IS THE CPC FORECAST FOR BLACK HILLS' SERVICE AREA THIS COMING WINTER?

A. The CPC forecasts that average temperatures for the 2009-10 winter period (December, January, and February) will likely be higher (and thus HDDs will be lower) than the 30-year NOAA Normal in both of the Nebraska climatological regions that encompass Black Hills Nebraska service area. Specifically the CPC forecasts that for the three-month period ending February 2009, the average temperature will exceed the 30-year NOAA

Normal by 0.80 and 0.55 degrees F in the northeastern and southeastern regions of Nebraska, respectively.

Q. WHAT IS THE IMPLICATION OF THIS CPC FORECAST ON THE EXPECTED HDDS?

A. One can only reasonably expect[8] that if rates set in this rate case were based on the 30-year NOAA Normals or 30-year averages, test period sales will exceed the level of sales the Company will experience when the rates approved in this case first go into effect. The plain result will be that Black Hills will be denied a reasonable opportunity to earn the rate of return allowed by the Commission.

Q. DO OTHER STATE REGULATORY COMMISSIONS RELY ON NORMALS OTHER THAN NORMALS BASED ON A 30-YEAR AVERAGE?

A. Yes, several do. I understand that the Minnesota Public Service Commission routinely relies on a 20-year average. In a recent decision, the Wyoming Public Service Commission adopted a settlement in which test period sales levels were based on a five-year weighted average. The New Mexico Public Service Commission is in the process of a generic investigation into whether NOAA Normals should continue to be used. Further, I understand that commissions in the states of Arizona, Colorado, Illinois, New Jersey, Rhode Island, Texas, Utah, and Vermont have relied on something other than the 30-year NOAA normals for normalizing weather in rate cases. These are only the states that I have identified; there may be more.

[8] The CPC indicates based on their forecasts, the probability of average temperatures during the three-month period ending February 2010 exceeding NOAA 30-year Normals amount to 58% and 56% in northeastern and southeastern Nebraska respectively.

Q. BASED ON THE FOREGOING, WHAT DO YOU CONCLUDE?

A. I conclude that one can no longer assume that because they are calculated and published by NOAA, the traditional NOAA normals are reasonable for normalizing sales in gas rate cases. In his direct testimony, Dr. Livezey addresses the reasonableness of the use of normals based on a 30-year average. In simple fact, a 30-year average does not give consideration to the sustained trend of warmer winter period temperatures since 1975.

VI. HDDS IN BLACK HILL'S SERVICE AREA

Q. PLEASE DESCRIBE EXHIBIT __ (LWL-1).

A. Exhibit __ (LWL-1) consists of four sheets (graphs). On these graphs, I have plotted annual (year ended July 31) HDDs reported from 1951 through 2009. I have also plotted:

1) The most recently published NOAA Normals available in each year since 1963,
2) The OCN for the period ended July 31, 2009, and
3) The normal using data for the 58-year period ended July 31, 2009, following the hinge-fit technique described by Dr. Livezey.

In Sheet 2 through 4, I show data for the Lincoln, Norfolk, and Omaha weather stations. On these sheets, I also show the 30-year rolling average. In Sheet 1, I show the three-station average as well as the average for the 30-year periods ended 2000 and 2009.

Q. WHY DO YOU USE DATA FOR THIS 58-YEAR PERIOD?

A. This period corresponds to the end of the test year in this rate case (July 31, 2009). The first year of data that I include is 1951 because data prior to January 1, 1951 are not readily available. Daily temperature data are available but not HDD data.

Q. DO YOU REACH ANY CONCLUSIONS BASED ON THE INFORMATION YOU SHOW IN EXHIBIT __ (LWL-1)?

A. Yes, I do. Based on my examination of these graphs, I conclude that neither the NOAA normals nor the 30-year average reasonably relate to HDDs actually experienced. The degree that NOAA Normals fail to relate to actuals is demonstrated by the fact that actual reported HDDs for each of the three weather stations have been less than NOAA normals for eight out of the most recent ten years.

Since NOAA normals exceeded actual HDDs in eight out of the most recent ten years for all three weather stations, one can reasonably conclude that in all likelihood, normals based on a 30-year average will continue to exceed actual HDDs.

Q. DO YOU HAVE ANY FURTHER OBSERVATIONS REGARDING THE INFORMATION SET FORTH IN EXHIBIT __(LWL-1)?

A. Yes, I have. The slope of the hinge for the Lincoln and Omaha weather stations is much less, and the number of years determined by the OCN much higher than I expect based on studies I have performed elsewhere.

In Exhibit __ (LWL-2), Sheet 5, I summarize some statistics developed in my hinge-fit analysis. As I show, the slope for the Lincoln and Omaha weather stations is negative 4.8 and 6.9 HDD/yr respectively, whereas the slope for the Norfolk station is a negative 20.7. Based on my experience elsewhere, I expect that the slopes for all three stations should exceed negative 10, if not negative 15 or 20.

A second key measure is the r-squared value. The r-squared value is a measure of the degree changes in annual HDDs are explained by the hinge fit. As I show, based on the

complete data set the r-squared value ranges from less than 2 to 18.5 percent. Using the data set to date,[9] I find r-squared value ranging from 26 to 36.7 percent. Due to the extreme variability in HDDs from year to year, I expect relatively low r-squared values. However, these values are less than I expect.

Q. WHAT CAN ACCOUNT FOR THESE RELATIVELY LOW VALUES?

A. One explanation is that the hinge fit does not fit the underlying data. However, my experience with weather data at a number of other weather stations (including some located in Nebraska) indicates that the problem more likely relates to inadequacies in the underlying data, especially when using an extended data set. In order to assess the reliability of weather data over the long term from these three stations I examined the station history for each.

Q. WHAT DO YOU CONCLUDE FROM THIS INVESTIGATION?

A. Station moves appear to explain at least some of the inconsistencies I see. For example, consistent data are not available for the Lincoln Station. Prior to 1970, data for the Lincoln Airport are not reported, as are data for parts of 1993 and 1994. Though data are not reported prior to 1970, in 1964, the Lincoln Station was reported to have moved about 0.9 miles east from the western side of the Lincoln airport to the eastern side. In 1992, the station was again moved about 1.4 miles southwest to the southwestern portion of the airport. The first two stations appear to have been sheltered somewhat by their proximity to buildings.

[9] The data set to date represents calculating a new hinge-fit each rear based on data ended for the period 1952 to date. The complete data set (1952 – 09) represents calculating one hinge-fit and using that equation to predict HDDs each year in the period. I show the r-squared values on Line 4 of Exhibit __ (LWL-2)

Station moves may also explain inconsistencies with regard to the Omaha station. The Omaha Station was relocated in October 1995 0.9 miles east from immediately west of the existing terminal building to a point on the eastern side of the airport. In February 1996, the station was moved about 1.1 miles to the northwest. These latter two stations are in the open about ½ mile from the Missouri River.

I expect that the move of both stations in the 1990's resulted in relatively colder reported conditions than from the station prior to the move. This would explain a hinge slope less than expected and a relatively lower r-squared value.

VII. HOMOGENIZED (SYNTHESIZED) HDDS

Q. ARE DATA AVAILABLE THAT DO NOT SUFFER FROM THIS PROBLEM?

A. Yes, there are. To recognize the implications of station moves, changes in equipment, and equipment reading practices, NOAA adjusts historical data when calculating normals. In his direct testimony, Dr. Livezey refers to this adjusted data as homogenized.

Q. CAN YOU USE THIS HOMOGENIZED DATA TO DIRECTLY DETERMINE NORMAL WEATHER CONDITIONS FOR THE TEST YEAR?

A. No, I can not. The homogenized data available consists of monthly average daily temperatures from January 1950 through December 2008. The data includes only monthly averages (of average daily temperatures). I cannot therefore directly calculate HDDs. For example, if the average temperature in a month amounts to 65 degrees. That average will include days in which the average temperature exceeds 65 degrees and days when the average temperature is below 65. When the average temperature exceeds 65,

HDDs are set equal to zero. When the average temperature is below 65, the HDDs for that day are equal to 65 less the average temperature.

During the cold winter months, I can reasonably synthesize monthly HDDs by subtracting the average monthly temperature from 65 and multiplying the result by the number of days in the month. However, for those months where the average temperature approximates 65 degrees, these synthesized HDD will differ from those reported by NOAA.

Q. FOR COLD WINTER MONTHS HAVE YOU DEVELOPED WHAT YOU REFER TO AS SYNTHESIZED HDDS?

A. Yes, I have. For the seven-months ended April 30 (ONDJFMA), of each winter period, I develop synthesized HDDs using the homogenized HDDs Dr. Livezey provided me. I compare these synthesized HDDs with actual reported HDDs for the same seven-month period. I show this comparison graphically in Exhibit __ (LWL-3) for the Lincoln, Norfolk, and Omaha weather stations.

Q. BASED ON THE COMPARISONS YOU SHOW IN EXHIBIT __(LWL-3) DO YOU REACH ANY CONCLUSIONS?

A. Yes, I do. As the comparison clearly shows, for the Norfolk Station synthesized HDDs are nearly identical to actual reported HDDs throughout the entire period. However, for the Lincoln and Omaha weather stations, synthesized HDDs are considerably greater than actual HDDs:

1) From 1951 through 1972 for the Lincoln weather station, and

2) From 1951 through 1979 for the Omaha weather station

Since about 2000, for both stations, synthesized HDDs are nearly equal to actual reported HDDs.

The fact that actual HDDs are considerably higher than actual HDDs prior to about 1980, indicates that dislocations in historical data contributes to the reduction in slope and low r-squared values for Lincoln and Omaha.

Q. HOW CAN YOU USE THIS HOMOGENIZED DATA TO DEVELOP NORMAL HDDS?

A. I can use average temperatures directly or synthesized HDDs developed from homogenized data to evaluate trends that I can then apply to reported HDDs to develop HDDs normals to use in this rate case. Specifically, I use synthesized HDDs to develop the optimum climate normal period based on homogenized data. I then use the number of years indicated as the optimum climate normal to calculate normal HDDs based on actual reported HDDs during that period.

VIII. HINGE-FIT AND OPTIMUM CLIMATE NORMAL

Q. HAVE YOU DEVELOPED THE HINGE FIT AND OPTIMUM CLIMATE NORMAL USING SYNTHESIZED HDDS?

A. Yes, I have. In Exhibit __(LWL-4), I develop the hinge fit and optimum climate normal based on the ten-station average synthesized HDDs. In Exhibit __(LWL-5), I develop the hinge fit and optimum climate normal for the Lincoln, Norfolk, and Omaha weather stations.

Q. PLEASE EXPLAIN EXHIBIT __(LWL-4).

A. Exhibit __(LWL-4) consists of four sheets. In Sheets 1 through 3, I graphically show synthesized HDDs, the hinge-fit, OCN, and the average for the 30-year period ended 2000, and the 30-year period ended 2008. In Sheet 1, I show information graphically for the seven-month period ended April 30 (ONDJFMA). In Sheet 2, I show information graphically for the five-month period ended March 31 (NDJFM). In Sheet 3, I show information graphically for the three-month period ended February 28 (DJF). In Sheet 4, I show summary statistics.

Inspection of the three graphs indicates that regardless of whether data are analyzed over three, five, or seven winter months, the hinge fit and OCN appear reasonable and provide a good fit in explaining the underlying data. This conclusion is confirmed based on examination of the summary statistics I show in Sheet 4. As I show, regardless of the winter period used the r-squared values have increased to over 13 percent based on the entire data set. The r-squared value increases to over 35 percent when the data set to date is evaluated. While r-squared values of 13 or 35 percent are low for most applications, with the extreme variability of weather conditions from year to year, I consider these values good.

Further, as I show, the OCN ranges between nine and ten years. The hinge-slopes of negative 13 and negative 20 fall within the range of my expectation.

Q. PLEASE EXPLAIN EXHIBIT __(LWL-5).

A. Exhibit __(LWL-5) consists of five sheets. In Sheets 1 through 4, I graphically show synthesized HDDs for the seven winter months, the hinge-fit, OCN, and the average for the 30-year period ended 2000, and the 30-year period ended 2008. In Sheet 1, I show information graphically for the average of the three stations. In Sheets 2 through 4, I

show information graphically for the Lincoln, Norfolk, and Omaha weather stations respectively. In Sheet 5, I show summary statistics.

As with the graphs I show in Exhibit __(LWL-4), inspection of the four graphs indicates that regardless of the weather station, the hinge fit and OCN appear reasonable and provide a good fit in explaining the underlying data. This conclusion is again confirmed based on examination of the summary statistics I show in Sheet 5. As I show, regardless of the weather station the r-squared values exceed 15 percent based on the entire data set and over 35 percent when the data set to date is evaluated.

Further, as I show, the OCN ranges between eight to ten years. The hinge-slope ranges between negative 19 and negative 27. These results clearly demonstrate that the use of a 10-year average of actual HDDs as recommended by Dr. Livezey in this case is reasonable and conservative.

IX. IMPACT OF ALTERNATIVES

Q. WHAT ARE THE IMPLICATIONS OF USING THE NOAA NORMAL?

A. My study demonstrates that, because of the warming trend since about 1975, normals based on a 30-year average no longer reasonably correspond to the actual HDDs experienced during the first year rates are in effect. This failure is especially evident during the most recent 10 years. Over the 10-year period ended July 2009, NOAA normals exceed actuals so consistently and to such a significant extent that it is likely their use will result in weather-normalized sales in excess of the levels the Company will actually experience when rates developed on the basis of such excess sales levels are in effect. The distribution of HDDs for the Lincoln, Norfolk, and Omaha weather stations

over the past 10 years indicates that the probability of actual HDDs exceeding the NOAA normal amounts to 20%. This means that statistically, one can expect that actual HDDs will exceed NOAA normal HDDs once every 5 years. Further, this historical data indicates that the NOAA normal HDD's will exceed actual by over 7 percent. Such a likely overstatement in this rate case does not provide Black Hills with a reasonable opportunity to collect the revenue requirement determined by the Commission or to earn the allowed rate of return.

My study also demonstrates that while a 30-year average better corresponds to actual HDDs than NOAA normals, the use of a 30-year average likewise does not provide Black Hills a reasonable opportunity actually to collect the revenue requirement.

Q. WHAT IMPACT DOES THIS HAVE ON THE COMPANY?

A. Since NOAA 30-year Normals and 30-year averages have been higher than actual HDDs one can only reasonably expect their use in this rate case will result in an overstatement of test year sales, with a corresponding understatement of rates, and, therefore, will not provide a reasonable opportunity for Black Hills to earn its allowed rate of return.

Q. HAVE YOU DETERMINED THE FINANCIAL IMPACT OF USING NOAA NORMALS OVER THE PAST TEN YEARS?

A. Yes, I have. Based on the coefficients used by Mr. Sullivan in his weather normalization adjustment and existing rate levels, and assuming that Black Hills filed and the Commission acted on a rate case in each of the past 10 years, Black Hills would have experienced a before tax shortfall in earnings of about $14,000,000.

Q. SINCE NEITHER NOAA NORMALS NOR 30-YEAR AVERAGES ARE REPRESENTATIVE OF ACTUAL HDDS, HAVE YOU DEVELOPED NORMALS THAT MORE REASONABLY PROVIDE BLACK HILLS WITH AN OPPORTUNITY TO EARN ITS ALLOWED RATE OF RETURN?

A. Yes, I have. I do so by relying on the hinge-fit technique outlined in Dr. Livezey's direct testimony. I show the results of my hinge analysis as the curve labeled "Hinge-Fit" in Exhibit __ (LWL-1).

Q. HOW DO YOU APPLY DR. LIVEZEY'S HINGE-FIT TECHNIQUE IN THIS CASE?

A. Dr. Livezey observes that from about 1940 to the mid-1970's there was no predominant trend in average temperatures. He further observes that after the mid-1970's a strong linear trend of warming temperatures (fewer HDDs) is evident. Recognizing these two features, I use a simple least squares linear regression technique where:

1) The dependent variable (Y) is equal to the actual annual HDDs,

2) The independent variable (X) is equal to one each year prior to 1976, and

3) The independent variable is increased by one each year beginning in 1976.

The result of this linear regression is an equation in the form of:

"Y = A + BX"

where "A" is a constant and "B" is the change (since 1975) in HDDs over time (each year).

By setting "X" equal to one prior to 1976, I anchor the hinge at 1975. By incrementing "X" by one each year after 1975, I reflect the implication of the linear warming trend discussed by Dr. Livezey.

With this equation, I can predict HDDs for the period 1951 through 2007, and estimate HDDs a few years in the future. For example, I can use this equation to estimate HDDs for the first year rates resulting from this Docket will be in effect.

The resulting fitted curve (equation) is a straight line (constant) up to 1975. Beginning in 1976, the curve exhibits a downward trend[10]. I show this curve for each weather station in Exhibit __ (LWL-1).

Q. HAVE YOU PREPARED AN EXHIBIT SHOWING YOUR DEVELOPMENT OF THE HINGE-FIT?

Yes, I have. In Exhibit __ (LWL-2), I show my development of the hinge-fit based on reported HDDs for the average of the three stations and for the Lincoln, Norfolk, and Omaha stations individually. In Exhibit __ (LWL-4), Sheet 4, I show the hinge-fit results for the 10-station average based on DJF, NDJFM, and ONDJFMA synthesized HDD. In Exhibit __ (LWL-5), Sheet 5, I show hinge-fit results for the three-station average and for the Lincoln, Norfolk, and Omaha stations using ONDJFMA synthesized HDDs.

Q. DO YOU HAVE ANY OBSERVATIONS REGARDING THE HINGE-FIT RESULTS?

[10] In my testimony and exhibits, I have expressed weather conditions in terms of HDDs. The HDDs have been declining while, of course, winter period average temperatures have been increasing. In other words, charts showing temperatures have an upward sloping trend, while the same chart showing HDDs will have a downward trend.

A. Yes, I do. In examining the results that I show in Exhibits __ (LWL-2), __ (LWL-4), and __ (LWL-5), I note (with the exception of the use of reported HDDs for the Lincoln and Omaha stations)[11] the results are the same. When I eliminate the questionable data from Lincoln and Omaha, I find that for the Norfolk Station, and using synthesized HDDs for the three stations and the 10-station average, the OCN (optimum climate normal period) falls in the narrow range of 8 to 10 years. Because of the consistency in result, I agree with Dr. Livezey's recommendation to use the 10-year average of actual reported HDDs in this rate case. The 10-year average is slightly longer than the OCN and the data for the most recent 10-years does not appear to suffer from the dislocations evidenced in earlier periods.[12]

X. IMPLICATIONS OF OTHER AVERAGING PERIODS

Q. HAVE YOU EVALUATED NORMALS BASED ON VARIOUS AVERAGING PERIODS OTHER THAN 10-YEARS?

A. Yes, I have. I do so in Exhibit __ (LWL-6). In Exhibit __ (LWL-6), I show the results of my comparison over the 25-year and the 10-year periods ended July 31, 2009. In this Exhibit, I compare actual HDDs with "normal" HDDs based on data for the period ended the second preceding year.

In this regard, I compare actual HDDs with 30-year normals published by NOAA once a decade and rolling averages for 30, 25, 20, 15, 10, and 5-year periods. By comparing actuals

[11] As I previously discussed the consistency of HDDs reported at the Lincoln and Omaha stations is questionable over the long term.

[12] Examination of Exhibit__(LWL-3), shows that homogenized (synthesized) HDDs since 1999 are nearly equal to actual for all three stations. However, homogenized HDDs prior to 1999 are substantially greater than actual for the Lincoln and Omaha stations, especially prior to about 1975.

to normals in this manner, I assume that a rate case prepared in the fourth quarter of 2009, using a July 31, 2009, test year, would rely on historical data through July 2009, adjusted to reflect the HDDs normals based on experience through July 31, 2007. Further, I assume the rates resulting from that rate case would become effective mid to late 2010.

Q. DO YOU HAVE ANY OBSERVATIONS ABOUT THE COMPARISONS YOU SHOW IN EXHIBIT __ (LWL-6)?

A. Yes, I do. As the number of years included in the average (normal) declines, the average difference between actual and normal decrease, and there is a better balance between the numbers of years that the actual exceeds the average (normal) and the number of years the average (normal) exceeds the actual.

As I show, while the 5-year average better corresponds to actual, the 10-year average represents a vast improvement over the longer-term averages, especially the NOAA 30-year normal. Since this 10-year average is comparable to the 8 to 10-year OCN for each station, I recommend its use.

Q. ARE THE RESULTS YOU SHOW IN EXHIBIT __ (LWL-6) SURPRISING?

A. No, they are not. The results reflect the simple fact that recent winter weather in Black Hills' service area has been generally warmer than in the past. Further, the results are comparable to results of similar studies I performed for weather stations in Colorado, Iowa, Missouri, Minnesota, Nebraska, New Mexico, and Wyoming. In each of these studies, I found that for nearly all weather stations evaluated, as the number of years included in measuring the normal decreases, the resulting normal better predicted actual

HDD in the second succeeding year, when the rates determined in that rate case would go into effect.

Q. WHAT IS THE RELEVANCE OF THE AVERAGE DIFFERENCE YOU SHOW IN LINES 4, 10, 17, 23, 30, AND 36 OF EXHIBIT __ (LWL-6)?

A. This average difference provides a measure of how well normal HDDs (based on the various averages) correspond to actual over the long term. As this difference approaches zero, sales during the period analyzed (in this case 10 and 25 years) more closely approximates (on average, all other factors equal) the level used to set rates during that period.

Q. WHAT IS THE SIGNIFICANCE OF THE BALANCE BETWEEN THE NUMBER OF YEARS WHEN ACTUAL HDDS EXCEED AVERAGE AND THE NUMBER OF YEARS WHEN THE AVERAGE EXCEEDS ACTUAL?

A. The number of years where the actual exceeds the normal versus the number where normal exceeds actual provides a measure of the probability that actual sales and sales revenues during the first year rates are in effect will exceed test period sales. It provides a measure of the degree to which rates approved by the Commission afford the Company a reasonable opportunity to realize its allowed rate of return in any one year. When the normals used in a rate case exceed actuals, test year weather normalized sales will exceed actual sales (all other factors being equal), and hence rates will have been set at a level that does not permit the Company a reasonable opportunity to earn its allowed rate of return.

Because of variations in the number of HDDs from year to year, I do not expect normal HDDs to exactly equal actual. However, there should be a reasonable balance or symmetry over the longer term.

XI. RECOMMENDED HDD NORMALS

Q. WHAT RECOMMENDATION DO YOU HAVE FOR THE COMMISSION REGARDING SETTING NORMAL HDDS?

A. Consistent with generally accepted ratemaking principles, the Commission should set rates based on sales levels using normal HDDs that recognize the sustained warming trend experienced in Black Hills Nebraska service area since about 1975. As Dr. Livezey explains in his direct testimony, based on studies he performed over the past 15 to 20 years, this warming trend is a global phenomenon that has been especially evident during the winter months, in Nebraska and states to the west and north.

Based on evaluation methods (the hinge-fit and optimum climate normal) developed by Dr. Livezey for developing weather normals as a forecasting tool, recognizing historical data limitations, the use of a 10-year average in this case, approximates the OCN, and overcomes limitations in the long term data available for the Lincoln and Omaha weather stations.

Q. WHAT IS THE RESULT IF THE COMMISSION USES NORMALS THAT MORE CLOSELY ALIGN WITH ACTUAL HEATING DEGREE-DAYS WHEN MAKING A WEATHER NORMALIZATION ADJUSTMENT IN THIS CASE?

A. The clear result is that the Commission will set rates based on sales levels that will better approximate actual sales during the first year rates are in effect. This will offer the

Company a more reasonable opportunity to earn the rate of return approved by the Commission.

Q. ARE YOU SUGGESTING THAT THE COMMISSION PREDICT THE WEATHER?

A. No, I am not. I am not suggesting that the Commission predict weather any more than the Commission has in the past. In reality, the Commission implicitly predicts the weather any time it approves or adopts a weather normalization adjustment in a rate case. The Commission assumes that the weather during the period the rates resulting from a rate case are in effect will be comparable to the normal used in the normalization adjustment.

The utilities subject to the jurisdiction of the Commission are entitled to rates that provide them a reasonable opportunity to earn the rate of return allowed by the Commission. In order for the Commission to provide this opportunity, the Commission must assume sales levels upon which rates are developed (test period normalized sales) that reasonably reflect what will be experienced during the period the rates approved by the Commission will be in effect. If the Commission uses normal HDDs, which exceed the level reasonably expected during the period the rates will be in effect, the Commission has denied the utility a reasonable opportunity to earn the allowed rate of return that the Commission finds reasonable, and such a result might be considered confiscatory.

Q. TO SUMMARIZE, BASED ON YOUR INVESTIGATION, HOW SHOULD THE COMMISSION DETERMINE NORMAL HDDS IN THIS CASE?

A. Consistent with generally accepted ratemaking principles, normal HDDs for the purpose of weather normalizing sales in this case should be determined using the 10-year average of actual HDDs through July 31, 2009.

Based on the analysis I have described in this testimony, and consistent with the concept of providing the Company with a reasonable opportunity to earn a return on equity commensurate with that allowed by the Commission; NOAA-published normal HDDs should not be used for the purpose of weather normalizing sales in this case. My analysis clearly demonstrates that in the areas served by the Company over the past 25 years, NOAA-published normals have consistently exceeded actual HDDs experienced during periods when rates based on such normals would have been in effect. Therefore, historically, the use of these NOAA normals to develop pro forma test period sales results in inadequate rate levels.

I have demonstrated historically that use of the hinge-fit technique or shorter-term averages to define normal HDDs for purposes of the weather normalization adjustment better aligns rates with conditions during the period that the Commission's approved rates would have been in effect.

Q. HAVE YOU DETERMINED THE APPROPRIATE LEVEL OF NORMAL HDDS BY MONTH?

A. Yes, I have. In Exhibit __ (LWL-7), I show normal HDDs by month based on use of the 10-year average.

Q. DO YOU HAVE A RECOMMENDATION FOR THE COMMISSION BASED ON YOUR ANALYSES?

A. Yes, I recommend the Commission approve the use of the monthly normals set forth in Exhibit __ (LWL-7) for normalizing sales in this case.

Q. DOES THIS CONCLUDE YOUR PREPARED DIRECT TESTIMONY?

A. Yes, it does.

BEFORE THE NEBRASKA PUBLIC SERVICE COMMISSION

IN THE MATTER OF BLACK HILLS/ NEBRASKA GAS UTILITY COMPANY, LLC D/B/A BLACK HILLS ENERGY, OMAHA, SEEKING A GENERAL RATE INCREASE FOR BLACK HILLS ENERGY'S RATE AREAS ONE TWO AND THREE (CONSOLIDATED)	))))))	APPLICATION NO. NG____

VERIFICATION

STATE OF ARIZONA)
) **ss**
COUNTY OF PINAL)

Larry W. Loos, of lawful age, being first duly sworn, deposes and says that he is a Director in the Eterprise Management Solutions Division of Black & Veatch Corporation that he has read the foregoing testimony, knows the contents thereof, and that the statements and allegations therein contained, including the information provided herewith pursuant to the State Natural Gas Regulation Act, are true to the best of his information, knowledge, and belief.

Larry W. Loos

SUBSCRIBED AND SWORN TO before me this 20th day of November, 2009.

Notary Public

JAEMA M. MEJIA
NOTARY PUBLIC - ARIZONA
PINAL COUNTY
My Commission Expires
September 03, 2012