Exhibit No. ___ (EJG-1T)
Docket No. UT-040788

BEFORE THE

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION,	)	
Complainant,	)	
v.	)	**DOCKET NO. UT-040788**
VERIZON NORTHWEST INC.,	)	
Respondent.	)	
. . . . .	)	

REBUTTAL TESTIMONY OF

EUGENE J. GOLDRICK

ON BEHALF OF
VERIZON NORTHWEST INC.

FEBRUARY 2, 2005

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. Eugene J. Goldrick, 1095 Avenue of the Americas, New York, NY.

Q. PLEASE DESCRIBE YOUR BUSINESS EXPERIENCE AND EDUCATION.

A. Verizon employs me as a Statistician within the Service Costs department. I am responsible for the statistical and sampling aspects of the cost studies for the various products and services offered by the Verizon telephone operating companies, including Verizon Northwest Inc. ("Verizon NW" or the "Company"). I also work on a variety of sampling and statistical modeling projects for the Engineering, Accounting, and Marketing organizations.

Verizon and its predecessor corporations have employed me since 1984. During that time I have worked on a diverse set of sampling, statistical modeling, prediction, and forecasting projects. I have designed and implemented sampling studies of customer accounts to determine the amount of unauthorized calling on blocked accounts; developed the sampling and extrapolation procedures used to verify the physical location of the hard-wired central office assets recorded on the company's property records; designed stratified random sampling plans for the central offices and feeder routes used in the company's cost studies for unbundled loop and platforms; and designed and carried out surveys of service technicians and customer service representatives to determine the average labor times for the work activities used in the company's non-recurring cost studies for unbundled network elements. I was responsible for the development of the sampling and extrapolation procedures embedded in the company's Subscriber Line

Usage System. I have presented expert statistical testimonies before several state Commissions and the FCC.

I received a Bachelor's Degree in Economics from the State University of New York at Stony Brook in 1978, and a Master's Degree in Economics from the State University of New York at Stony Brook in 1981. I completed all coursework for a Ph.D. in Economics from New York University in 1989.

Q. WHAT IS THE SUBJECT OF YOUR TESTIMONY?

A. My testimony provides a critical review of the statistical methodology employed by Commission Staff witness David E. Griffith in this docket. I will describe how Mr. Griffith's approach departs from accepted practice and results in an estimate of "missing equipment" that is so flawed it is unusable.

Q. WHAT IS THE SUBJECT OF MR. GRIFFITH'S TESTIMONY?

A. Mr. Griffith's testimony describes an audit he performed of Verizon NW's property records that relate to the Company's Washington intrastate regulated rate base. The purpose of the audit was to estimate the dollar amount of central office equipment appearing on the Company's Washington property records but not found in the field.

Q. HOW DID MR. GRIFFITH ESTIMATE THE DOLLAR AMOUNT OF MISSING EQUIPMENT?

A. First, Mr. Griffith subjectively selected three central offices for the audit located in the Greater Seattle metropolitan area. Next, for these offices and for each of the switching, radio, and electronic circuit accounts, he sorted the equipment items in these offices by installed cost and then selected the highest cost items. He sampled a total of 870 predominantly high-cost items. The physical presence of the sampled items was determined via field visits to the three offices and other information. Through this process, Mr. Griffith concluded that 29 of the 870 sampled items were missing. For each account (switching, radio, circuit), Mr. Griffith extrapolated or applied the "missingness" rate in the sample to the entire population of central offices, equipment items, and dollars within Washington. On the basis of this extrapolation, Mr. Griffith estimated that $38.8 million[1] of equipment was missing and proposed a reduction in the Company's Washington rate base of that amount.

Q. DOES MR. GRIFFITH'S APPROACH FOLLOW ACCEPTED SCIENTIFIC SAMPLING PRACTICE AND CAN THE RESULTS OF HIS STUDY BE USED TO PRODUCE A STATISTICALLY VALID ESTIMATE OF THE AMOUNT OF MISSING CENTRAL OFFICE EQUIPMENT?

A. No. Mr. Griffith chose his sample selectively, rather than randomly, and the selection criteria he used are not obviously correlated with the likelihood of missing equipment. Also, he chose far too few offices to produce a statistically accurate result. Further, he drew a biased sample of the equipment records and he made no corrections for these

[1] The $38.8 million is prior to Mr. Griffith applying a 75.5% intrastate separations factor to the investment.

obvious biases. As a result, no valid inferences about the true extent of missing equipment can be made from his study.

Q. WHAT ARE THE CONSEQUENCES OF MR. GRIFFITH'S FLAWED APPROACH TO SELECTING THE SAMPLE?

A. First, only three central offices were selected for audit. Verizon NW has over 200 central offices and remote-switching units in Washington. It is extremely difficult to achieve representativeness and statistical accuracy with a sample size of only 3 out of 200, except in rare circumstances.

Second, the selected offices are all located on the west side of the state in the Greater Seattle metropolitan area and appear to be chosen primarily for convenience. Given their limited geographic dispersion, it is unlikely that the selected offices are representative of the larger population and Mr. Griffith fails to provide any quantitative evidence that they are. Consequently, it is doubtful that his estimates of missing equipment can be validly extrapolated to the remaining 197 offices.

Third, Mr. Griffith made no attempt to ensure that the offices were representative of the more than 200 Verizon NW central offices and remote switching units in the state on the basis of factors that affect the missing equipment rate. In fact, Mr. Griffith "hand-picked" the central offices according to generalized criteria such as their proximity to each other, their mix of customer and equipment types, and their large dollar values of equipment. Mr. Griffith does not establish any connection between these criteria and the

missingness rate. Without this connection, it is pointless to select offices according to these criteria, since they do not help make the sample representative. By employing selection criteria that are unrelated to the occurrence of missingness, Mr. Griffith added "noise" to the sample selection process, which increased the likelihood of obtaining an unrepresentative sample.

Fourth, even if there were connections between Mr. Griffith's "hazy" selection criteria and the occurrence of missingness, he does not demonstrate that the central offices he chose are representative of the larger population of offices in terms of these criteria. For example, Mr. Griffith does not establish that the "mix of customer and equipment types" in the selected offices is similar to the mix in the general population.

Sample selection criteria enhance the accuracy of the sample estimates only if they reflect valid prior knowledge of the factors that drive missingness. Then the samples offices can be selected so that they are similar, in the aggregate, to the non-sampled offices on the values of these factors. Mr. Griffith's sample selection procedure does not employ valid prior knowledge and he does not "match" the sampled and non-sampled offices according to his own criteria. By contrast, a properly designed random sampling procedure would have first determined a valid set of criteria for selecting the sample. Second, these criteria would have been used to calculate the minimum number of offices required to produce statistically reliable results. Third, an automated random selection process would have been used to objectively choose at least the required minimum number of offices.

The selection criteria Mr. Griffith employed for his sample are not appropriate for yielding precise estimates of the amount of missing equipment in the larger population. Because his sample is unrepresentative in terms of the factors that affect missingness (e.g., retirement activity and equipment cost), the sample results cannot be extrapolated to the non-sampled population of equipment items.

Q. HOW SHOULD A REPRESENTATIVE SAMPLE HAVE BEEN SELECTED?

A. A representative sample should be an accurate approximation of the larger population in terms of the underlying factors that cause equipment to be missing or variables that are correlated with these causes, such as plant retirement activity. A sample is never a perfect representation of the larger population in this sense, however, so it is important to adjust for known differences between the sample and the population when extrapolating from the former to the latter, especially if the differences are large.

Q. CAN YOU GIVE A SPECIFIC EXAMPLE OF WHY MR. GRIFFITH'S SAMPLE IS UNREPRESENTATIVE?

A. Yes. The degree of historical retirement activity in a central office will have a considerable effect on the extent to which equipment is missing, because, for example, of the lag between the removal of the equipment and the updating of the property record. According to Mr. Griffith's audit results, a main reason for "missing equipment" was the failure to remove retired equipment from the books. Retirement histories, however, differ among central offices. As a result, the audited offices will not be representative of the larger population of offices unless their retirement histories are comparable. Because

Mr. Griffith did not use a measure of retirement activity as a selection criterion, the central offices he chose will not be representative of the larger population except by remote chance, especially since the number of sampled offices is so small.

Q. ARE THERE OTHER FACTORS THAT MAKE MR. GRIFFITH'S SAMPLE UNREPRESENTATIVE?

A. Yes. Mr. Griffith's sampling procedure is also flawed because equipment items with high installed costs were disproportionately selected. Mr. Griffith hand-selected items solely because they were high cost and generally excluded items with an installed cost less than $10,000 unless they were required to reach a minimal number of items for a specific account in a specific office. This bias in drawing the equipment records is noticeable by comparing the costs of sampled versus non-sampled items. The average installed cost of the sampled items is approximately $15,200 while the average installed cost of the non-sampled items is less than $900. This fact, by itself, might be unimportant if the rates for missing equipment were similar for high and low cost items. However, as I discuss below, there is statistical evidence in Mr. Griffith's own sample that high cost equipment has a higher missing rate than low cost equipment. Consequently, Mr. Griffith's extrapolation of the missing rate from the extremely high-cost sampled items to the low cost non-sampled items is biased and invalid. His approach results in a serious overstatement of the true amount of missing equipment in the population.

Q. IS THERE EVIDENCE TO SUPPORT MR. GRIFFITH'S SIMPLISTIC ASSUMPTION THAT THE OCCURRENCE OF MISSING EQUIPMENT IS UNRELATED TO ITS INSTALLED COST?

A. No. In fact, his assumption is wrong and not based upon any evidence. The average installed cost of a missing item in his sample is approximately $16,800 while the average installed cost of an item that is not missing is about $15,100. This indicates higher cost items are more likely to be missing than lower cost items since otherwise the averages for the missing and non-missing equipment would be the same.

Q. HAVE YOU USED MR. GRIFFITH'S SAMPLE TO QUANTIFY THE RELATIONSHIP BETWEEN INSTALLED COST AND THE OCCURRENCE OF MISSINGNESS?

A. Yes. For the 2232 – electrical circuit equipment account, a linear regression analysis applied to Mr. Griffith's sample indicates that the occurrence of missingness declines by approximately 0.18% for every $1,000 reduction in installed cost. This means that the percentage point difference in the missingness rate between items costing $11,000 and items costing $1,000 is 1.8% (0.18% x $10K).

Q. CAN THIS RELATIONSHIP BE USED TO REMOVE THE UPWARD BIAS IN MR. GRIFFITH'S MISSINGNESS RATE FOR THE 2232 ACCOUNT DUE TO HIS "OVER-SAMPLING" OF HIGH COST EQUIPMENT?

A. Yes. The missingness rate for the 2232 account calculated from Mr. Griffith's sample is 5.71% but this rate applies to equipment items with an average installed cost of $11,600.

The average installed cost of all account 2232 equipment items in the population, however, is only $800. Because low cost items are less likely to be missing than high cost items, it is necessary to make a downward adjustment to Mr. Griffith's 5.71% missingness rate so that it is representative of the low cost non-sampled items to which it is applied. There is a standard statistical adjustment to make in this situation.[2] The adjustment entails reducing the missingness rate of 5.71% for the high-cost sampled items by the difference in average installed costs between the sample and the population ($11,600 - $800 = $10,800) multiplied by the sensitivity of the missingness rate to installed cost (0.18% per thousand). Performing this calculation yields a reduction of 1.9 percentage points in Mr. Griffith's estimate of the proportion of missing dollars. Applying this reduction to Mr. Griffith's biased estimate of 5.71% yields an unbiased estimate of 3.81%. This "size-adjusted" estimate is a much more accurate reflection of the missingness that is likely to occur among all the items in the population. It is important to note, however, that his adjustment corrects only for Mr. Griffith's "over-sampling" of high cost equipment. It does not correct for the other deficiencies in his study.

Q. HAVE YOU CALCULATED THE IMPACT OF THIS ADJUSTMENT ON MR. GRIFFITH'S ESTIMATE OF THE AMOUNT OF DOLLARS MISSING IN THE 2232 ACCOUNT AND ON HIS ESTIMATE OF THE AGGREGATE AMOUNT MISSING?

[2] See R. Valliant, A. H. Dorfman, and R. M. Royall, Finite Population Sampling and Inference: A Prediction Approach, John Wiley & Sons, Inc. 2000, Page 265.

A. Yes. Applying the revised missingess rate of 3.81% to the population of dollars in the 2232 account yields a revised estimate of $19.8 million in missing plant. This is nearly $9.8 million lower than Mr. Griffith's biased estimate of $29.7 million. The aggregate estimate of missing dollars is correspondingly reduced from $38.8 million to $28.9 million, due solely to the size disparity between Mr. Griffith's sample and the population.

Q. ARE THEIR ADDITIONAL ASPECTS OF MR. GRIFFITH'S SAMPLING METHOD THAT MAKES HIS RESULTS UNRELIABLE?

A. Yes. Even if the central offices had been selected randomly, in which case the sampled offices would have had some chance of being representative, three offices are far too few for accurate and reliable extrapolation from the sample to the population since there are more than 200 central offices and remote switching units in the Verizon NW's Washington operation from which a sample could have been selected.

In sampling analysis, the type of sampling performed by Mr. Griffith is known as two-stage cluster sampling and special estimation techniques are generally required when the sample is obtained via this method.[3] In this sampling method, central offices are viewed as "clusters" of individual equipment items. In the first stage, Mr. Griffith selected three central offices (clusters) for further sampling. In the second stage, Mr. Griffith selected high-cost items within each of the three clusters. It is well-known in sampling statistics that when individual items are clustered into groups such as central offices, more accurate estimates are obtained by sampling more clusters (central offices) and fewer items within

[3] P. V. Sukhatme, B. V. Sukhatme, S. Sukhatme, and C. Asok, Sampling Theory of Surveys with Applications, Third Edition, Iowa State University Press 1984, Page 304.

each sampled cluster.[4] Mr. Griffith reversed this sampling method, incorrectly sampling too few central offices (clusters) and an excessive number of items within each office (cluster).

Two-stage cluster sampling, when properly applied will result in a sample that reflects the variation in central office specific factors, such as retirement activity, that impact the occurrence of missingness for all the individual equipment items in an office in a similar way. This has the effect of making the sample representative in terms of these factors.

In terms of providing information on the extent of missing equipment in the population, cluster sampling makes the effective sample size smaller than a simple random sample of the same size taken from a straight list of items in the property record.[5] A simple random sample of 870 items would be an improvement over Mr. Griffith's improper application of the two-stage cluster sampling method. Even within the two-stage approach, however, allocating the 870 equipment items among more central offices would generate more accurate missingness estimates than those developed by Mr. Griffith.

Q. DOES THE FACT THAT MR. GRIFFITH SAMPLED TOO FEW OFFICES AND TOO MANY ITEMS WITHIN EACH OFFICE ADVERSELY AFFECT THE RELIABILITY OF HIS ESTIMATES OF MISSING EQUIPMENT IN THE POPULATION?

[4] Ibid. and R. Lehtonen and E. Pahkinen, Practical Methods for the Design and Analysis of Complex Surveys, Second Edition, John Wiley & Sons, Ltd 2004, Page 78.
[5] Ibid. Pages 216-217.

A. Yes, although the magnitude of the inaccuracy due to the poor sampling procedure cannot be properly evaluated unless a comparison study is conducted whereby a new sample of 870 items is allocated among more central offices. In fact, it is virtually impossible to assess the adverse impact of the clustering because Mr. Griffith selected so few clusters.

What can be assessed, however, is the accuracy of Mr. Griffith's $38.8 million estimate of the dollar amount of missing equipment under the assumption that the items selected by Mr. Griffith constitute a simple random sample from the entire population of individual equipment items. It is important to recognize, however, that this assumption is not accurate since Mr. Griffith subjectively selected the three central offices and selected mostly high-cost items within these offices. Nonetheless, using Mr. Griffith's sample and (for the purposes of this analysis) the assumption of simple random sampling, I calculated standard statistical 95% confidence intervals around Mr. Griffith's estimates of the missing dollars for the 2212 – digital switching equipment and 2232 – electrical circuit equipment accounts. Without the assumption of simple random sampling assumption, the accuracy of Mr. Griffith's estimates cannot even be calculated because his sampling procedure is so flawed.

Q. WHAT IS A CONFIDENCE INTERVAL AND WHAT DO THEY SHOW FOR MR. GRIFFITH'S ESTIMATES?

A. A 95% confidence interval gives a range of estimates within which the true amount of missing equipment dollars is highly likely to be. Narrower intervals are preferred to wider intervals since it is then highly likely that the true amount lies within a narrower

range. In general, as the confidence interval becomes narrower, it indicates that the estimate is more precise. As I will show, the confidence intervals for Mr. Griffith's estimates tell us that they are essentially meaningless as a source for accurately estimating the percent of missing equipment for the Company.

Q. WHAT, SPECIFICALLY, DO THE CONFIDENCE INTERVALS FOR MR. GRIFFITH'S ESTIMATES SHOW?

A. The 95% confidence intervals for Mr. Griffith's estimates are very wide. This is strong evidence that they are highly imprecise, even under the assumption that the selected items are a simple random sample from the population. Mr. Griffith's estimate of the missing dollars in the 2212 account is $9.1 million plus or minus $8.0 million with 95% confidence. The uncertainty surrounding Mr. Griffith's estimate of missing dollars is nearly 88% of the estimate itself.

For the 2232 account, Mr. Griffith's estimate of missing dollars is $29.7 million plus or minus $21.7 million with 95% confidence. The uncertainty surrounding this estimate of missing dollars is 73% of the estimate itself.

Such wide confidence intervals demonstrate that Mr. Griffith's sample does not provide much information about the true dollar amount of missing equipment.

Q. WHAT CONCLUSIONS ABOUT THE EXTENT OF MISSING EQUIPMENT AND DOLLARS CAN BE DRAWN FROM MR. GRIFFITH'S AUDIT?

A. Mr. Griffith's method for selecting the sample is statistically incorrect and inefficient. He subjectively selected central offices and equipment items for audit. As a result his sample is not an objective representation of the population of items. He did not use random sampling methods to impart "objectivity" into the process of selecting the central offices and the equipment items within them.[6]

The flawed sampling procedure employed by Mr. Griffith makes it extremely unlikely that his sample is representative of the larger population of equipment items. As a result, it is virtually impossible to validly extrapolate his sample results to the larger population of items. About the only valid conclusion that can be drawn from Mr. Griffith's study is that 29 items in Verizon NW's Washington property record with a total installed cost of $488,500 could not be located where the records said they should be.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

[6] See R. Valliant, A. H. Dorfman, and R. M. Royall, Finite Population Sampling and Inference: A Prediction Approach, John Wiley & Sons, Inc. 2000, Page 20.