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Case No.:	WR.2010.XXXX SR.2010.XXXX
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MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. WR-2010-XXXX
SR-2010-XXX

DIRECT TESTIMONY

OF

EDWARD L. SPITZNAGEL, JR.

ON BEHALF OF

MISSOURI-AMERICAN WATER COMPANY

MAWC Exhibit No. 121
Date 5-11-10 Reporter KF
File No. WR-2010-0131

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-2010-XXXX CASE NO. SR-2010-XXXX**

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 22 day of October 2009.

Jacqueline C Metcalfe
Notary Public

My commission expires:

JACQUELIN C. METCALFE
Notary Public - Notary Seal
State of Missouri - County of St. Louis
My Commission Expires Jul. 18, 2010
Commission #06916396

DIRECT TESTIMONY
EDWARD L. SPITZNAGEL, JR.
MISSOURI-AMERICAN WATER COMPANY
CASE NO. WR.2010.XXXX
SR.2010.XXX

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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 periods January 2009 to December 2009 and January 2010 to December 2010, and to determine if there are non-meteorological impacts on sales by customers. The districts I was asked to analyze were St. Louis Metro (to include St. Louis County and St. Charles County), St. Joseph, Joplin and Jefferson City.

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 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.

DESCRIPTION OF ANALYSIS

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 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 (PDSI) 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 (i.e., those variables displaying strong correlation to water usage) 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 in my model.

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 CURRENT AND PREVIOUS CASES?

A. From 2003 to 2006 a billing method called 4-4-5 was employed by the Company. In other words, for a calendar quarter, or 13 weeks, the Company would use two billing cycles of four weeks and one billing cycle of five weeks. The idea behind this method was to provide the company with income based on four quarters of a year, since the thirteen weeks of the 4-4-5 reporting corresponds to one-fourth of a year minus one day. In the previous two cases, 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 monthly reporting to be very uneven in this year. I added earlier years to the consumption data so I would have ten years of consumption data to estimate the effects of weather.

In the current case, I used the same methodology for St. Louis County, St. Charles County, St. Joseph, Joplin, and Jefferson City, this time using the ten years 1998 to

2008, with 2003 skipped as described above. Webster Groves and Florissant customers are excluded from the St. Louis County estimates because they were added during the study period and are both light consumers of water. Including them causes the rate of decrease in consumption to be over-estimated.

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 ("PDSI") 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 2009 THROUGH DECEMBER 2009 AND JANUARY 2010 THROUGH DECEMBER 2010?

A. In fitting each model, I added two additional lines of data with years since 1990 set equal to 19 and 20, to correspond to the years 2009 and 2010. I set the Palmer Drought Severity Index to the thirty-year average from 1979 to 2008 for the weather-sensitive months of May 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 calculated the predicted value, and I printed it out as the estimated average daily consumptions for 2009 and 2010. This produces the same results as if I had evaluated the regression equation with the values of 19 and 20 for year since 1990, and the average regional PDSI value, but with no risk of computational error.

I used these predicted values when at least one of the years and the PDSI was statistically significant. If neither variable was a statistically significant predictor of consumption, I used the 6-year average as the estimate of both 2009 and 2010 consumption, except in Jefferson City commercial customers, where I used a 4-year average because of a large unexplained drop in commercial customers between April and May in 2003.

CONCLUSIONS & RECOMMENDATIONS

Q. WHAT ARE YOUR PROJECTIONS OF DAILY UTILIZATION UNDER AVERAGE WEATHER BY OPERATING COMPANY AND CUSTOMER CLASS, IN GALLONS PER CUSTOMER PER DAY?

A. They are, for 2009:

	Residential	Commercial
St Louis County Quarterly	245.84	1053.65
St Louis County Monthly		13,798
St Charles	267.94	1275.48
St Joseph	158.78	822.32
Joplin	190.73	1066.88
Jefferson City	159.81	746.63

And for 2010:

	Residential	Commercial
St Louis County Quarterly	242.96	1053.65
St Louis County Monthly		13,798
St Charles	267.94	1275.48
St Joseph	156.61	822.32
Joplin	190.73	1090.10
Jefferson City	159.81	746.63

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

Edward L. Spitznagel, Jr.

Born: Cincinnati, Ohio, September 4, 1941.

Education:

Xavier University, 1959-1962
Awarded Bachelor of Science Degree (Summa cum Laude), 1962
University of Chicago, 1962-1965
Awarded Master of Science Degree, 1963
Awarded Ph.D. in Mathematics, 1965

Scholarships and Fellowships:

Xavier University, 1959-1962
Honorary Woodrow Wilson Fellow, 1962-1963
National Science Foundation Fellow, 1962-1965

Positions:

Assistant Professor of Mathematics
Northwestern University, 1965-1969
Associate Professor of Mathematics
Washington University, 1969-1980
Professor of Mathematics
Washington University, 1980-present
Joint appointment, Division of Biostatistics,
Washington University School of Medicine, 1978-present

Consulting Experience:

Litton Industries (USACDCEC, Fort Ord, CA)
Price Waterhouse (Advanced Auditing Methods, NY)
Mallinckrodt, Inc.
St. Louis County Juvenile Court
Monsanto Company
American Red Cross
Carboline Corporation
Regional Justice Information Service
Harris-Stowe State College
Equal Employment Opportunity Commission
American Optometric Association
Petrolite Corporation
U.S. Army Atmospheric Sciences Laboratory (White Sands, NM)
St. Louis County Water Company
Gateway Medical Research, Inc.
MasterCard
Simmons Market Research Bureau
Transactional Data Solutions
Missouri-American Water Company
Capital City Water Company
Kentucky-American Water Company
Tennessee-American Water Company
Iowa-American Water Company
New Jersey-American Water Company
Anheuser-Busch, Inc.
Partek, Inc.
Santa Clara County Mental Health Administration (San Jose, CA)
and many law firms

Publications:

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Test for time trend and moisture effects:
St. Louis County Residential Quarterly, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	2119.13326	1059.56663	14.69	0.0031
Error	7	504.79437	72.11348		
Corrected Total	9	2623.92764			

Root MSE	8.49197	R-Square	0.8076
Dependent Mean	265.65869	Adj R-Sq	0.7527
Coeff Var	3.19657		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	303.78635	9.29454	32.68	<.0001
since_90	1	-2.87468	0.71603	-4.01	0.0051
pdsi5_12	1	-3.85612	1.21953	-3.16	0.0159

Weather normalized estimates:
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Weather normalized estimates:
St. Louis County Residential Quarterly, 1997-2008,
excluding 2002 and 2003.

year	resdaily	normalized
1997	280.274	286.768
1998	266.493	272.007
1999	287.354	284.098
2000	273.989	270.012
2001	281.165	265.465
2004	245.209	253.982
2005	267.914	268.282
2006	256.723	263.720
2007	265.361	259.621
2008	232.105	232.631
2009	.	245.835
2010	.	242.961

Test for time trend and moisture effects:
St. Louis County Commercial Quarterly, 1997-2008,
excluding 2002 and 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: comdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	8044.17631	4022.08816	0.91	0.4461
Error	7	31012	4430.22472		
Corrected Total	9	39056			

Root MSE	66.55993	R-Square	0.2060
Dependent Mean	1045.15660	Adj R-Sq	-0.0209
Coeff Var	6.36842		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	1002.65203	72.85053	13.76	<.0001
since_90	1	3.93261	5.61224	0.70	0.5061
pdsi5_12	1	-11.69252	9.55866	-1.22	0.2608

Six-year average:
St. Louis County Commercial Quarterly, 2001-2008,
excluding 2002 and 2003.

The MEANS Procedure

Analysis Variable : comdaily

Mean	N
1053.65	6

Test for time trend and moisture effects:
St. Louis County Commercial Monthly, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: comdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	2960436	1480218	1.87	0.2231
Error	7	5532268	790324		
Corrected Total	9	8492704			

Root MSE	889.00166	R-Square	0.3486
Dependent Mean	14204	Adj R-Sq	0.1625
Coeff Var	6.25892		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	16035	1138.12611	14.09	<.0001
since_90	1	-134.39086	84.80168	-1.58	0.1570
pdsi5_12	1	-136.33184	128.29494	-1.06	0.3232

Six-year average:
St. Louis County Commercial Monthly, 2002-2008,
excluding 2003.

The MEANS Procedure

Analysis Variable : comdaily

Mean	N
13797.50	6

Test for time trend and moisture effects:
St. Charles Residential, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	3642.72031	1821.36015	33.75	0.0003
Error	7	377.77353	53.96765		
Corrected Total	9	4020.49384			

Root MSE	7.34627	R-Square	0.9060
Dependent Mean	270.11809	Adj R-Sq	0.8792
Coeff Var	2.71965		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	277.04053	9.40491	29.46	<.0001
since_90	1	-0.12132	0.70076	-0.17	0.8675
pdsi5_12	1	-8.69858	1.06017	-8.20	<.0001

Weather normalized estimates:
St. Charles Residential, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	3641.10273	3641.10273	76.78	<.0001
Error	8	379.39111	47.42389		
Corrected Total	9	4020.49384			

Root MSE	6.88650	R-Square	0.9056
Dependent Mean	270.11809	Adj R-Sq	0.8938
Coeff Var	2.54944		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	275.46678	2.26164	121.80	<.0001
pdsi5_12	1	-8.70413	0.99336	-8.76	<.0001

Weather normalized estimates:
St. Charles Residential, 1998-2008,
excluding 2003.

year	resdaily	normalized
1998	258.165	255.643
1999	284.332	289.426
2000	259.996	264.119
2001	266.647	260.343
2002	277.114	278.513
2004	260.527	253.891
2005	288.002	292.657
2006	300.952	288.849
2007	280.511	286.086
2008	224.934	231.652
2009	.	267.945
2010	.	267.945

Test for time trend and moisture effects:
St. Charles Commercial, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: comdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	16109	8054.34190	5.75	0.0333
Error	7	9806.00680	1400.85811		
Corrected Total	9	25915			

Root MSE	37.42804	R-Square	0.6216
Dependent Mean	1279.16321	Adj R-Sq	0.5135
Coeff Var	2.92598		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	1381.30995	47.91648	28.83	<.0001
since_90	1	-7.17594	3.57025	-2.01	0.0844
pdsi5_12	1	-14.41747	5.40137	-2.67	0.0320

Weather normalized estimates:
St. Charles Commercial, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: comdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	10450	10450	5.41	0.0485
Error	8	15465	1933.14871		
Corrected Total	9	25915			

Root MSE	43.96759	R-Square	0.4032
Dependent Mean	1279.16321	Adj R-Sq	0.3286
Coeff Var	3.43721		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	1288.22426	14.43966	89.21	<.0001
pdsi5_12	1	-14.74540	6.34222	-2.32	0.0485

Weather normalized estimates:
St. Charles Commercial, 1998-2008,
excluding 2003.

year	comdaily	normalized
1998	1288.19	1254.64
1999	1352.91	1311.87
2000	1274.30	1269.00
2001	1311.77	1262.60
2002	1246.96	1293.39
2004	1280.61	1251.67
2005	1263.30	1317.35
2006	1333.01	1310.90
2007	1284.28	1306.21
2008	1156.32	1214.00
2009	.	1275.48
2010	.	1275.48

Test for time trend and moisture effects:
St. Joseph Residential, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	1036.32488	518.16244	8.88	0.0120
Error	7	408.56605	58.36658		
Corrected Total	9	1444.89093			

Root MSE	7.63980	R-Square	0.7172
Dependent Mean	171.86187	Adj R-Sq	0.6364
Coeff Var	4.44532		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	204.33844	9.90165	20.64	<.0001
since_90	1	-2.17586	0.72861	-2.99	0.0203
pdsi5_12	1	-4.16803	1.37144	-3.04	0.0189

Weather normalized estimates:
St. Joseph Residential, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	1036.32488	518.16244	8.88	0.0120
Error	7	408.56605	58.36658		
Corrected Total	9	1444.89093			

Root MSE	7.63980	R-Square	0.7172
Dependent Mean	171.86187	Adj R-Sq	0.6364
Coeff Var	4.44532		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	204.33844	9.90165	20.64	<.0001
since_90	1	-2.17586	0.72861	-2.99	0.0203
pdsi5_12	1	-4.16803	1.37144	-3.04	0.0189

Weather normalized estimates:
St. Joseph Residential, 1998-2008,
excluding 2003.

year	resdaily	normalized
1998	178.198	174.058
1999	179.583	184.573
2000	194.677	182.158
2001	161.547	168.004
2002	175.784	183.339
2004	163.503	164.847
2005	167.303	173.347
2006	181.270	172.797
2007	167.318	166.875
2008	149.435	148.621
2009	.	158.785
2010	.	156.609

Test for time trend and moisture effects:
St. Joseph Commercial, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: comdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	6328.86315	3164.43158	2.24	0.1770
Error	7	9885.80625	1412.25804		
Corrected Total	9	16215			

Root MSE	37.58002	R-Square	0.3903
Dependent Mean	840.39137	Adj R-Sq	0.2161
Coeff Var	4.47173		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	902.52291	48.70598	18.53	<.0001
since_90	1	-3.81221	3.58402	-1.06	0.3228
pdsi5_12	1	-12.50553	6.74609	-1.85	0.1062

Six-year average:
St. Joseph Commercial, 2001-2008,
excluding 2003 and 2006.

The MEANS Procedure

Analysis Variable : comdaily

Mean	N
822.3176858	6

Test for time trend and moisture effects:
Joplin Residential, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	1550.22911	775.11455	5.72	0.0337
Error	7	948.19479	135.45640		
Corrected Total	9	2498.42390			

Root MSE	11.63857	R-Square	0.6205
Dependent Mean	193.42902	Adj R-Sq	0.5120
Coeff Var	6.01697		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	213.46098	15.13251	14.11	<.0001
since_90	1	-1.41918	1.13795	-1.25	0.2525
pdsi5_12	1	-5.97225	2.14024	-2.79	0.0269

Weather normalized estimates:
Joplin Residential, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	1339.54562	1339.54562	9.25	0.0160
Error	8	1158.87828	144.85978		
Corrected Total	9	2498.42390			

Root MSE	12.03577	R-Square	0.5362
Dependent Mean	193.42902	Adj R-Sq	0.4782
Coeff Var	6.22232		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	195.16829	3.84878	50.71	<.0001
pdsi5_12	1	-6.56332	2.15833	-3.04	0.0160

Weather normalized estimates:
Joplin Residential, 1998-2008,
excluding 2003.

year	resdaily	normalized
1998	196.758	184.593
1999	199.261	198.475
2000	206.560	200.304
2001	199.739	194.528
2002	192.357	198.409
2004	189.519	185.955
2005	183.506	206.539
2006	222.494	206.556
2007	185.596	193.117
2008	158.500	165.814
2009	.	190.731
2010	.	190.731

Test for time trend and moisture effects:
Joplin Commercial, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: comdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	63256	31628	11.70	0.0059
Error	7	18923	2703.33417		
Corrected Total	9	82179			

Root MSE	51.99360	R-Square	0.7697
Dependent Mean	937.66777	Adj R-Sq	0.7039
Coeff Var	5.54499		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	642.35164	67.60225	9.50	<.0001
since_90	1	23.21675	5.08360	4.57	0.0026
pdsi5_12	1	-24.53434	9.56120	-2.57	0.0372

Weather normalized estimates:
Joplin Commercial, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: comdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	63256	31628	11.70	0.0059
Error	7	18923	2703.33417		
Corrected Total	9	82179			

Root MSE	51.99360	R-Square	0.7697
Dependent Mean	937.66777	Adj R-Sq	0.7039
Coeff Var	5.54499		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	642.35164	67.60225	9.50	<.0001
since_90	1	23.21675	5.08360	4.57	0.0026
pdsi5_12	1	-24.53434	9.56120	-2.57	0.0372

Weather normalized estimates:
Joplin Commercial, 1998-2008,
excluding 2003.

year	comdaily	normalized
1998	843.89	788.55
1999	870.39	863.66
2000	881.08	893.72
2001	848.65	895.34
2002	912.16	933.07
2004	919.71	932.95
2005	985.84	1033.11
2006	1076.18	1056.39
2007	1124.02	1029.37
2008	914.75	950.52
2009	.	1066.88
2010	.	1090.10

Test for time trend and moisture effects:
Jefferson City Residential, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	1030.03144	515.01572	7.52	0.0181
Error	7	479.71690	68.53099		
Corrected Total	9	1509.74834			

Root MSE	8.27834	R-Square	0.6823
Dependent Mean	162.60290	Adj R-Sq	0.5915
Coeff Var	5.09114		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	181.40473	10.59075	17.13	<.0001
since_90	1	-1.41480	0.78931	-1.79	0.1162
pdsi5_12	1	-4.23743	1.23076	-3.44	0.0108

Weather normalized estimates:
Jefferson City Residential, 1998-2008,
excluding 2003.

The REG Procedure
Model: MODEL1
Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	809.85108	809.85108	9.26	0.0160
Error	8	699.89726	87.48716		
Corrected Total	9	1509.74834			

Root MSE	9.35346	R-Square	0.5364
Dependent Mean	162.60290	Adj R-Sq	0.4785
Coeff Var	5.75233		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	163.01170	2.96087	55.06	<.0001
pdsi5_12	1	-4.23087	1.39059	-3.04	0.0160

Weather normalized estimates:
Jefferson City Residential, 1998-2008,
excluding 2003.

year	resdaily	normalized
1998	158.444	151.567
1999	177.196	164.826
2000	164.768	172.499
2001	171.011	157.564
2002	162.113	167.819
2004	151.170	153.815
2005	163.060	169.231
2006	181.964	176.762
2007	159.993	163.816
2008	136.311	148.130
2009	.	159.811
2010	.	159.811

Four-year average:
Jefferson City Commercial, 2004-2008,
excluding 2003.

NOTE: No test for trend could be made,
and four-year average was used, due to
earlier years having a much larger
number of commercial customers.

The MEANS Procedure

Analysis Variable : comdaily

Mean	N
746.6317106	4