Exhibit No.:	
Issues:	Weather Normalization
Witness:	Edward L. Spitznagel, Jr.
Exhibit Type:	Direct
Sponsoring Party:	Missouri-American Water Company
Case No.:	WR.2007.XXXX, SR.2007.XXXX
Date:	December 15, 2006

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. WR.2007.XXXX
SR.2007.XXXX

DIRECT TESTIMONY

OF

EDWARD L. SPITZNAGEL, JR.

ON BEHALF OF

MISSOURI-AMERICAN WATER COMPANY

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

IN THE MATTER OF MISSOURI-AMERICAN WATER COMPANY FOR AUTHORITY TO FILE TARIFFS REFLECTING INCREASED RATES FOR WATER AND SEWER SERVICE	)))))	**CASE NO. WR-2007-XXXX** **CASE NO. SR-2007-XXX**

AFFIDAVIT OF EDWARD L. SPITZNAGEL, JR.

Edward L. Spitznagel, Jr., being first duly sworn, deposes and says that he is the witness who sponsors the accompanying testimony entitled "Direct Testimony of Edward L. Spitznagel, Jr."; that said testimony and schedules were prepared by him and/or under his direction and supervision; that if inquires were made as to the facts in said testimony and schedules, he would respond as therein set forth; and that the aforesaid testimony and schedules are true and correct to the best of his knowledge.

Edward L. Spitznagel, Jr.

State of Missouri
County of St. Louis
SUBSCRIBED and sworn to
Before me this 12 **day of** December **2006.**

Notary Public

My commission expires: 04/11/2010

DIRECT TESTIMONY
EDWARD L. SPITZNAGEL, JR.
MISSOURI-AMERICAN WATER COMPANY
CASE NO. WR.2007.XXXX
SR.2007.XXX

TABLE OF CONTENTS

DIRECT TESTIMONY

EDWARD L. SPITZNAGEL, JR.

WITNESS INTRODUCTION

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS, AND EMPLOYER.

A. My name is Edward L. Spitznagel, Jr., and my business address is Campus Box 1146, One Brookings Drive, St Louis, Missouri 63130. I am employed by Washington University.

Q. WHAT IS YOUR PRESENT POSITION?

A. I am Professor of Mathematics in the College of Arts and Sciences at Washington University. I also hold a joint appointment in the Division of Biostatistics of the Washington University School of Medicine.

Q. Please review your educational background and work experience.

A. I hold a Bachelor of Science, summa cum laude, in mathematics, awarded in 1962 by Xavier University, Cincinnati, Ohio. I hold a Master of Science (1963) and Ph.D. (1965) in mathematics awarded by the University of Chicago. I have served on the Faculty of Arts and Sciences of Washington University since 1969. I have held a joint appointment in the Division of Biostatistics since 1978. From 1965 to 1969, I was on the faculty of Northwestern University.

Attached to my testimony is Schedule ELS-1, which provides a more detailed listing of my education and qualifications in the area of mathematics and statistics.

PURPOSE AND SCOPE

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS CASE?

A. I have been employed by Missouri-American Water Company to make weather-normalized predictions of water utilization for the period January 2007 to December 2007.

Q. WHAT IS WEATHER NORMALIZATION?

A. From one year to the next, variations in temperature and precipitation lead to changes in water consumption. More water will generally be used during hotter, drier periods. The regulatory question is how to reflect those weather-related differences when setting rates.

For ratemaking purposes, revenues need to be set at as "normal" a level as possible, factoring out the potential or actual results of unusual weather conditions. This can be accomplished by building statistical models that predict water utilization from meteorological data and other possible predictors. An estimate of future utilization can then be made by using a long-term average of meteorological data and known values of the other predictors.

Q. WHAT ARE EXAMPLES OF THESE OTHER NON-METEOROLOGICAL PREDICTORS?

A. One is the year itself. Due to gradual introduction of water-conserving plumbing fixtures and appliances, in many regions use of water appears to be slowly declining over time. In other regions where the growth has led to new homes with expansive lawns and/or larger commercial establishments, the use of water can increase over time.

Another is the month of the year. While water utilization increases during the warmer, drier summer months, analysis of variance shows that month as a categorical variable is a powerful predictor even after temperature and moisture have been included in the model.

Q. WHAT MODEL FOR WATER UTILIZATION DID YOU EMPLOY?

A. In a previous case before the Public Service Commission of the Commonwealth of Kentucky (1997), I screened a large number of candidate predictors by examining data from fourteen different operating systems in five states: Kentucky, Missouri, Ohio, Tennessee, and Virginia. Five of these fourteen operations were located in Missouri: Brunswick, Cottleville (St. Charles), Mexico, Parkville, and Warrensburg. I also received data from two other Missouri operations: Joplin and St. Joseph. These two systems billed on a quarterly basis but could not provide records on the numbers of customers billed in each billing cycle, so it was not possible to compute monthly consumption on a per-customer basis.

I used as candidate predictors only those variables that correlated consistently with utilization for most or all of these operating companies.

Q. WHAT WERE SOME OF THE VARIABLES THAT MET THIS CRITERION?

A. For heat, both mean temperature and cooling degree days correlated strongly with utilization. For moisture, the Palmer Drought Severity Index correlated strongly with utilization. Rainfall and the available soil moisture index used in Missouri at that time did not correlate nearly as well.

I then fitted the surviving candidates in a multivariate model to predict utilization. I found that calendar month was a strong predictor even in the presence of heat and moisture variables. Therefore, I included month as a categorical variable. With month included, I tested drought severity index, temperature, and calendar year as potential numeric predictors. I found that temperature was not a useful predictor in the presence of the other variables, so from that point onward, I did not use it.

For the months of January through April, there was no evidence that moisture predicted utilization. For the months of May through December, there was evidence of moisture predicting utilization, being a weak predictor in the months of May, June, November, and December and a strong predictor for the months of July through October.

Month was a very strong predictor, both as a main effect and interacting with the drought severity index. Because of this, I estimated twelve separate predictive models, one for each month of the year.

Q. WERE ANY CHANGES TO YOUR METHODS REQUIRED IN THE PRESENT CASE?

A. From 2003 onward, a new accounting closing schedule called 4-4-5 was introduced. The idea behind this method is to provide the company with accounting closing periods based on four quarters of year, since the thirteen weeks of the 4-4-5 reporting corresponds to one-fourth of a year minus one day. Due to some non-uniformities in this new billing method, I was unable to make accurate estimates of monthly consumption. As a consequence, I found it necessary to use annual consumption rather than monthly consumption. I also skipped over the year 2003, because the changeover to the 4-4-5 billing method caused this year to be short by nine days. I added the year 1995 to the consumption data so I would have ten years of consumption data to estimate the effects of weather.

Q. HOW DID YOU ADAPT THE MEASURE OF DROUGHT SEVERITY TO MAKING ESTIMATES ON AN ANNUAL RATHER THAN A MONTHLY BASIS?

A. Since the monthly predictions of my previous method were combined linearly to obtain daily consumption averaged over a year, I calculated the average value of the Palmer Drought Severity Index over the eight weather-sensitive months of May through December and used this average value in an annual prediction equation.

This effectively produces the same prediction, just with the computations done in a different order. The computations can be found in Schedule ELS-2. Both Type I (sequential) and Type III (partial) sums of squares and F-tests are given. The selection criterion for retaining a term in the model was based on its Type III sum of squares and F-test. If the drought severity index was not statistically significant, it was removed from the model. If the year since 1990 was not statistically significant, it was removed from the model.

Q. ONCE YOU HAD ESTIMATED THE COEFFICIENTS IN THESE MODELS, HOW DID YOU PROJECT UTILIZATION FOR JANUARY 2007 THROUGH DECEMBER 2007?

A. In fitting each model, I added an additional line of data with years since 1990 set equal to 17, to correspond to the year 2007. I set the Palmer Drought Severity Index to the thirty-year average from 1976 to 2005 for the months of April through December, for the climate region in which the water company is located. I left the daily consumption missing so the regression coefficients would not be affected by the addition of this line of data. I then asked for the predicted value to be calculated, and I printed it out as the estimated average daily consumption for 2007. This produces the same result as if I had evaluated the regression equation with the values of 17 for year since 1990, and the average regional PDSI value, but with no risk of computational error.

Q. WHAT ARE YOUR PROJECTIONS OF DAILY UTILIZATION UNDER AVERAGE WEATHER BY DISTRICT FOR ST LOUIS COUNTY, ST. CHARLES, ST. JOSEPH AND JOPLIN FOR RESIDENTIAL AND COMMERCIAL CUSTOMER CLASSES, IN GALLONS PER CUSTOMER PER DAY?

A. They are:

	Residential	Commercial
St Louis County Quarterly	260.681	1214.18
St Louis County Monthly	N/A	14,448.09
St Charles	270.755	1215.55
St Joseph	158.307	833.223
Joplin	185.770	960.654

Q. YOUR TABLE ABOVE INDICATES THAT YOU ARE NOT PROVIDING THE SAME WATER UTILIZATION ANALYSIS FOR ALL THE DISTRICTS OF THE COMPANY. WHY WERE THE OTHER DISTRICTS EXCLUDED?

A. Based on discussions with the Company, the use of average utilization over the last few years would be incorporated into the Company's filing. I was asked to perform my analysis for the four largest districts which represents over 94% of the customer base for the Company.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.