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Ms. Blanca S. Bayo, Director
Division of Commission Clerk
and Administrative Services
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, FL 32399-0850

Re: Load Research Sampling Report - Tampa Electric Company

Dear Ms. Bayo:

In compliance with Rule 25-6.0437, enclosed are five copies of Tampa Electric Company's report entitled Load Research Sampling Plan – August 2004.

Please acknowledge receipt and filing of the above by stamping the duplicate copy of this letter and returning same to this writer.

Thank you for your assistance in connection with this matter.

Sincerely,

James D. Beasley

JDB/pp
Enclosures

cc: Angela Llewellyn

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TAMPA ELECTRIC COMPANY

LOAD RESEARCH SAMPLING PLAN

APRIL 2004

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APPLICABLE RATE CLASSES

Table 1 lists Tampa Electric Company's rate classes and the respective annual MWH sales for each Rate class. The third column provides the percent of total annual sales for each rate class and demonstrates that the company is complying with Florida Administrative Code Chapter 25-6.0437, which requires sampling of all rate classes that account for more than one percent of a utility's annual sales. The annual sales reported are for the twelve month period ending December 31, 2003.

TABLE 1

PERCENTAGE OF ANNUAL MWH SALES BY RATE

RATE	ANNUAL SALES (MWH)	PERCENTAGE OF TOTAL SALES
Residential (RS & RST)	8,245,456	45.2
General Service Non-Demand (GS, GST, TS)	957,868	5.3
General Service Demand (GSD & GSDT)	4,972,900	27.3
General Service Large Demand (GSLD, GSLDT, SBFT)	2,160,539	11.9
Interruptible Service (IS-1, IST-1, IS-3, IST-3, SBIT-1, SBIT-3)	1,702,782	9.3
All Other Rate Classes	190,763	1.0
Total	18,230,308	100.0

Each Rate class shown in Table 1 was monitored during 2003 as part of Tampa Electric Company's ongoing load research program. The two overlapping samples for the Residential (RS), General Service Non-Demand (GS), and General Service Demand (GSD) classes were selected in 2001 and 2002 and in most cases the recording equipment was installed prior to December 31st of the year during which the sample was selected. Samples for the General Service Large Demand (GSLD) and Interruptible Service (IS) classes are not needed because all of the customers on the aforementioned rates have recorders installed on the meters for billing purposes. The data collected by the recorders is also used for load research purposes. Under this plan, the collection of load data for the GSLD and IS classes will continue in this manner.

EXISTING SAMPLE DESIGN

The RS sample was pre-stratified by housing type. The three housing type categories are single family detached, multi-family and mobile home. This stratification was used primarily because the load patterns for the three housing types are dissimilar and the percentage of mobile homes in the population changes significantly with the seasons. The percentage of mobile homes ranged from a winter high of 12.1% to a summer low of 11.5%. The housing type stratification allows corresponding changes to be made in stratum weights, since inter-strata migration is not a concern, on a month-by-month basis when estimating class demands. The estimated demands thus reflect the seasonal changes in the housing type mix.

The sample points were allocated to the strata using Neyman allocation with stratum variances estimated from previous sample results. A minimum sample size of 50 was used in the multi-family and mobile home categories to allow generating more accurate data for these sub-populations. The resulting allocation is shown in Table 2.

TABLE 2

RS SAMPLE

Stratum	Sample Size 2001	Sample Size 2002	Total
Single Family Detached	87	88	175
Multi-family	25	25	50
Mobile Home	25	25	50
Total	137	138	275

The GS class was stratified on the basis of annual kilowatt-hour consumption at the time of sample selection. Two strata were used with the boundary for the first stratum being 15,000 kWh. The sample points were allocated to the strata using Neyman allocation with stratum variances estimated from the previous sample results. The allocation is shown in Table 3.

TABLE 3

GS SAMPLE

Stratum	Sample Size 2001	Sample Size 2002	Total
0 – 14,999 kWh	128	129	257
15,000 – infinity kWh	121	122	243
Total	249	251	500

The GSD class was stratified by several different variables. The first variable was service voltage level. The GSD class contains customers served at either primary or secondary voltage. Voltage level stratification was used to facilitate analysis required for performing cost of service studies. All customers served and/or metered at primary voltage were included in the sample. Among secondary customers an additional 100% sampled stratum was included in the sample design. Customers having demand over 300 kW are included in this stratum. During the course of the data collection for this sample, new customers meeting the criteria of the 100% sampled strata were added to the sample. The remaining GSD Customers were stratified into two strata on the basis of their highest demand in the twelve-month period prior to sample selection. The first stratum boundary used was 200 kW. Sample points were allocated to the two strata using Neyman allocation with variances being estimated from the preceding sample. The allocation shown in Table 4 reflects the sample as of December 2003.

TABLE 4

GSD SAMPLE

Stratum	Sample Size 2001	Sample Size 2002	Total
Secondary 0 – 199 kW	35	35	70
Secondary 200 – 300 kW	35	35	70
Secondary over 300 kW	988 (100%)		988
Primary Metered/Primary Served	66 (100%)		66
Primary Metered/Secondary Served	39 (100%)		39
Total	1,163	1,163	1,233

EXISTING SAMPLE ACCURACY

The accuracy achieved for the three classes sampled was calculated for each month's coincident peak for 2003 and for the average of the twelve monthly coincident peaks as well. The accuracy for each class was calculated in the conventional manner for combined ratio analysis. The results are shown in Table 5.

TABLE 5

2003 COINCIDENT PEAK PERCENTAGE ACCURACIES AT 90% CONFIDENCE LEVEL USING COMBINED RATIO ESTIMATION

Month	RS	GS	GSD
January	4.8	9.9	8.1
February	7.6	9.7	5.9
March	5.1	6.8	4.9
April	5.1	6.3	3.8
May	4.4	5.1	5.1
June	4.6	4.8	4.0
July	4.1	4.6	4.1
August	4.1	5.9	4.9
September	4.9	6.3	5.0
October	4.1	4.9	5.0
November	5.5	5.7	4.6
December	7.5	11.5	4.3
12 Coincident Peak Average	2.4	3.8	3.4

The 2003 annual system winter peak occurred in January and the summer peak occurred in July. All three samples achieved better accuracy than the target of ±10% accuracy at the 90% confidence limit for the winter coincident peak, the summer coincident peak and the 12 coincident peak average.

PROPOSED SAMPLING PLAN FOR 2005 LOAD RESEARCH STUDY

The RS sample met the required levels of accuracy for 2003; therefore, no changes are required in this sample design. Proposed sample allocations for this class remain the same as filed in the 2002 Load Research Sampling Plan and are shown in the table below.

TABLE 6

PROPOSED RS SAMPLE

Stratum	Sample Size 2004
Single Family Detached	175
Multi Family	50
Mobile Home	50
Total	275

The GS sample also met the required levels of accuracy for the 2003 winter coincident peak, summer coincident peak and 12 coincident peak average; therefore, no changes are required in the sample design. Proposed sample allocations for this class remain the same as filed in the 2002 Load Research Sampling Plan and are shown in the table below.

TABLE 7

PROPOSED GS SAMPLE

Stratum	Sample Size 2004
0 – 14,999 kWh	257
15,000 – infinity kWh	243
Total	500

The GSD sample also met the required winter coincident peak, summer coincident peak and 12 coincident peak average levels of accuracy for 2003, but the sample design for this class was modified somewhat. By the end of 2004, the threshold for 100% sampling will be raised from 300kW to 500kW. Internal business needs no longer require the need for 100% sampling below 500kW. The proposed GSD sample design is as follows:

TABLE 8

PROPOSED GSD SAMPLE

Stratum	Total
Secondary 0 – 199 kW	70
Secondary 200 –500 kW	70
Secondary over 500 kW	400 (100%)
Primary Metered/Primary Served	66 (100%)
Primary Metered/Secondary Served	39 (100%)
Total	645

ELIMINATION OF CONTINUOUS OVERLAPPING SAMPLES

Tampa Electric plans to discontinue using the overlapping sampling methodology for all three of the sampled rate classes, RS, GS and GSD. The methodology has been in place since the 1996 Load Research Sampling Plan. The overlapping samples methodology will be replaced with a method discussed below which will result in less administrative upkeep and also improve response time for annual load research analyses.

The half-sized RS, GS, and GSD samples selected and installed in 2001 and 2002 will be removed and replaced with an entirely new sample selected and installed prior to December 31, 2004.

For subsequent years, new full-sized samples will be selected and installed for one to two rate classes every year; data will be collected from these samples for twenty-four months. Once the new sample is fully installed and data collection has begun, the previously selected sample for the class(s) will be retired and removed. This will eliminate the complexity of computing combined statistics from two or three independent, overlapping samples, as well as maintain operational efficiency.

SAMPLE REMOVALS AND REPLACEMENTS

Tampa Electric is also proposing another modification to the maintenance of our sample design. In order to improve operational efficiency, the company proposes to minimize the number of meter replacements (drop outs) after the sample has been installed and data collection has begun. In the past, the proposed number of sampling meters was maintained throughout the year by replacing removed sampling meters with the next randomly selected customer.

Tampa Electric plans to set a limit to the number of removals per class that do not need to be replaced. The RS class will be allowed 5 removals per stratum, before installation of replacements begins. The GS class will be allowed 10 removals per stratum and the GSD class will be allowed 5 removals per stratum.

There is no expectation that accuracy levels will be impacted by this change because the sample sizes are well above the computed sample size levels for meeting the +/- 10% accuracy requirement.

FORMULAS AND DEFINITIONS

Combined Ratio Estimate:

$$\hat{R}_c = \frac{\sum_h W_h \bar{y}_h}{\sum_h W_h \bar{x}_h}$$

Where,

$\hat{R}_c$ = *combined ratio estimate*
W_h = *stratum weight for stratum h*
$\bar{Y}_h$ = *mean coincident demand for stratum h*
$\bar{X}_h$ = *mean billed energy for stratum h*

Coincident Peak Estimate:

$$\hat{Y}_{rc} = \hat{R}_c X$$

Where,

$\hat{R}_c$ = *combined ratio estimate*
$\hat{Y}_{rc}$ = *estimated class total coincident peak*
X = *class total billed energy*

Standard Deviation of Sample Residuals:

$$s_{dh}^2 = \frac{\sum_{i=1}^{n_h} (y_{hi} - \hat{R}_c x_{hi})^2}{n_h - 1}$$

Where,

$\hat{R}_c$ = *combined ratio estimate*
n_h = *sample size for stratum h*
s_{dh} = *standard deviation of sample residuals*
y_{hi} = *coincident demand for sample Customer i of stratum h*
x_{hi} = *billed energy for Customer i of stratum h*

Variance of Coincident Peak Estimate:

$$\hat{V}(\hat{Y}_{rc}) = \sum_{h} \frac{N_h^2 \left(1 - \frac{n_h}{N_h}\right)}{n_h} s_{dh}^2$$

Where,

$\hat{V}(\hat{Y}_{rc})$ = *variance of coincident estimate*
N_h = *population size for stratum h*
n_h = *sample size for stratum h*
s_{dh} = *standard deviation of sample residuals*

Accuracy at 90% Confidence Level:

$$A = \frac{1.645\sqrt{\hat{V}(\hat{Y}_{rc})}}{\hat{Y}_{rc}}$$

Where,

$\hat{Y}_{rc}$ = *estimated class total coincident peak*
$\hat{V}(\hat{Y}_{rc})$ = *variance of coincident estimate*
A = *accuracy at 90% confidence level*

Sample Size:

$$n = \frac{\left(\sum_{h} W_h s_{dh}\right)^2}{\left(\frac{d}{1.645}\right)^2 \left(\frac{\hat{Y}_{rc}}{N}\right)^2}$$

W_h = *stratum weight for stratum h*
$\hat{Y}_{rc}$ = *estimated class total coincident peak*
N = *population size*
s_{dh} = *standard deviation of sample residuals*
n = *total sample size*
d = *desired relative accuracy*

Where,

Sample Allocation (Neyman):

$$n_h = n\frac{W_h s_{dh}}{\sum_h W_h s_{dh}}$$

Where,

W_h = *stratum weight for stratum h*
n_h = *sample size for stratum h*
s_{dh} = *standard deviation of sample residuals*
n = *total sample size*

Twelve Coincident Peak Estimate:

$$12\hat{C}P = \frac{1}{12}\sum_{m=1}^{12}\hat{Y}_{rcm}$$

Where,

$\hat{Y}_{rcm}$ = *Coincident Peak Estimate for Month M*

Variance Of Twelve Coincident Peak:

$$VAR(12\hat{C}P) = \left(\frac{1}{12}\right)^2\left(\sum_{m=1}^{12}\hat{V}(\hat{Y}_{rcm}) + 2\sum_{m=1}^{12}\sum_{k<m}\hat{C}(\hat{Y}_{rcm},\hat{Y}_{rck})\right)$$

Where,

$\hat{V}(\hat{Y}_{rcm})$ = *Variance of Coincident Peak Estimate Month m*
$\hat{C}(\hat{Y}_{rcm},\hat{Y}_{rck})$ = *Covariance of Month m and Month k Estimates*

Month-To-Month Covariance:

$$\hat{C}(\hat{Y}_{rcm},\hat{Y}_{rck}) = \sum_{h=1}^{l} \frac{N_{hm} N_{hk}}{\bar{n}_{hmk}} (fpc_{mk})\, s_{hd_m d_k}$$

Where,

$$N_{hm} = Population\ Size\ in\ Month\ m$$
$$N_{hk} = Population\ Size\ in\ Month\ k$$
$$\bar{n}_{hmk} = Average\ Sample\ Size\ in\ Months\ m\ and\ k$$
$$fpc_{mk} = 1 - \min\left(\frac{n_m}{N_m}, \frac{n_k}{N_k}\right)$$
$$s_{hd_m d_k} = \sum_{i=1}^{n_{hmk}} \frac{(y_{hmi} - \hat{R}_m x_{hmi})(y_{hki} - \hat{R}_k x_{hki})}{n'_{hmk} - 1}$$
$$n'_{hmk} = Sample\ Size\ with\ good\ data\ in\ Month\ m\ and\ k$$

Combining Estimates From Two Samples:

$$\hat{Y}_{rc} = \alpha \hat{Y}_{rcA} + (1-\alpha)\hat{Y}_{rcB}$$

Where,

$$\hat{Y}_{rcA} = Sample\ A\ Estimate$$
$$\hat{Y}_{rcB} = Sample\ B\ Estimate$$
$$\alpha = Weighting\ factor$$

Combining Variances From Two Samples:

$$\hat{V}(\hat{Y}_{rc}) = \alpha^2 \hat{V}(\hat{Y}_{rcA}) + (1-\alpha)^2 \hat{V}(\hat{Y}_{rcB})$$

Where,

$$\hat{V}(\hat{Y}_{rcA}) = Variance\ of\ Sample\ A\ Estimate$$
$$\hat{V}(\hat{Y}_{rcB}) = Variance\ of\ Sample\ B\ Estimate$$
$$\alpha = Weighting\ factor$$

Weight To Obtain Minimum Variance:

$$\alpha = \frac{\hat{V}(\hat{Y}_{rcA})}{\hat{V}(\hat{Y}_{rcA}) + \hat{V}(\hat{Y}_{rcB})}$$

Where,

$$\hat{V}(\hat{Y}_{rcA}) = Variance\ of\ Sample\ A\ Estimate$$
$$\hat{V}(\hat{Y}_{rcB}) = Variance\ of\ Sample\ B\ Estimate$$
$$\alpha = Weighting\ factor$$

Twelve Coincident Peak -- Three Samples Equal / Weighting:

$$12\hat{C}P = \left(\frac{1}{24}\right)\left(\sum_{m=1}^{l} \hat{Y}_{mA} + \sum_{m=1}^{12} \hat{Y}_{mB} + \sum_{m=l+1}^{12} \hat{Y}_{mC} \right)$$

Where,

Sample A is in place for the first *l* months, sample B is in place for all 12 months and sample C is in place for the last 12 - *l* months.

$$\hat{Y}_{mA} = Sample\ A\ Estimate\ for\ Month\ m$$
$$\hat{Y}_{mB} = Sample\ B\ Estimate\ for\ Month\ m$$
$$\hat{Y}_{mC} = Sample\ C\ Estimate\ for\ Month\ m$$

Variance Of Twelve Coincident Peak:

$$VAR(12\hat{C}P) = \left(\frac{1}{24}\right)^2 \{\sum_{m=1}^{l} \hat{V}(\hat{Y}_{rcmA}) + 2 \sum_{m=1k<m}^{l} \sum \hat{C}(\hat{Y}_{rcmA}, \hat{Y}_{rckA}) \}$$
$$+ \left(\frac{1}{24}\right)^2 \{\sum_{m=1}^{12} \hat{V}(\hat{Y}_{rcmB}) + 2 (\sum_{m=1k<m}^{12} \sum \hat{C}(\hat{Y}_{rcmB}, \hat{Y}_{rckB}) \}$$
$$+ \left(\frac{1}{24}\right)^2 \{ \sum_{m=l+1}^{12} \hat{V}(\hat{Y}_{rcmC}) + 2 \sum_{m=l+1k<m}^{12} \sum \hat{C}(\hat{Y}_{rcmC}, \hat{Y}_{rckC}) \}$$