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BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON, D.C. 20268-0001

POSTAL RATE AND FEE CHANGES	Docket No. R2006-1

RESPONSE OF UNITED STATES POSTAL SERVICE WITNESS BOZZO (USPS-T-12) TO PRESIDING OFFICER'S INFORMATION REQUEST NO. 10, QUESTION 6 (August 15, 2006)

The United States Postal Service hereby provides the response of witness Bozzo (USPS-T-12) to Presiding Officer's Information Request (POIR) No. 10, Question 6, issued August 4, 2006.

The question is stated verbatim and is followed by the response.

Respectfully submitted,

UNITED STATES POSTAL SERVICE

By its attorneys:

Daniel J. Foucheaux, Jr.
Chief Counsel, Ratemaking

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Frank R. Heselton

475 L'Enfant Plaza West, S.W.
Washington, D.C. 20260-1137
(202) 268-5204; Fax: -6187
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Response of United States Postal Service Witness Bozzo (USPS-T-12)
To POIR No. 10, Question 6

6. At page 13 of USPS-T-12, Postal Service witness Bozzo states:

> My understanding is that the Evolutionary Network Development (END) changes may alter the identities of origin and destinating plants (LPCs and DPCs) and that Regional Distribution Centers (RDCs generally created from existing facilities) will assume ADC and AADC functions. See Docket No. N2006-1, USPS-T-1 at 11-12. However, existing sorting technologies will remain is use, and the general organization of sorting activities appears likely to undergo evolutionary rather than revolutionary changes in the near future. In particular, the basic organization of processing at originating, destinating, and transfer facilities will remain largely intact.

(Footnote omitted.)

This passage seems to understate the degree of change expected by the test year due to the network realignment initiative based on information made public elsewhere about the nature, scope, and timing of that initiative. At the Great Lakes Area Focus Group meeting in Chicago, Illinois, on February 9, 2006, postal management provided a public briefing on its END initiative. It characterized its network realignment initiative as a program that will cause "drastic change" on a national scale, resulting in a standardized and streamlined network. As of February of this year, according to management, the Postal Service's goal was to construct a future network that trims 675 "Function 1" facilities down to 407, consisting of 71 RDCs, 258 LPCs, 60-70 Airport Transport Centers (ATCs), and 5-8 Remote Encoding Centers.

As described by postal management, RDCs are intended to be the "backbone" of a shape-based network, serving as Surface Transport Centers (regional hubs) for mail of all classes, and processing bundles and package mail of all classes. Management reported that by next February, it expects to convert all HASPS to Surface Transfer Centers, and to have 22 to 24 RDCs in place. It plans to convert P&DCs into LPCs and DPCs in two major phases in 2006, with additional phases planned for in 2007. *See* Docket No. N2006-1, USPS-T-2 (Williams) at 12.[1]

If management's plans are carried out, it raises the prospect that by the 2008 test year, numerous P&DCs will have been upgraded to RDCs, which combine the roles of current ADCs, BMCs, and HASPS. As RDCs, these

[1] The future network that the Postal Service uses for planning purposes is also described in Docket No. N2006-1. As of July, 2006, the Postal Service plans a future network consisting of 419 "Function 1" facilities, 69 RDCs, and 202 LDCs, and 103 DPCs. This is generally consistent with management's February description of the future network, but it assumes fewer LDCs. See response to Presiding Officer's Information Request No. 5, Question 7, filed June 9, 2006.

facilities will be refitted with next-generation tray, bundle, and package sorting equipment, have greatly expanded service areas, and altered internal and external mail flows. *See* USPS-LR-N2006-1/23. Numerous P&DCs will also have been converted to LPCs, requiring larger capital stocks to process outgoing volumes for a wider service area, while numerous other P&DCs are converted to DPCs, losing processing roles, volumes, and equipment. The Postal Service expects to capture economies of scale in the reconfigured facilities through standardization of its distribution concept, plant layouts, and processing procedures. *See* the Postal Service's responses to interrogatories OCA/USPS-36, and Postcom/USPS-T-1-2 in Docket No. N2006-1.

The amount of network realignment that is expected to take place by the test year has a number of implications for mail processing variability modeling. Network realignment is intended to shift enough volume among processing facilities to require facilities to alter their equipment configurations and staffing levels and, thereby, their marginal costs. This appears to conflict with a crucial maintained assumption underlying the Postal Service's mail processing variability modeling, i.e., that an operation at a given facility will only experience incremental changes in volumes over the rate cycle. This assumption was invoked to justify using a facility-level fixed-effect model rather from (sic) a random effects or ordinary least squares model to estimate variability. In addition to these substantial volume shifts among facilities, network realignment intends to reconfigure numerous facilities to perform fundamentally different tasks in the new RDC-based network. These proposed changes are aimed at increasing the average labor productivity of all postal operations.

If substantial progress toward network realignment is made by the test year, it raises the following questions:

a. Are the estimating equations on pages 52-53 of USPS-T-12 based on an assumption that the estimated fixed-effect at one facility may differ from the estimated fixed effect at another facility because of persistent differences in the facility's network role, mail mix, mail volume, plant layout, or management practices?

b. In response to VP/USPS-T12-6 in Docket R2006-1, witness Bozzo states that "the purpose of my analysis was to estimate systemwide elasticities applicable to entire mail processing cost pools." The estimating equations for automated operations on pages 52-53 of USPS-T-12 contain the logarithm of the level of volume, ln(TPF), and lagged values of this variable, and $\ln(TPF)^2$ and lagged values of this variable. In addition, ln(TPF) is interacted with ln(CAP), ln(DEL), ln(WAGE) and ln(TREND). This implies that the elasticity of HRS with respect to TPF depends on all these factors. Doesn't this functional form for this estimating equation imply that the systemwide volume variability estimate for processing operations will depend on the level and mix of mail volume at all the mail processing facilities in the sample, and depend on the distribution of ln(CAP), ln(DEL), ln(WAGE) and ln(TREND) across the sample of facilities?

c. If the answer to the previous questions are affirmative, please state whether a model of mail processing cost variability by individual operation that uses a fixed-effects estimator that includes variables given in the estimating equations on pages 52-53 of USPS-T-12 and computes a systemwide estimate based on the current distribution of mail volume and mix across facilities, and the current distribution of ln(CAP), ln(DEL), ln(WAGE) and ln(TREND) across facilities, is an appropriate one to predict the impacts of the major network realignment that will be under construction in the test year? If so, why?

d. As noted above, the Postal Service's mail processing cost variability models contain regressors that are intended to control for unobservable processing plant characteristics that impact the level and sensitivity of labor costs to TPF. The "fixed" effects control for persistent unobservable plant characteristics that impact the level of ln(HRS). [i] Isn't it true that the Hausman test for the appropriateness of the fixed effects estimator versus the random effects (or ordinary least squares) estimator relies on the fact that the fixed effects can be correlated with the regressors (the right-side variables in the equations on pages 52-53 of USPS-T-12)? [ii] Isn't it also true that correlation between the facility-specific random effects and the regressors implies that the probability limit of random effects and ordinary least squares slope coefficient estimates are not the same as the probability limit of the fixed-effects slope coefficient estimates? [iii] Further, isn't it true that the Hausman test examines the validity of the lack of correlation between the regressors and the random effects? Therefore, wouldn't a statistically significant difference between the coefficient estimates in the fixed effects and the random effects models be evidence in favor of the alternative hypothesis, i.e., that the facility-specific effects are correlated with the regressors, including ln(TPF)? [iv] The hypothesis testing result reported in USPS-T-12 rejecting the random effects assumption in favor of the fixed effects assumption implies correlation between the fixed effects and ln(TPF). The cross-sectional correlation between the fixed effects and ln(TPF), and the fixed effects and other right-hand side regressors, implies that if there were substantial changes in these regressors this would result in a significantly different facility-specific effect under the re-organized postal network. Please resolve this apparent contradiction between assuming that the fixed effects of a facility will be invariant to significant changes in volume, with the hypothesis testing result that indicates that there is cross-sectional correlation between ln(TPF) and the facility-specific effect.

e. Given the answer to the previous question, please discuss why a fixed effects estimator is capable of accurately modeling the variability of the mail processing network in the test year when an RDC-based network will be under construction, and many plants will have radically different capital stocks, service areas, and network roles.

Response of United States Postal Service Witness Bozzo (USPS-T-12)
To POIR No. 10, Question 6

Response.

The preamble to the questions raises a number of issues regarding the scope and applicability of the Base Year mail processing volume-variability analysis, as well as the effects of network realignment on the analysis, that merit discussion before I address the Commission's specific questions.

The Commission is justified in being concerned about the applicability of the models going forward prior to adopting a better-founded analysis than its current 100 percent variability assumption. In this regard, the Commission should be aware that the Base Year econometric analysis primarily covers operations that would undergo evolutionary rather than revolutionary changes due to network realignment, especially in the time frame of the Test Year, consistent with my statement in the quoted passage from USPS-T-12.

A large majority of the costs covered by the econometric volume-variability analysis—80 percent—are in letter and flat piece sorting operations in which the outgoing (LPC) and incoming (LPC and DPC) piece sorting operations will substantially resemble their current P&DC counterparts. I am informed that the AMP facility consolidation process has been advancing more slowly than was originally indicated in Docket No. N2006-1, with several of the FY 2006 AMP studies having been concluded without action and few of the remaining studies in final review or implementation stages of the process. This would tend to further

limit the effects of facility consolidation over the current Base Year to Test Year time horizon.

The remaining 20 percent of costs are in mechanized bundle (SPBS) and manual parcel and Priority Mail operations. The APPS, the equipment used in the cornerstone operations for RDC automated bundle processing, is too new to have sufficient data for the econometric models, and so is presently outside the scope of the analysis; by the time sufficiently long APPS data series are available, those data will reflect the RDC-based processing environment. Nor is there any evidence for the existing SPBS operation that suggests that variabilities differ systematically by the scale of the operation (see the response to Docket No. N2006-1, POIR No. 6, Question 1). My understanding from sources with operational knowledge of the changes is that the number of facilities processing parcels and Priority Mail will not change dramatically by the Test Year.

When AMPs are implemented, the scale of some operations will indeed increase. However, since most AMPs involve absorbing mail processing operations (or portions thereof) at smaller facilities into considerably larger neighboring plants, to characterize the changes as “radical” on a systemwide basis is inaccurate. This is particularly the case for consolidations of outgoing mail processing, since it is generally not necessary to expand a plant’s capital stock at all to accommodate mail volumes from neighboring facilities. Stocks of automated

piece sorting equipment are sized for the much larger (due to presorting and greater depth-of-sort) incoming operations. For example, BY2005 incoming workload is three times larger than outgoing workload for BCS operations and 2.5 times larger than outgoing workload for AFSM 100 operations. Thus, it would be possible to radically consolidate outgoing processing (and managed mail operations) without significant changes to capital equipment stocks.

The preamble to the question, in claiming

> …that an operation at a given facility will only experience incremental changes in volumes over the rate cycle [is a critical assumption] to justify using a facility-level fixed-effect model rather from (sic) a random effects or ordinary least squares model to estimate variability

mischaracterizes the motivation for the fixed-effects analysis. The facility-level fixed-effects model is motivated by the underlying economic "experiment" that is appropriate for the measurement of mail processing marginal costs; further, use of the fixed-effects model specifically reflects the fact that after time-varying factors are taken into account (including MODS volumes, the size of the sites' delivery networks, and capital input quantities), there remain significant site-specific (or time-invariant) cost-causing factors. Prof. Mark Roberts did an excellent job of describing the key issues during the March 14, 2006, workshop on his mail processing model (Transcript, March 14, 2006 workshop, at 37-40), specifically in the context of the planned network realignment:

> [Q.:] …[O]ne of the things that we've been seeing from other cases filed recently is how much the Postal Service has

tried to reorganize its network starting now, I guess, in 2001 it had an area mail processing initiative where they tried to consolidate the functions at certain plants, taking away, for example, outgoing sorts from smaller plants, consolidating at larger plants. Now, they're trying to reconfigure the network to apparently more closely resemble a hub and spoke configuration than what they have now. Apparently, [these] are quite extensive reconfigurations that they have been doing and contemplate doing.

My question is does that make the particular role that a particular plant plays in the network so volatile that a fixed effect approach may not be valid?

MR. ROBERTS: A fixed effect is correcting for a number of things in the model. Let me back up and explain. Here's what I view the fixed effects as doing, okay? In these models. Because I use them as does the Postal Service, so I think they're appropriate to use and here's the reason, is that there are certain things about plants that make them different, that one plant, even if we took all the observable characteristics that we could, the capital stocks in particular, and we took the exact same capital stocks from one plant and we stuffed them into another plant, would that second plant replicate what goes on in the first one?

I think the answer is probably no, it wouldn't, that there are going to be unique things about that second plant that make it different from the first one, even when we control as much as possible for the observable things that are different.

Another way of asking the question, sort of looking at the question, would be suppose we had a small plant and we had a large plant. Do we want to use the size difference in these two plants to estimate our output elasticity? Do we really want to use the fact that one plant is small, has small FHP, small hours, another plant is large, and look at the difference between those two and say, oh, yes, that's telling us about the output elasticity that we want to measure?

Effectively what we're saying is if that little plant grew up, it would look like the big plant and I think that's probably not true in most case, that when you take the small plant and you try to make it handle the mail volumes and do things the way the large plant did, it's still going to come out with a different mix of hours and FHP. And so the idea is that the cross plant differences are not really picking up the right kind of variation in the data.

They're picking up variation that is reflecting things that are permanent differences across plants. Someone mentioned earlier in the day whether they're two-story or one-story plants. That's the sort of thing a fixed effect would control for nicely.

> So what we're saying is we don't want to use that variation in the data to estimate the output elasticity. It's not the right kind of experiment in the data to estimate the output elasticity.
>
> What we really want to estimate the output elasticity is if the plant got more FHP coming into it, more volume, what's the range of responses that that plant could make in terms of its use of hours?
>
> So I think it's much more the time series variation in the data that we want to use for estimating the output elasticity than it is the cross plant differences.
>
> Now, that said, both sources of variation, time variation and cross plant variation, have got useful information in them and they have some less than useful information in them and it's a matter of degree how much of one we're throwing away when we get rid of the other.
>
> I think a reasonable compromise is to include the fixed effects because they deal with things that are likely to be non-reproducible or non-replicable differences across plants. So that would be my argument for using them.

Finally, it is important to keep in mind that the analysis in USPS-T-12 is not, nor is it meant to be, a stand-alone analysis of Test Year costs. As an input to the volume-variable cost calculations for the mail processing component of the Base Year CRA, its purpose is to contribute to the accurate measurement of the actual volume-variable costs of the Postal Service under the operating conditions prevailing in the Base Year. Accurate estimates of Base Year CRA volume-variable costs are, in turn, important as major inputs into the estimation of Test Year costs in the rollforward model. It is within the rollforward model, not the Base Year CRA, that adjustments to reflect cost changes from future changes to the operational plan are made. (See Docket No. R2000-1, USPS-T-16 at 9-10.) And, insofar as the changes to the operational plan are expected to reduce the Postal Service’s costs—and presumably to decrease or at least not increase mail

processing marginal costs—the question would be how the *higher* marginal costs that would result, other things equal, from higher volume-variability factors such as those produced by biased estimators such as ordinary least squares would better measure forward-looking mail processing costs than the Postal Service's Base Year variabilities.

a. The recommended estimating equation specifications are based on the demonstration, through statistical hypothesis tests, of site-specific cost causing factors that do not vary (or vary minimally) over time. Since mail volume and mail mix do vary considerably over time, and indeed the relevant mail processing volumes (workloads) are explicitly included as right-hand side explanatory variables, those factors will not be captured by the site-specific fixed effects, which by construction reflect time-invariant facility characteristics. In his March 14, 2006 workshop, Prof. Roberts addressed the matter directly (Transcript of March 14, 2006 workshop at 40-42):

> [Question]: I guess the thing I was focusing on is if the essential differences between plants don't seem actually to be fixed, then I guess what your response was that you sort of have an intuitive belief that the essential differences somehow are fixed even if you're doing radical reconfiguring.
>
> MR. ROBERTS: Well, to the extent you're doing radical reconfiguring, too, it should show up in the time varying data and that's really what we're relying on to estimate these output elasticities. Think of the variation in the data, some of it's systematic and permanent across plants and some of it is time varying for both plants. If the system is under reconfiguration and volumes are being shifted from one plant to another over time, that kind of stuff is picked up in the time dimension of the data and that's what we are using to estimate the output elasticities.

> So it's really a matter of -- I guess it's a broader issue that I've wrestled with in using this data and it comes out when I talk about quarterly variation in this paper as what's the right experiment in the data, what's the right source of variation to use in estimating the output elasticity that we're after?
>
> Ideally, the experiment we would like to do is take a plant and control the amount of mail that's going into the plant over time. So one day we get a million pieces, the next day we give it two, we give it three and we watch how the plant responds in terms of its hours used. If we could run a controlled experiment to measure the output elasticity, I think that's what we would do. We would just vary the volumes going into the plant and watch how the plant responds with hours.
>
> So what we want when we approach a data set like the MODS data set, I approach it saying where is that kind of variation showing up in the data? Is it showing up in differences between a small plant and a large plant? No, I don't think so. I don't think that's the kind of data variation [I] want to use.
>
> Is it showing up in the time series variation for an individual plant? Yes, I think it is because now what we're seeing is, yes, a plant is in operation in a low quarter and then it moves to a busy quarter and volumes increase by 25 percent but that's reality, the plant is getting 25 percent more volume and it's dealing with it. So I look at the data, the quarterly variation, I say that's a good source of variation to use because that really is approximating the kind of experiment that we'd like to run for measuring the output elasticity, whereas I don't think the cross plant differences is the right kind of experiment.

While there are a priori operational and theoretical considerations that originally led the Postal Service to consider panel data fixed effects models, the recommendation that such models be employed in the development of base year costs is based on the repeated showing that alternative regression models that do not control for site-specific fixed effects are to be rejected as producing biased and inconsistent estimates of volume-variability factors. (Please see USPS-T-12 at 73-74; Docket No. R2005-1, USPS-T-12 at 51-52; Docket No. R2001-1,

USPS-T-14 at 63-64; Docket No. R2000-1, USPS-T-15 at 122-124; Docket No. R97-1, USPS-T-14 at 39-46.)

b. Yes. Naturally, the results of an econometric analysis will depend on the data. More specifically for econometric analyses using flexible functional forms such as the translog, quadratic, and the like, economic quantities of interest such as elasticities are functions of coefficients and data. This requires that the elasticities be evaluated at suitable values of the data. For the mail processing analysis, the purpose as noted above is to obtain accurate elasticities for use in the development of Base Year costs, so the elasticities are evaluated using base year average values of the data. Please see also Docket No. R2000-1, USPS-T-15 at 72-79. My understanding is that related procedures are or have been employed in other cost segments where the Base Year volume-variable cost methods involve flexible functional forms.

c. As noted in response to part (b), the choice of evaluating the translog-based elasticities using Base Year data is intended to yield accurate estimates applicable to the Base Year CRA. Moreover, my understanding is that the effects of network realignment on Test Year costs would be implemented as a cost reducing program in the rollforward model.

In principle, it would be possible to evaluate the mail processing elasticities at other in- or out-of-sample values of the data. (For instance, in Docket No. R97-1, the mail processing elasticities were evaluated at the overall sample means, rather than the means for the Base Year observations.) The practical question is

how much a hypothetical set of alternative out-of-sample values would differ from the Base Year values to reflect changes in workloads, delivery points, capital input, trend effects, and so on, and how sensitive the elasticity calculations are to the changes.

In fact, elasticities from the translog models are not very sensitive to the within-sample values of the data used to evaluate the elasticities. The output files in USPS-LR-L-56 report elasticities evaluated at the overall sample means as well as with the base year means. As shown in the table below, evaluating the elasticities at the base year means instead of the overall sample means has relatively small effects (ranging from -3 to +6 percentage points) with an unweighted average difference of one percentage point.

Effect of Elasticity Evaluation Method on Translog Elasticities

Cost Pool	BY 2005 Mean	Overall sample mean	Difference
AFSM 100	0.99	1.00	-0.01
Incoming BCS	0.82	0.83	-0.01
Outgoing BCS	1.06	1.03	0.03
OCR	0.78	0.81	-0.03
FSM 1000	0.72	0.72	0.00
SPBS	0.87	0.81	0.06
Average Difference			0.01

While it would be expected that AMP consolidations will gradually increase the size of a “typical” plant, given that the number of LPCs and DPCs will not differ tremendously from that of the P&DCs, P&DFs, DDCs, and post offices housing

Function 1 operations presently in the USPS-LR-L-56 data set, it stands to reason that the "typical" LPC will not become dramatically larger than its P&DC or P&DF predecessor. As shown in the table below, changing the scale of the "average" operation used to evaluate the elasticities by large amounts has relatively small consequences for evaluation of the elasticities. Thus, the elasticity calculations should be relatively robust to facility size effects from network realignment.

Effect of "Typical" Operation Scale on Selected Translog Elasticity Evaluations

Operation	Scale Factor for TPH, Deliveries, and Capital	Evaluated Elasticity (*)
OCR	1X (BY 2005 values)	.783
OCR	2X	.735
OCR	0.5X	.830
SPBS	1X (BY 2005 values	.866
SPBS	2X	.860
SPBS	0.5X	.872

(*) See response to POIR No. 8, Question 10 for methodology

d. For clarity, I have divided this question into five subparts, each with a separate response.

(i) Not exactly. The Hausman test makes use of a general result for the asymptotic distribution of the difference between an estimator that is consistent under both the null and alternative hypothesis (in this case, the fixed effects estimator) and an estimator that is consistent and statistically "efficient" under the null hypothesis but inconsistent under the alternative hypothesis (in this case, the OLS and/or random effects estimator). Specifically, the OLS estimator is

inconsistent in the presence of site-specific effects, and the random effects estimator is inconsistent if its assumption that the random effect and the regressors are uncorrelated.

(ii) Yes. If the site-specific effects are present and correlated with the regressors, the fixed-effects estimator is consistent—i.e., its probability limit is the "true" coefficient vector. In contrast, the OLS and random effects estimators are inconsistent under such conditions—i.e., their probability limits take some values other than the "true" coefficient vector.

(iii) Yes. The alternative hypothesis for the Hausman test of fixed versus random effects may be characterized as a violation of the random effects model's assumption (the null hypothesis) that the individual effects and the regressors are uncorrelated. Most notably, rejection of this null hypothesis implies that the random effects estimates are inconsistent.

(iv) There is no contradiction. The question inappropriately concludes from the correlation between the site-specific effects and the explanatory variables that there is causality from the explanatory variables to the site-specific effects. Indeed, to the extent there is any causal relationship, the direction of causality is the opposite of that implied by the question. As I noted in Docket No. R2000-1 (Tr. 15/6418-9; 6423):

> I wouldn't agree with the statement… that volume does cause network characteristics… The statement that I have in mind is at lines 19 and 20 of the testimony [Docket No. R2000-1, USPS-T-15 at 47] is that the observable network characteristics, which are primarily the location of the delivery points the Postal Service actually serves, are clearly not determined by mail volumes, but rather that the other way around; that the patterns of mail volumes

> and deliveries of pieces in the Postal Service are determined by the geographical dispersion and other characteristics of the Postal Service's network. That's what I mean by the statement…
>
> [I]t is also my belief that many of these hard-to-measure characteristics of [the] network -- for instance, its geographic dispersion or whether it is located in an urban or rural area – are features of the facilities that are unlikely to change much if at all over time, so… the fixed effects terms are present in the model in part to capture the effects of unmeasured characteristics of the network.

Please see also the response to part (a).

e. As stated above, the fixed-effects model is appropriate and indeed required for consistent estimation of the Base Year elasticities (volume-variability factors) and thus accurate estimation of Base Year volume-variable costs. Accurate Base Year costs are the appropriate basis for projecting Test Year costs, including the effects of network realignment activities between the Base Year and Test Year. As Prof. Roberts noted, see the response to part d(iv), the cost consequences of network realignment would, over time, manifest themselves in the time-varying data. Thus, the appropriate econometric method to address changes to operations is not to employ inconsistent estimators for Base Year variabilities, but rather to employ statistically consistent estimation methods, such as the fixed effects and fixed effects/instrumental variables models, in conjunction with periodic updating of the analysis to reflect current Base Year operating conditions. Changes to future operating conditions are appropriately incorporated in the rollforward model to adjust Test Year costs..

Respectfully submitted,

UNITED STATES POSTAL SERVICE

By its attorneys:

Daniel J. Foucheaux, Jr.
Chief Counsel, Ratemaking

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Frank R. Heselton

CERTIFICATE OF SERVICE

I hereby certify that I have this date served the foregoing document in accordance with Section 12 of the Rules of Practice and Procedure.

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Frank R. Heselton

475 L'Enfant Plaza West, S.W.
Washington, D.C. 20260-1137
(202) 268-5204, FAX: -6187
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