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APPLICATION OF ENTERGY TEXAS, INC.	**§**	**PUBLIC UTILITY COMMISSION**
FOR AUTHORITY TO CHANGE RATES	**§**	**OF TEXAS**
	§	

DIRECT TESTIMONY AND EXHIBITS

OF

DAVID J. GARRETT

ON BEHALF OF THE CITIES OF

Anahuac, Beaumont, Bridge City, Cleveland, Dayton, Groves, Houston, Huntsville, Liberty, Montgomery, Navasota, Nederland, Oak Ridge North, Orange, Pine Forest, Pinehurst, Port Arthur, Port Neches, Roman Forest, Rose City, Shenandoah, Silsbee, Sour Lake, Splendora, Vidor, West Orange, and Willis

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OCTOBER 26, 2022

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I. INTRODUCTION

Q. State your name and occupation.

A. My name is David J. Garrett. I am a consultant specializing in public utility regulation. I am the managing member of Resolve Utility Consulting, PLLC. I focus my practice on the primary capital recovery mechanisms for public utility companies: cost of capital and depreciation.

Q. Summarize your educational background and professional experience.

A. I received a B.B.A. degree with a major in Finance, an M.B.A. degree, and a Juris Doctor degree from the University of Oklahoma. I worked in private legal practice for several years before accepting a position as assistant general counsel at the Oklahoma Corporation Commission ("Oklahoma Commission" or "Commission") in 2011. At the Oklahoma Commission, I worked in the Office of General Counsel in regulatory proceedings. In 2012, I began working for the Public Utility Division as a regulatory analyst providing testimony in regulatory proceedings. After leaving the Oklahoma Commission, I formed Resolve Utility Consulting, PLLC, where I have represented various consumer groups and state agencies in utility regulatory proceedings, primarily in the areas of cost of capital and depreciation. I am a Certified Depreciation Professional with the Society of Depreciation Professionals. I am also a Certified Rate of Return Analyst with the Society of Utility and Regulatory Financial Analysts. A more complete description of my qualifications and regulatory experience is included in my curriculum vitae.[1]

[1] Direct Exhibit DJG-1.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of the Cities of Anahuac, Beaumont, Bridge City, Cleveland, Dayton, Groves, Houston, Huntsville, Liberty, Montgomery, Navasota, Nederland, Oak Ridge North, Orange, Pine Forest, Pinehurst, Port Arthur, Port Neches, Roman Forest, Rose City, Shenandoah, Silsbee, Sour Lake, Splendora, Vidor, West Orange, and Willis (collectively "Cities").

Q. Describe the purpose and scope of your testimony in this proceeding.

A. I am testifying in response to the direct testimonies of two witnesses for Entergy Texas, Inc. ("ETI" or the "Company"). I will address the depreciation rates proposed by Mr. Dane A. Watson. I will also address the demolition costs proposed by Mr. Sean C. McHone.

II. EXECUTIVE SUMMARY

Q. Summarize the key points of your testimony.

A. In this case, ETI is proposing a substantial increase of $84 million to its annual depreciation accrual.[2] As demonstrated by the evidence presented in this testimony, it would not be reasonable to accept ETI's filed position regarding its proposed depreciation rates. ETI's proposed increase is unreasonably high due to several factors, which are summarized as follows:

1. The Company is proposing to accelerate the probable retirement dates for several of its production units, which results in a substantial increase in depreciation expense associated with production plant. Cities position is to leave the approved retirement dates for these plants in place for cost recovery purposes.

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[2] Direct Testimony of Dane A. Watson, p. 6.

2. The Company's proposed demolition costs include arbitrary and unsupported contingency costs, which increase base demolition costs by 10%. The Commission should disallow contingency costs from the demolition cost estimates.

3. For several transmission and distribution accounts, ETI is proposing service lives that are shorter than those indicated by the Company's historical retirement data, and as a result, the corresponding depreciation rates proposed for these accounts are too high.

4. The Company is proposing significant increases to the negative net salvage rates for many of its mass property accounts. In light of the substantial financial impact to customers, the Commission should consider taking a gradual approach with negative net salvage rate increases in this case.

For these reasons, it would not be reasonable to accept the Company's proposed increase to its depreciation rates and expense. The following table summarizes ETI's and Cities' proposed depreciation accruals for plant at December 31, 2021.[3]

Figure 1:
Summary Proposed Depreciation Accrual Comparison

Plant Function	Plant Balance 12/31/2021	ETI Proposed Accrual	Cities Proposed Accrual	Accrual Difference
Steam Production	$ 1,238,611,477	$ 110,085,796	$ 53,959,863	$ (56,125,933)
Other Production	736,186,792	25,593,776	24,752,296	(841,480)
Transmission	2,125,787,700	39,720,926	34,910,714	(4,810,212)
Distribution	2,470,913,519	78,441,061	70,832,483	(7,608,578)
General	81,611,366	2,396,626	2,396,626	-
Total	$ 6,653,110,854	$ 256,238,184	$ 186,851,981	**$ (69,386,203)**

[3] Exhibit DJG-2; *see also* Exhibit DJG-4 and DJG-5 for detailed rate calculations; *see* Exhibit DJG-14 for remaining life development.

As shown in the table above, adopting my proposed depreciation rates would result in an adjustment decreasing the Company's proposed annual depreciation accrual by $69.4 million, when applied to plant as of December 31, 2021.[4]

Q. Describe why it is important not to overestimate depreciation rates.

A. The issue of depreciation is essentially one of timing. Under the rate base rate of return model, the utility is allowed to recover the original cost of its prudent investments required to provide service. Depreciation systems are designed to allocate those costs in a systematic and rational manner – specifically, over the service life of the utility's assets. If depreciation rates are overestimated (i.e., service lives are underestimated), it encourages economic inefficiency. Unlike competitive firms, regulated utility companies are not always incentivized by natural market forces to make the most economically efficient decisions. If a utility is allowed to recover the cost of an asset before the end of its useful life, this could incentivize the utility to unnecessarily replace the asset in order to increase rate base, which results in economic waste. Thus, from a public policy perspective, it is preferable for regulators to ensure that assets are not depreciated before the end of their true useful lives. While underestimating the useful lives of depreciable assets could financially harm current ratepayers and encourage economic waste, unintentionally overestimating depreciable lives (i.e., underestimating depreciation rates) does not harm the Company. This is because if an asset's life is overestimated, there are a variety of measures that regulators can use to ensure the utility is not financially harmed. One such

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[4] *See* Direct Testimony of Cities witness Karl J. Nalepa for Cities' depreciation expense adjustment.

measure would be the use of a regulatory asset account. In that case, the Company's original cost investment in these assets would remain in the Company's rate base until they are recovered. Thus, the process of depreciation strives for a perfect match between actual and estimated useful life. However, when these estimates are not exact, it is better to ensure that service lives are not underestimated.

Q. What is Cities' recommendation to the Commission regarding ETI's proposed depreciation rates?

A. Cities recommend the Commission adopt the proposed depreciation rates presented in Exhibit DJG-4. These rates have been incorporated into the Direct Testimony and Exhibits of Karl J. Nalepa to calculate Cities' adjustment to the Company's proposed depreciation expense included in the cost of service model.

III. <u>DEPRECIATION STANDARDS</u>

Q. Discuss the standard by which regulated utilities are allowed to recover depreciation expense.

A. In *Lindheimer v. Illinois Bell Telephone Co.*, the U.S. Supreme Court stated that "depreciation is the loss, not restored by current maintenance, which is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy, and obsolescence."[5] The *Lindheimer* Court also recognized that the original cost of plant assets, rather than present value or some other measure, is the proper basis for calculating depreciation expense.[6] Moreover, the *Lindheimer* Court found:

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[5] *Lindheimer v. Illinois Bell Tel. Co.*, 292 U.S. 151, 167 (1934).

[6] *Id.* (Referring to the straight-line method, the *Lindheimer* Court stated that "[a]ccording to the principle of this accounting practice, the loss is computed upon the actual cost of the property as entered upon the books, less the

> [T]he company has the burden of making a convincing showing that the amounts it has charged to operating expenses for depreciation have not been excessive. That burden is not sustained by proof that its general accounting system has been correct. The calculations are mathematical, but the predictions underlying them are essentially matters of opinion.[7]

Thus, the regulatory authority should ultimately determine if the Company has met its burden of proof by making a convincing showing that its proposed depreciation rates are not excessive.

Q. Should depreciation represent an allocated cost of capital to operation, rather than a mechanism to determine loss of value?

A. Yes. While the *Lindheimer* case and other early literature recognized depreciation as a necessary expense, the language indicated that depreciation was primarily a mechanism to determine loss of value.[8] Adoption of this "value concept" would require annual appraisals of extensive utility plant and is thus not practical in this context. Rather, the "cost allocation concept" recognizes that depreciation is a cost of providing service, and that in addition to receiving a "return on" invested capital through the allowed rate of return, a utility should also receive a "return of" its invested capital in the form of recovered depreciation expense. The cost allocation concept also satisfies several fundamental accounting principles, including verifiability, neutrality, and the matching principle.[9] The

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expected salvage, and the amount charged each year is one year's pro rata share of the total amount."). The original cost standard was reaffirmed by the Court in *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 606 (1944). The *Hope* Court stated: "Moreover, this Court recognized in [*Lindheimer*], supra, the propriety of basing annual depreciation on cost. By such a procedure the utility is made whole and the integrity of its investment maintained. No more is required."

[7] *Id*. at 169 (emphasis added).

[8] *See* Frank K. Wolf & W. Chester Fitch, *Depreciation Systems* 71 (Iowa State University Press 1994).

[9] National Association of Regulatory Utility Commissioners, *Public Utility Depreciation Practices* 12 (NARUC 1996).

definition of "depreciation accounting" published by the American Institute of Certified Public Accountants ("AICPA") properly reflects the cost allocation concept:

> Depreciation accounting is a system of accounting that aims to distribute cost or other basic value of tangible capital assets, less salvage (if any), over the estimated useful life of the unit (which may be a group of assets) in a systematic and rational manner. It is a process of allocation, not of valuation.[10]

Thus, the concept of depreciation as "the allocation of cost has proven to be the most useful and most widely used concept."[11]

IV. ANALYTIC METHODS

Q. Discuss the definition and purpose of a depreciation system, as well as the depreciation system you employed for this project.

A. The legal standards set forth above do not mandate a specific procedure for conducting depreciation analysis. These standards, however, direct that analysts use a system for estimating depreciation rates that will result in the "systematic and rational" allocation of capital recovery for the utility. Over the years, analysts have developed "depreciation systems" designed to analyze grouped property in accordance with this standard. A depreciation system may be defined by several primary parameters: 1) a <u>method</u> of allocation; 2) a <u>procedure</u> for applying the method of allocation; 3) a <u>technique</u> of applying the depreciation rate; and 4) a <u>model</u> for analyzing the characteristics of vintage property groups.[12] In this case, I used the straight-line method, the average life procedure, the

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[10] American Institute of Accountants, *Accounting Terminology Bulletins Number 1: Review and Résumé* 25 (American Institute of Accountants 1953).

[11] Wolf *supra* n. 8, at 73.

[12] *See id.* at 140.

remaining life technique, and the broad group model; this system would be denoted as an "SL-AL-RL-BG" system. This depreciation system conforms to the standards set forth above and is commonly used by depreciation analysts in regulatory proceedings. I provide a more detailed discussion of depreciation system parameters, theories, and equations in Appendix A.

Q. Did Mr. Watson use the same depreciation system that you used?

A. Yes. Therefore, the differences in our depreciation rate proposals are driven by different service life and other parameter assumptions, rather than by a difference in the depreciation system.

Q. Please describe the actuarial process you used to analyze the Company's depreciable property.

A. The study of retirement patterns of industrial property is derived from the actuarial process used to study human mortality. Just as actuarial scientists study historical human mortality data in order to predict how long a group of people will live, depreciation analysts study historical plant data in order to estimate the average lives of property groups. The most common actuarial method used by depreciation analysts is called the "retirement rate method." In the retirement rate method, original property data, including additions, retirements, transfers, and other transactions, are organized by vintage and transaction year.[13] The retirement rate method is ultimately used to develop an "observed life table," ("OLT") which shows the percentage of property surviving at each age interval. This

[13] The "vintage" year refers to the year that a group of property was placed in service (aka "placement" year). The "transaction" year refers to the accounting year in which a property transaction occurred, such as an addition, retirement, or transfer (aka "experience" year).

pattern of property retirement is described as a "survivor curve." The survivor curve derived from the observed life table, however, must be fitted and smoothed with a complete curve in order to determine the ultimate average life of the group.[14] The most widely used survivor curves for this curve-fitting process were developed at Iowa State University in the early 1900s and are commonly known as the "Iowa curves."[15] A more detailed explanation of how the Iowa curves are used in the actuarial analysis of depreciable property is set forth in Appendix C.

V. LIFE SPAN PROPERTY ANALYSIS

Q. Describe life span property.

A. "Life span" property accounts usually consist of property within a production plant. The assets within a production plant will be retired concurrently at the time the plant is retired, regardless of their individual ages or remaining economic lives. For example, a production plant will contain property from several accounts, such as structures, fuel holders, and generators. When the plant is ultimately retired, all of the property associated with the plant will be retired together, regardless of the age of each individual unit. Analysts often use the analogy of a car to explain the treatment of life span property. Throughout the life of a car, the owner will retire and replace various components, such as tires, belts, and brakes. When the car reaches the end of its useful life and is finally retired, all of the car's individual components are retired together. Some of the components may still have some

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[14] See Appendix C for a more detailed discussion of the actuarial analysis used to determine the average lives of grouped industrial property.

[15] *See* Appendix B for a more detailed discussion of the Iowa curves.

useful life remaining, but they are nonetheless retired along with the car. Thus, the various accounts of life span property are scheduled to retire concurrently as of the production unit's probable retirement date.

A. Terminal Retirement Dates

Q. Is the Company proposing earlier probable retirement dates for some of its production units?

A. Yes. The Company is proposing to accelerate the probable retirement dates for Nelson 6 and Big Cajun Unit 3.[16] In addition, the Company is proposing significant rate increases for Sabine Units 1, 3, and 4 to collect recent expenditures on these units before they retire.

Q. Do the depreciation rates proposed in your exhibits reflect the currently approved retirement dates for the these units?

A. Yes. In addition, my proposed depreciation rates reflect the currently-approved depreciation rates for Sabine Units 1, 3, and 4.[17]

Q. Are you testifying as to the most prudent, actual retirement date for the Nelson and Big Cajun units?

A. No. My proposed depreciation rates relate to the cost recovery of these units, not to the most prudent, actual retirement dates for these units.

Q. Are you aware of any depreciation standards or principles suggesting that the cost recovery of any asset cannot extend beyond the retirement date of an asset?

A. No. For mass property, depreciation analysis aims for matching the estimated service life of a group of assets with the actual, average life of the group based on statistical analyses.

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[16] *See* Direct Testimony of Anastasia Meyer, p. 12, lines 1-8; *see also* responses to OPUC RFI 3-6 and 6-2.

[17] Exhibit DJG-5.

For location life assets, such as the production plants at issue, the recovery of the utility's plant investments are generally allocated over the estimated life of the asset. However, in cases in which a utility proposes to accelerate the retirement of a plant that would have a significant impact on customers, regulators have often allowed for the cost recovery period for the asset to extend beyond its retirement date.[18] The ultimate aim is to set fair depreciation rates, not to strictly match the cost recovery period of a particular asset with its service life.

Q. Would Cities' proposal result in intergenerational inequity for future customers?

A. No. When a utility decides to accelerate the retirement of a production unit that would have a significant impact on current customers, it would arguably be inequitable to current customers to impose the entire cost burden on them. The supposed benefits of a plant retirement, such as improvements in environmental conditions, will be largely realized by future customers. It is not inequitable to have future customers share in some of the costs for a project from which they will ultimately benefit.

Q. Would Cities' proposal for these units result in financial harm to the Company in terms of cost recovery?

A. No. My proposed depreciation rates do not contemplate a scenario in which the Company does not fully recover its costs in the production units at issue.

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[18] *See* Direct Testimony of Mark E. Garrett, pp. 59-68.

Q. Are there other policy issues the Commission should consider related to Cities proposed treatment of these production units?

A. Yes. Additional support for Cities' proposed treatment of these production units is contained in the Direct Testimony of Cities witness Mark Garrett.

B. Terminal Net Salvage Analysis

Q. Describe terminal net salvage.

A. When a production plant reaches the end of its useful life, a utility may decide to demolish the plant. In that case, the utility may sell some of the remaining assets. The proceeds from this transaction are called "gross salvage." The corresponding expense associated with demolishing the plant is called "cost of removal." The term "net salvage" equates to gross salvage less the cost of removal. When net salvage refers to production plants, it is often called "terminal net salvage," because the transaction will occur at the end of the plant's life.

Q. Is ETI requesting recovery of terminal net salvage in this case?

A. Yes. In support of ETI's request for terminal net salvage, Mr. McHone sponsored and filed site-specific demolition studies for the Company's generating units.[19] The Company is requesting more than $100 million in total terminal negative net salvage recovery.[20]

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[19] *See* Exhibit SCM-2.

[20] Exhibit DAW-2, Appendix D-3.

Q. Describe how the demolition costs estimated by Mr. McHone affect the Company's depreciation rates for its production plants.

A. For each of the Company's generating units, Mr. McHone provides estimates for certain direct cost estimates, such as material and labor. Mr. McHone also estimates gross salvage that the Company would receive from selling any assets at the time of retirement (mostly scrap value). Mr. McHone presents the total gross demolition cost for each plant, then applies a contingency factor, which increases the costs by 10%. This equates to $24.4 million of contingency costs the Company is proposing to include in terminal net salvage rates.[21]

Q. Do you agree that contingency factors should be included in the Company's terminal net salvage rates?

A. No. Contingency costs are unknown by definition, and it is not appropriate to include them in rates in my opinion. If a particular future cost estimate is unknown, then it could either be higher or lower than estimated. It is unfair to current ratepayers to pay for a future cost that is "unknown" by definition, especially when that cost arbitrarily increases yet another unknown cost (plant demolition) by more than $24 million. If one can use the same logic to support a negative contingency factor as is used to support a positive contingency factor, I think the most appropriate ratemaking treatment is to disallow the contingency factors all together and focus on the specific direct and indirect cost estimates defined in the demolition studies.

[21] Exhibit DJG-6.

Q. Does the fact that contingency costs are sometimes used in construction contracts mean that they should also apply in this context?

A. No. Charging customers for demolition contingency costs is inappropriate in the context of ratemaking. In construction contracts, contingency costs are designed to cover unexpected costs during the construction process as well as the owner's requested changes or design modifications. In addition, construction contracts created in competitive environments will be driven by market forces to contain the lowest reasonable costs. In contrast, the Company's demolition cost estimates in this case were not the result of competitively-driven contractual negotiations. Sargent & Lundy is not bidding on performing demolition work, and there is no financial incentive for Sargent & Lundy to provide a market driven estimate containing the lowest reasonable costs. Rather, the costs contained in the demolition studies are theoretical in nature. Adding an arbitrary and unsupported cost inflation of 10% on top of costs that are already speculative in nature is inappropriate.

Q. Do the depreciation rates you propose for ETI's production accounts exclude the contingency factors?

A. Yes. ETI's demolition costs affect the amounts of the net salvage and depreciation rates for the Company's production accounts. The rates I propose for these accounts have been calculated without the inclusion of the contingency factors.[22]

[22] Exhibit DJG-5.

VI. MASS PROPERTY ANALYSIS

Q. Describe mass property.

A. Unlike life span property accounts, "mass" property accounts usually contain a large number of small units that will not be retired concurrently. For example, poles, conductors, transformers, and other transmission and distribution plant are usually classified as mass property. Estimating the service life of any single unit contained in a mass account would not require any actuarial analysis or curve-fitting techniques. Since we must develop a single rate for an entire group of assets, however, actuarial analysis is required to calculate the average remaining life of the group.

Q. How did you determine the depreciation rates for the mass property accounts?

A. To develop depreciation rates for the Company's mass property accounts, I obtained the Company's historical plant data to develop observed life tables for each account. I used Iowa curves to smooth and complete the observed data to calculate the average remaining life of each account. Finally, I analyzed the Company's proposed net salvage rates for each mass account by reviewing the historical salvage data. After estimating the remaining life and salvage rates for each account, I calculated the corresponding depreciation rates. Further details about the actuarial analysis and curve-fitting techniques involved in this process are presented in the attached appendices.

A. Service Life Estimates

Q. Please describe your approach in estimating the service lives of mass property.

A. I analyzed the Company's property data used to derive an observed life table ("OLT") for each account. The data points on the OLT can be plotted to form a curve (the "OLT curve"). The OLT curve is not a theoretical curve, rather, it is actual observed data from the Company's records that indicate the rate of retirement for each property group. An OLT curve by itself, however, is rarely a smooth curve, and is often not a "complete" curve (i.e., it does not end at zero percent surviving). In order to calculate average life (the area under a curve), a complete survivor curve is needed. The Iowa curves are empirically-derived curves based on the extensive studies of the actual mortality patterns of many different types of industrial property. The curve-fitting process involves selecting the best Iowa curve to fit the OLT curve. This can be accomplished through a combination of visual and mathematical curve-fitting techniques, as well as professional judgment. The first step of my approach to curve-fitting involves visually inspecting the OLT curve for any irregularities. For example, if the "tail" end of the curve is erratic and shows a sharp decline over a short period of time, it may indicate that this portion of the data is less reliable, as further discussed below. After inspecting the OLT curve, I use a mathematical curve-fitting technique which essentially involves measuring the distance between the OLT curve and the selected Iowa curve in order to get an objective, mathematical assessment of how well the curve fits. After selecting an Iowa curve, I observe the OLT curve along with the Iowa curve on the same graph to determine how well the curve fits. I may repeat this process several times for any given account to ensure that the most reasonable Iowa curve is selected.

Q. Do you always select the mathematically best-fitting curve?

A. Not necessarily. Mathematical fitting is an important part of the curve-fitting process because it promotes objective, unbiased results. While mathematical curve fitting is important, however, it may not always yield the optimum result; therefore, it should not necessarily be adopted without further analysis. In fact, for some of the accounts in this case I selected Iowa curves that were not the mathematical best fit, and in every such instance, this decision resulted in shorter curves (higher depreciation rates) being chosen, as further illustrated below.

Q. Should every portion of the OLT curve be given equal weight?

A. Not necessarily. Many analysts have observed that the points comprising the "tail end" of the OLT curve may often have less analytical value than other portions of the curve. "Points at the end of the curve are often based on fewer exposures and may be given less weight than points based on larger samples. The weight placed on those points will depend on the size of the exposures."[23] In accordance with this standard, an analyst may decide to truncate the tail end of the OLT curve at a certain percent of initial exposures, such as one percent. Using this approach puts a greater emphasis on the most valuable portions of the curve. For my analysis in this case, I not only considered the entirety of the OLT curve, but also conducted further analyses that involved fitting Iowa curves to the most significant part of the OLT curve for certain accounts. In other words, to verify the accuracy of my curve selection, I narrowed the focus of my additional calculation to consider the top 99% of the "exposures" (i.e., dollars exposed to retirement) and to eliminate the tail end of the curve representing the bottom 1% of exposures for applicable accounts.

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[23] Wolf *supra* n. 8, at 46.

Q. Please describe the banding periods you used for each account.

A. For each account discussed below, I conducted my Iowa curve analyses on the overall placement and experience bands, which means I incorporated all of the Company's retirement history in my analysis. The OLT curves presented in the graphs below represent the total placement and experience bands.

Q. Discuss the general differences between your service life estimates and the Company's service life estimates for these accounts.

A. Mr. Watson and I used similar curve-fitting approaches in this case. However, for each account to which I propose a service life adjustment, the Iowa curve I selected to calculate the depreciation rate for the account provides a closer mathematical fit to the observed data.[24] For each of the accounts to which I propose service life adjustments, the Company has selected a curve that underestimates the average service life of the assets in the account, which results in unreasonably high depreciation rates.

Q. Do you have other general criticisms of Mr. Watson's service life estimates?

A. Yes. In discussing his service life estimates for many of ETI's accounts, Mr. Watson has apparently relied heavily upon the expectations of Company personnel with regard to how long the assets will be in service. ETI is the applicant in this case, and it has hired an independent expert in Mr. Watson to develop service life estimates based on specialized, statistical analysis of the Company's historical retirement data for an issue that heavily affects the Company's cash flow. To the extent ETI's employees have simply told the Company's depreciation expert how long they think the Company's assets will survive,

[24] *See* Exhibits DJG-9 thru DJG-21.

and such opinions were relied upon more than the service lives indicated by objective retirement data, it calls into question the objectivity and accuracy of ETI's proposed depreciation rates.

Q. Please summarize your proposed service life adjustments.

A. The following table shows a comparison of the proposed Iowa curves in this case for the accounts in dispute regarding service life.[25]

Figure 2:
Proposed Iowa Curve Comparison

Account No.	Description	ETI Iowa Curve	Cities Iowa Curve
	Transmission Plant		
353.00	Station Equipment	R1 - 64	R1 - 70
354.00	Towers & Fixtures	R4 - 75	R4 - 79
355.00	Poles & Fixtures	R1.5 - 70	R1 - 77
	Distribution Plant		
362.00	Station Equipment	R1 - 65	R0.5 - 70
364.00	Poles, Towers & Fixtures	R1 - 45	R1 - 47
366.00	UG Conduit	R3 - 50	R2 - 60
367.00	UG Conductors & Devices	R2.5 - 40	R2 - 46

These accounts are discussed in more detail below.

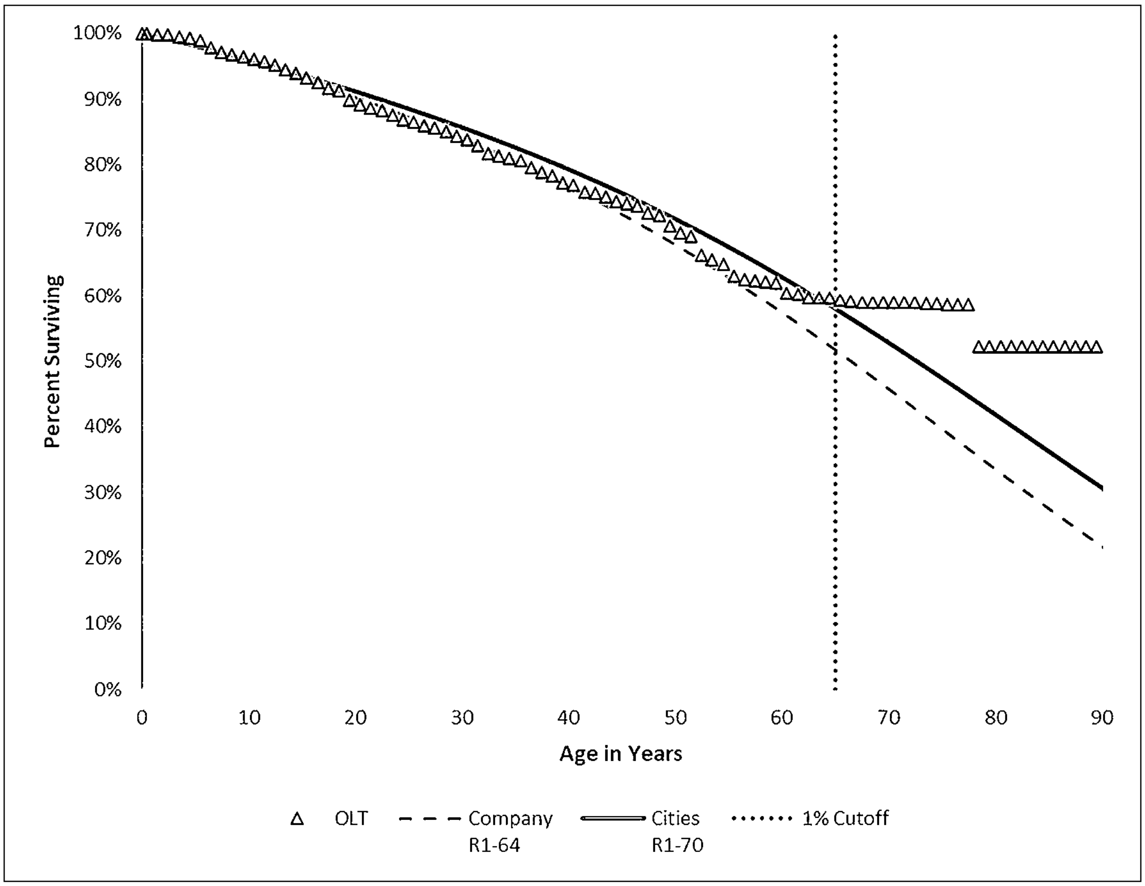
[25] *See also* Exhibit DJG-3.

1. Account 353 – Transmission Station Equipment

Q. Describe your service life estimate for this account and compare it with the Company's estimate.

A. For this account, Mr. Watson selected the R1-64 Iowa curve and I selected the R1-70 Iowa curve. The graph below shows these two curves along with the OLT curve.

Figure 3:
Account 353 – Transmission Station Equipment



The vertical dotted line in the graph represents the benchmark truncation point discussed above, in which data points occurring to the right of this line are less statistically relevant for curve-fitting purposes. As shown in this graph, both of the selected Iowa curves provide relatively close fits to the observed data. However, the curve selected by Mr. Watson appears to decline to sharply relative to the observed relevant data. We can use mathematical curve fitting techniques to confirm the closer fitting Iowa curve.

Q. Does your selected curve provide a better fit to the observed data?

A. Yes. The best mathematically-fitted curve is the one that minimizes the distance between the OLT curve and the Iowa curve, thus providing the closest fit. The "distance" between the curves is calculated using the "sum-of-squared differences" ("SSD") technique. The curve with the lower SSD represents the better mathematical fit. For this account, regardless of whether the entire or truncated OLT curve is measured, the SSD for the R1-70 curve I selected is lower. Specifically, the SSD for the Company's curve is 1.0130, and the SSD for the R1-70 curve I selected is only 0.3906, which means it results in the closer fit.[26]

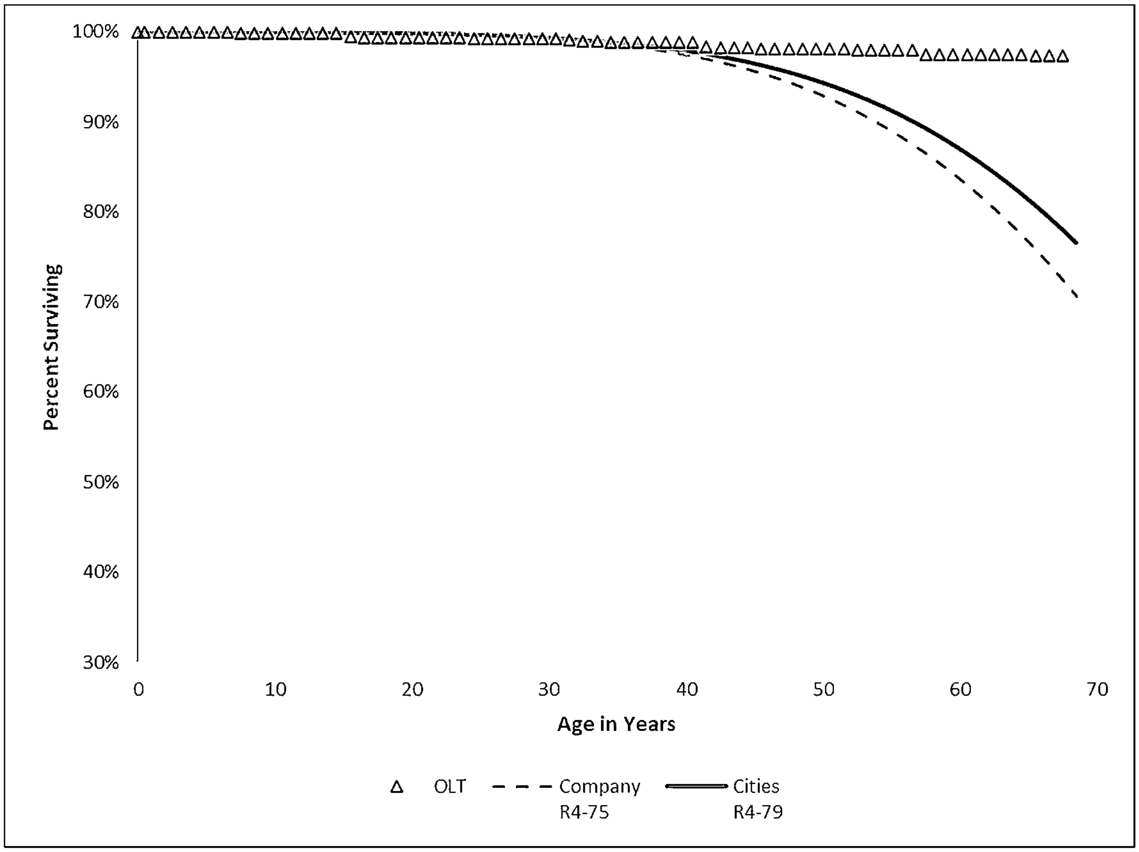
2. Account 354 – Towers and Fixtures

Q. Describe your service life estimate for this account and compare it with the Company's estimate.

A. For this account, Mr. Watson selected the R4-75 curve, and I selected the R4-79 curve. The graph below shows these two curves along with the OLT curve.

[26] Exhibit DJG-7.

Figure 4:
Account 354 – Towers and Fixtures



Unlike Account 353 discussed above, the OLT curve for Account 354 does not have an ideal amount of retirement history for Iowa curve analysis. Nonetheless, the data presented are relevant for analysis. Specifically, we know that nearly 100% of the assets reaching age 67 are still surviving in this account. Both of the selected Iowa curves essentially imply that the remaining life going forward for this account will be less than what the historical retirement pattern indicates. However, until more objective evidence is presented indicating an average service life of only 75 years, it is more reasonable to select a service life for this account that is closer to the one indicated by the historical data in my opinion.

Q. Did Mr. Watson present any convincing evidence outside of the statistical data to support a 75-year service life for this account?

A. No. According to the depreciation study, "Company subject matter experts are comfortable" with a 75-year life for this account.[27] Whether company employees are "comfortable" with a depreciation rate for a particular account is irrelevant. To rely on such subjective, unverified, and potentially biased opinions outside of the statistical data would defeat the purpose of objective depreciation analyses.

Q. Does your selected curve provide a better mathematical fit to the observed data than the Company's curve?

A. Yes. The SSD for the Company's curve is 0.4111, and the SSD for the R4-79 curve I selected is 0.2379, which means it results in the closer fit to the OLT curve.[28]

3. Account 355 – Poles and Fixtures

Q. Describe your service life estimate for this account and compare it with the Company's estimate.

A. For this account, Mr. Watson selected the R1.5-70 curve, and I selected the R1-77 curve. The graph below shows these two Iowa curves and the OLT curve.

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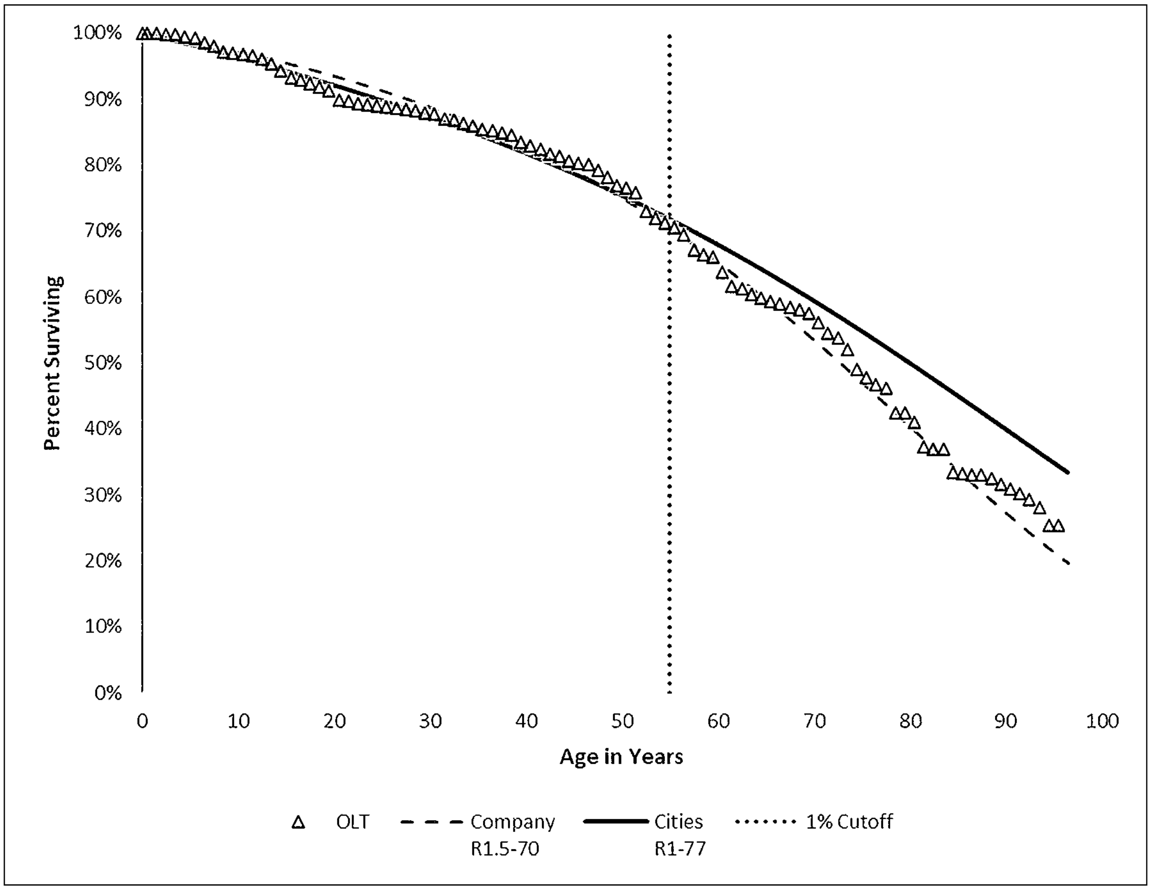
[27] Exhibit DAW-2, p. 39.

[28] Exhibit DJG-8.

Figure 5:
Account 355 – Poles and Fixtures



As shown in this graph, both Iowa curves provide relatively close fits through the most relevant portion of the OLT curve (i.e., before the 1% truncation line).

Q. Does your selected curve provide a better mathematical fit to the observed data than the Company's curve?

A. When measuring the selected Iowa curves with the entire OLT curve, the R1.5-70 curve provides the closer fit. However, when measuring the most relevant portion, or truncated portion of the OLT curve, the R1-77 curve I selected provides the closer fit. In my opinion, both Iowa curves are within a reasonable service life range for this account. However, the R1-77 curve provides a closer mathematical fit to the most relevant portion of the OLT curve. Furthermore, selecting the longer of the two Iowa curves can help mitigate the substantial impact to current ratepayers that the Company's proposed depreciation rates impose in this case. When measuring the truncated OLT curve, the SSD for the Company's Iowa curve is 0.0119, and the SSD for the R1-77 curve I selected is 0.0075, which means it is a closer fit to the observed data.[29]

4. Account 362 – Distribution Station Equipment

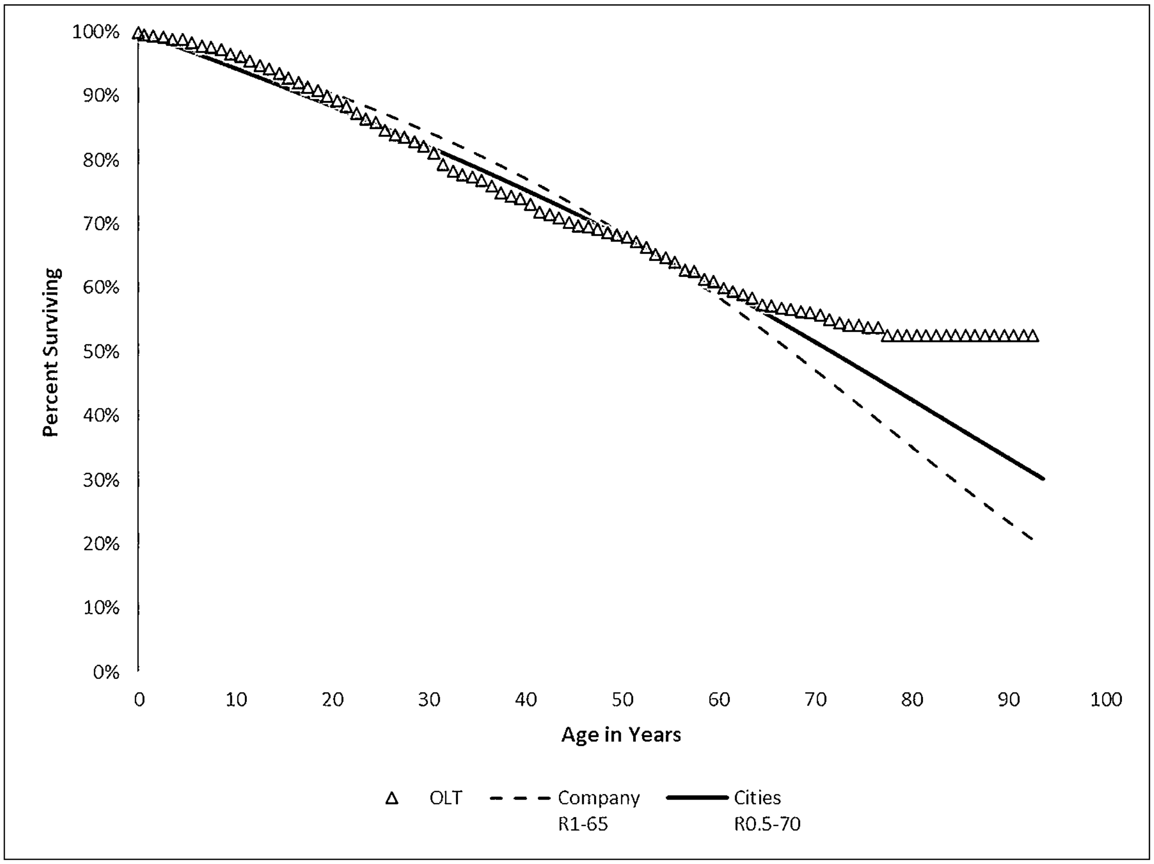
Q. Describe your service life estimate for this account and compare it with the Company's estimate.

A. For this account Mr. Watson selected the R1-65 curve, and I selected the R0.5-70 curve. Both curves are illustrated in the graph below along with the OLT curve.

[29] Exhibit DJG-9.

28

Figure 6:
Account 362 – Distribution Station Equipment



As shown in this graph, both Iowa curves provide relatively close fits to the OLT curve through the 60-year age interval. After that point, however, Mr. Watson's curve ignores relevant retirement data, even if the tail-end of the OLT curve is truncated based on the 1% exposure benchmark. Given the data presented, a lower-modal and longer-lived Iowa curve than the one selected by Mr. Watson is preferable at this time.

29

Q. Does your selected curve provide a better mathematical fit to the observed data than Company's curve for this account?

A. Yes. The SSD for the Company's curve is 1.0617, and the SSD for the R0.5-70 curve I selected is 0.4140, which means it results in the closer mathematical fit.[30]

5. Account 364 – Poles, Towers, and Fixtures

Q. Describe your service life estimate for this account and compare it with the Company's estimate.

A. For this account I selected the R1-47 curve, and Mr. Watson selected the R1-45 curve. The graph below shows these two Iowa curves along with the OLT curve.

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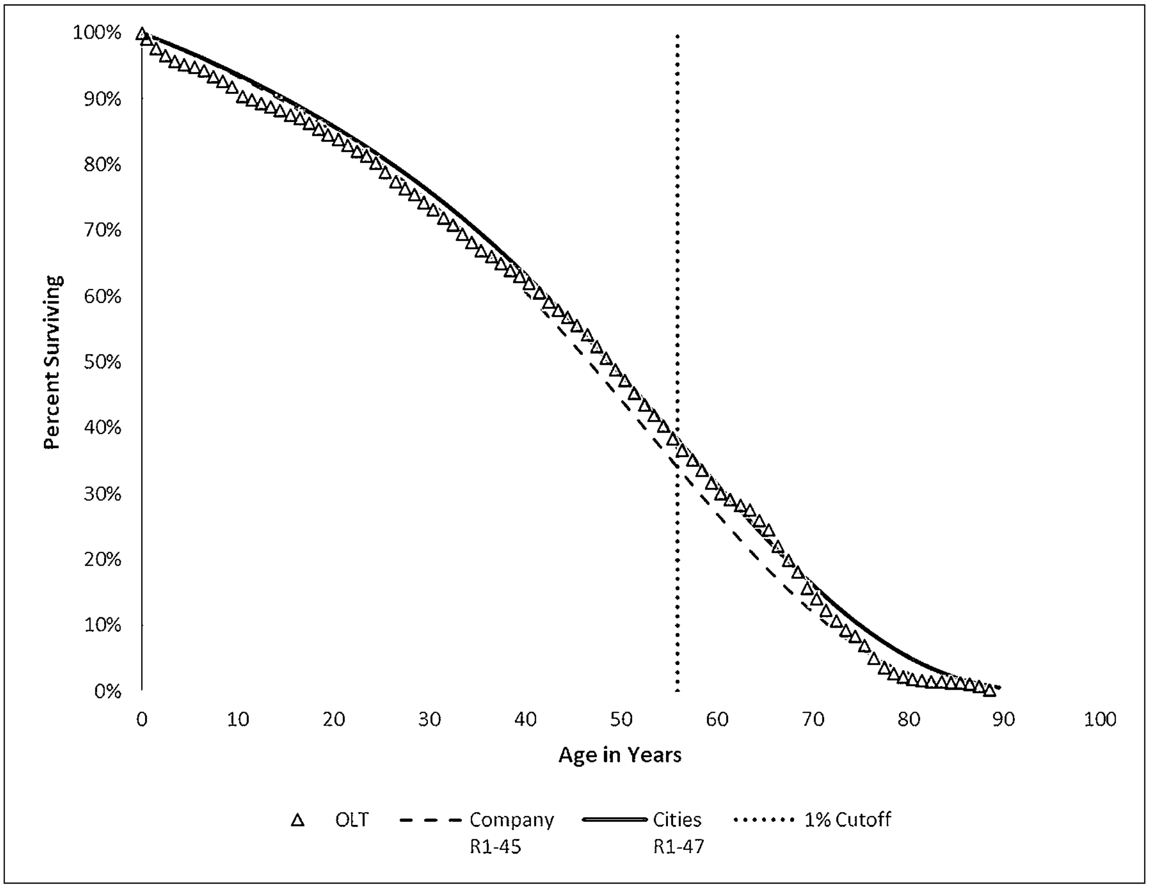
[30] Exhibit DJG-10.

30

Figure 7:
Account 364 – Poles, Towers, and Fixtures



As shown in this graph, both Iowa curves provide close fits to the OLT curve for this account. This OLT curve is very well suited for conventional Iowa curve fitting techniques in that it presents a very adequate amount of retirement history and displays a retirement pattern that is typically observed in utility property. Under these circumstances, it is even more appropriate to lean more heavily on the objective statistical analyses than on other subjective factors outside of the retirement data.

Q. Does your selected curve provide a better mathematical fit to the observed data than Company's curve?

A. Yes. Whether the entire or truncated OLT curve is measured, the Iowa curve I selected results in a closer mathematical fit. Specifically, the Company's curve has an SSD of 0.0554, and the SSD for the R1-47 curve I selected is 0.0292, which means it results in the closer fit.[31]

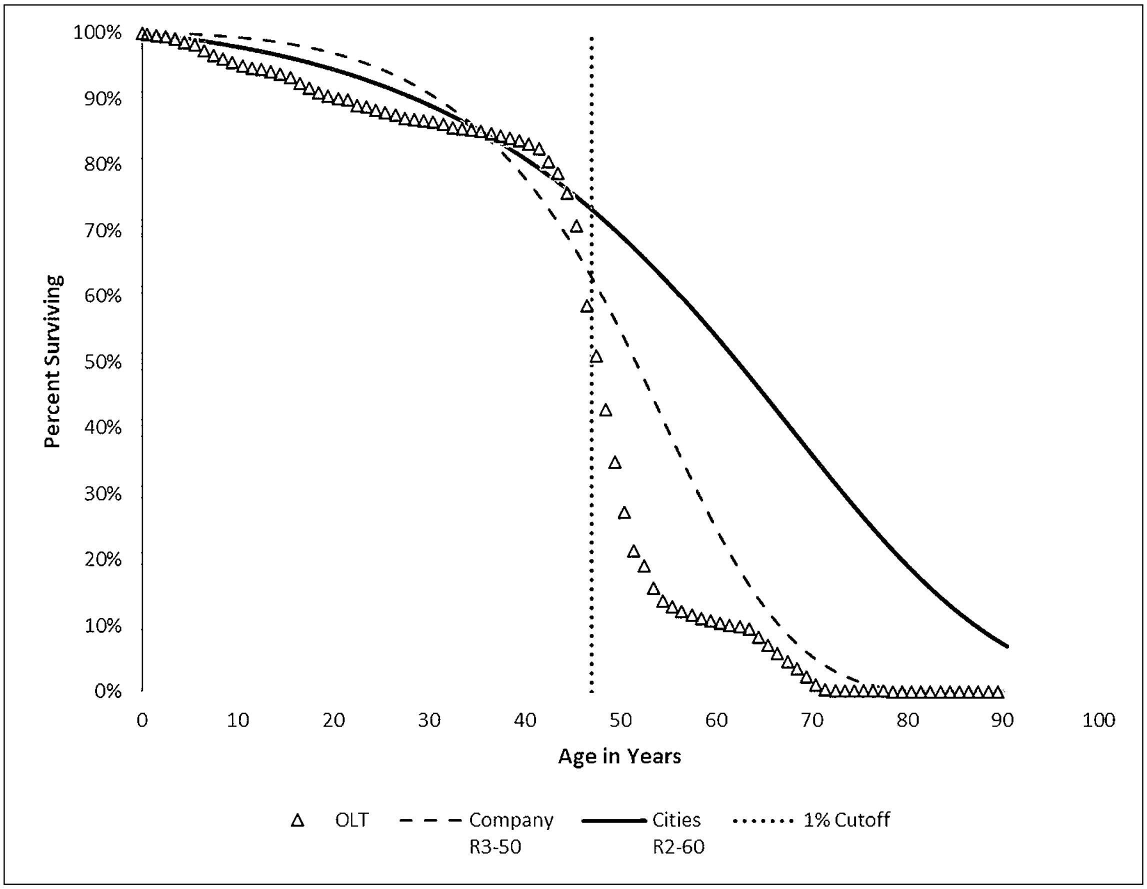
6. Account 366 – Underground Conduit

Q. Describe your service life estimate for this account and compare it with the Company's estimate.

A. The Iowa curve I selected for this account is the R2-60 curve, and Mr. Watson selected the R3-50 curve. The graph below shows these two Iowa curves along with the OLT curve.

[31] Exhibit DJG-11.

Figure 8:
Account 366 – Underground Conduit



Visually it is apparent that this OLT curve starts becoming erratic near the 45-year age interval. The vertical line shows the truncation point based on the 1% exposure benchmark discussed above. Mr. Watson's selected Iowa curve does not provide a good fit through the most statistically relevant portions of this OLT curve, and it also appears to give undue consideration to irrelevant data points in the truncated portion of the OLT curve. The relevant OLT curve indicates a lower mode and longer life than the Company's selected Iowa curve at this time.

Q. Does your selected Iowa curve provide a better mathematical fit to the truncated OLT curve than the than Company's Iowa curve for this account?

A. Yes. The SSD for the Company's curve is 0.1070, and the SSD for the R2-60 curve I selected is 0.0581, which means it results in the closer mathematical fit.[32]

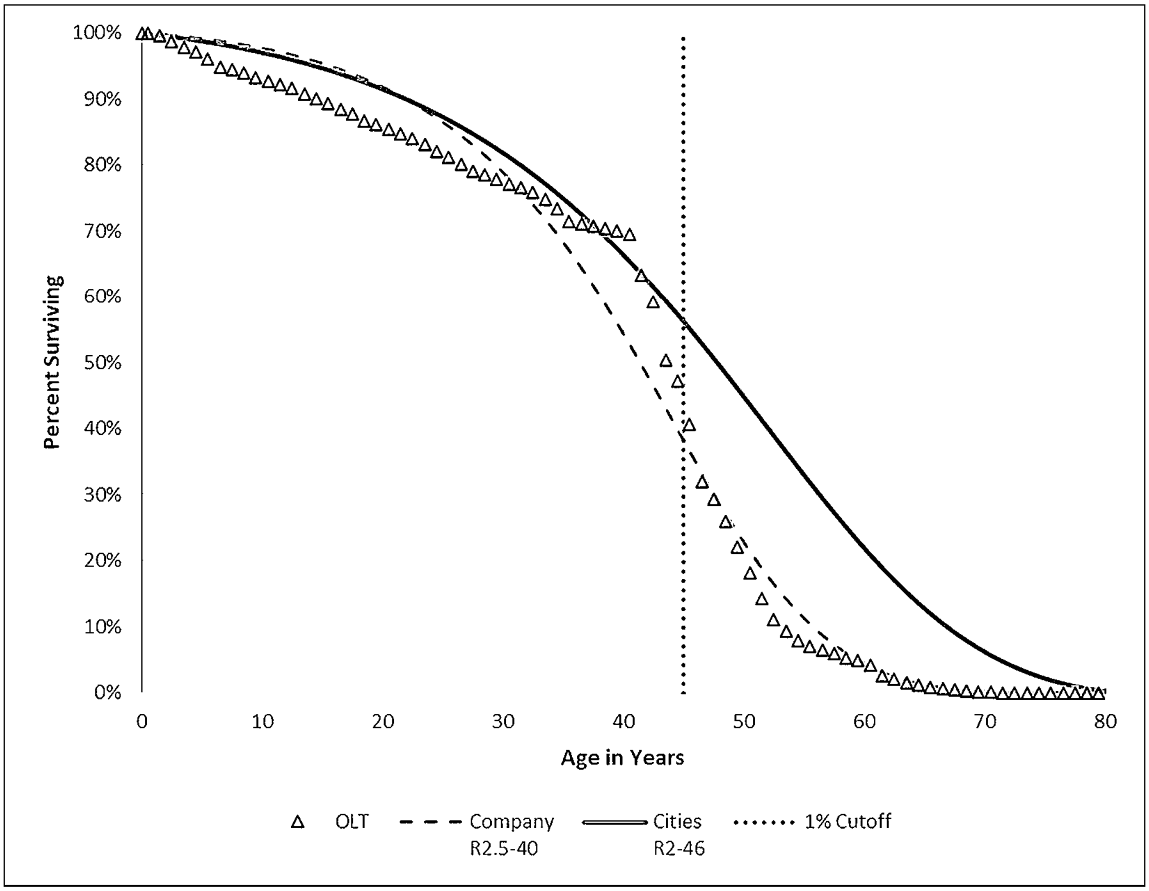
7. Account 367 – Underground Conductors and Devices

Q. Describe your service life estimate for this account and compare it with the Company's estimate.

A. Mr. Watson selected the R2.5-40 curve for this account, and I selected the R2-46 curve. Both of these Iowa curves are shown in the graph below along with the OLT curve.

[32] Exhibit DJG-12.

Figure 9:
Account 367 – Underground Conductors and Devices



As with Account 366 discussed above, Mr. Watson's curve does not provide an ideal fit through the most relevant portions of the OLT curve, and instead gives undue statistical weight to the most irrelevant, tail-end portion of the OLT curve.

Q. Does your selected Iowa curve provide a better mathematical fit to the truncated OLT curve than the than Company's Iowa curve for this account?

A. Yes. The SSD for the Company's curve is 0.1853, and the SSD for the R2-46 curve I selected is 0.0892, which means it results in the closer mathematical fit.[33]

[33] Exhibit DJG-13.

B. Net Salvage Analysis

Q. Describe the concept of net salvage.

A. If an asset has any value left when it is retired from service, a utility might decide to sell the asset. The proceeds from this transaction are called "gross salvage." The corresponding expense associated with the removal of the asset from service is called the "cost of removal." The term "net salvage" equates to gross salvage less the cost of removal. Often, the net salvage for utility assets is a negative number (or percentage) because the cost of removing the assets from service exceeds any proceeds received from selling the assets. When a negative net salvage rate is applied to an account to calculate the depreciation rate, it results in increasing the total depreciable base to be recovered over a particular period of time and increases the depreciation rate. Therefore, a greater negative net salvage rate equates to a higher depreciation rate and expense, all else held constant.

Q. Please describe the Company's proposal regarding its net salvage rates for mass property accounts.

A. The Company is proposing notable increases in negative net salvage for many of its mass property accounts. This has an increasing effect on depreciation rates and expense.

Q. Did the Company provide evidence to support its proposed increases in negative net salvage rates?

A. Yes. The Company did provide objective evidence generally supporting its proposed increase in negative net salvage for its mass property accounts. While I would agree that a general increase in negative net salvage is warranted at this time, I recommend taking a gradual approach with the proposed increase in this case, as discussed further below.

Q. Has there been a trend in increasing negative net salvage in the utility industry?

A. Yes. Negative net salvage rates occur when the cost of removal exceeds the gross salvage of an asset when it is removed from service. Net salvage rates are calculated by considering gross salvage and removal costs as a percent of the original cost of the assets retired. In other words, salvage and removal costs are based on current dollars, while retirements are based on historical dollars. Increasing labor costs associated with asset removal combined with the fact that original costs remain the same have contributed to increasing negative net salvage over time.

Q. Have other utility commissions expressed concern over increasing negative net salvage rates?

A. Yes. The Pacific Gas and Electric Company's ("PG&E") 2014 rate case, the California commission stated: "We remain concerned with the growing cost burden associated with increasing cost trends for negative net salvage."[34] The California commission also expressed an interest in the ratemaking concept of gradualism:

> In evaluating whether a proposed increase reflects gradualism, however, we believe the more appropriate measure is how the change affects customers' retail rates. The fact that PG&E previously proposed higher removal costs than adopted has no bearing on how a proposed change would impact current ratepayers. Accordingly, we apply the principle of gradualism based on how a proposed change in estimate compares to adopted costs reflected in current rates, irrespective of what PG&E may have forecasted in an earlier depreciation study.[35]

In PG&E's 2014 rate case, the Office of Ratepayer Advocates proposed a 25% cap on increased net salvage rates to mitigate sudden increases in net salvage and instead provide

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[34] Decision Authorizing Pacific Gas and Electric Company's General Rate Case Revenue Requirement for 2014-2016, D.14-08-032, p. 597

[35] *Id.* at 598.

for more gradual levels of increases.[36] The Commission ultimately found: "As a general approach, we adopt no more than 25% of PG&E's estimated increases in the accrual provision for removal costs. This limitation tempers the impacts on current ratepayers. . . ."[37]

Q. Please summarize your proposed net salvage adjustments.

A. The benchmark for net salvage gradualism discussed above is 25% of the utility's proposed increase (assuming the increase is supported by evidence). Given the Company's substantial proposed increase in depreciation expense, I would recommend the Commission adopt a similar approach in this case with regard to increasing negative net salvage rates. That is, I recommend that the Company's proposed increase to negative net salvage be limited to 25% of the proposed increase at this time. The follow table shows the current and proposed net salvage rates for these accounts at issue.[38]

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[36] *Id.* at 592-93.

[37] *Id.* at 602.

[38] *See also* Exhibit DJG-3.

Figure 10:
Net Salvage Adjustment Summary

Account No.	Description	Current NS	ETI Proposed	Cities Proposed
	Transmission Plant			
352.00	Structures & Improv.	-20%	-30%	-23%
354.00	Towers & Fixtures	-5%	-10%	-6%
355.00	Poles & Fixtures	-30%	-45%	-34%
356.00	OH Conductors & Devices	-30%	-45%	-34%
	Distribution Plant			
361.00	Structures & Improv.	-10%	-15%	-11%
362.00	Station Equipment	-20%	-25%	-21%
364.00	Poles, Towers & Fixtures	-30%	-45%	-34%
365.00	OH Conductors & Devices	-20%	-30%	-23%
366.00	UG Conduit	-10%	-15%	-11%
367.00	UG Conductors & Devices	-1%	-5%	-2%
368.00	Line Transformers	-20%	-30%	-23%
369.10	Services - Overhead	-15%	-25%	-18%
369.20	Services - Underground	-10%	-15%	-11%
371.00	I.O.C.P	-10%	-15%	-11%
373.00	Street Lighting & Signal Systems	-20%	-30%	-23%

As shown in this table, adopting my proposed net salvage rates would still have an increasing effect to the depreciation rates and expenses to each of these accounts compared to current levels, but would result in a more gradual increase than that proposed by the Company.

Q. Does this conclude your testimony?

A. Yes, including any exhibits, appendices, and other items attached hereto. I reserve the right to supplement this testimony as needed with any additional information that has been requested from the Company but not yet provided.

APPENDIX A:

THE DEPRECIATION SYSTEM

A depreciation accounting system may be thought of as a dynamic system in which estimates of life and salvage are inputs to the system, and the accumulated depreciation account is a measure of the state of the system at any given time.[39] The primary objective of the depreciation system is the timely recovery of capital. The process for calculating the annual accruals is determined by the factors required to define the system. A depreciation system should be defined by four primary factors: 1) a method of allocation; 2) a procedure for applying the method of allocation to a group of property; 3) a technique for applying the depreciation rate; and 4) a model for analyzing the characteristics of vintage groups comprising a continuous property group.[40] The figure below illustrates the basic concept of a depreciation system and includes some of the available parameters.[41]

There are hundreds of potential combinations of methods, procedures, techniques, and models, but in practice, analysts use only a few combinations. Ultimately, the system selected must result in the systematic and rational allocation of capital recovery for the utility. Each of the four primary factors defining the parameters of a depreciation system is discussed further below.

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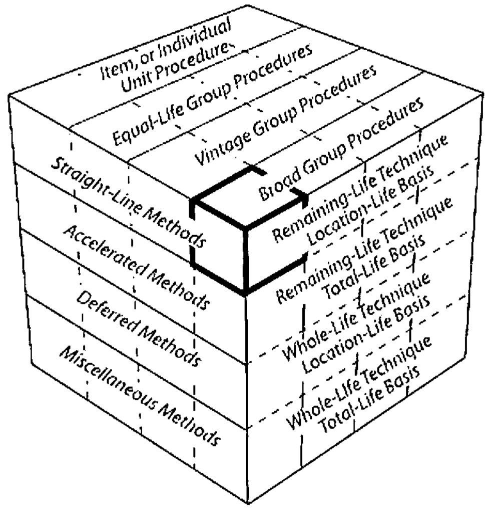
[39] Wolf *supra* n. 8, at 69-70.

[40] *Id.* at 70, 139-40.

[41] Edison Electric Institute, *Introduction to Depreciation* (inside cover) (EEI April 2013). Some definitions of the terms shown in this diagram are not consistent among depreciation practitioners and literature due to the fact that depreciation analysis is a relatively small and fragmented field. This diagram simply illustrates the some of the available parameters of a depreciation system.

Figure 11:
The Depreciation System Cube



1. Allocation Methods

The "method" refers to the pattern of depreciation in relation to the accounting periods. The method most commonly used in the regulatory context is the "straight-line method" – a type of age-life method in which the depreciable cost of plant is charged in equal amounts to each accounting period over the service life of plant.[42] Because group depreciation rates and plant balances often change, the amount of the annual accrual rarely remains the same, even when the straight-line method is employed.[43] The basic formula for the straight-line method is as follows:[44]

[42] NARUC *supra* n. 9, at 56.

[43] *Id.*

[44] *Id.*

Equation 1:
Straight-Line Accrual

$$Annual\ Accrual = \frac{Gross\ Plant - Net\ Salvage}{Service\ Life}$$

Gross plant is a known amount from the utility's records, while both net salvage and service life must be estimated in order to calculate the annual accrual. The straight-line method differs from accelerated methods of recovery, such as the "sum-of-the-years-digits" method and the "declining balance" method. Accelerated methods are primarily used for tax purposes and are rarely used in the regulatory context for determining annual accruals.[45] In practice, the annual accrual is expressed as a rate which is applied to the original cost of plant in order to determine the annual accrual in dollars. The formula for determining the straight-line rate is as follows:[46]

Equation 2:
Straight-Line Rate

$$Depreciation\ Rate\ \% = \frac{100 - Net\ Salvage\ \%}{Service\ Life}$$

2. <u>Grouping Procedures</u>

The "procedure" refers to the way the allocation method is applied through subdividing the total property into groups.[47] While single units may be analyzed for depreciation, a group plan of depreciation is particularly adaptable to utility property. Employing a grouping procedure allows for a composite application of depreciation rates to groups of similar property, rather than

[45] *Id*. at 57.

[46] *Id*. at 56.

[47] Wolf *supra* n. 8, at 74-75.

excessively conducting calculations for each unit. Whereas an individual unit of property has a single life, a group of property displays a dispersion of lives and the life characteristics of the group must be described statistically.[48] When analyzing mass property categories, it is important that each group contains homogenous units of plant that are used in the same general manner throughout the plant and operated under the same general conditions.[49]

The "average life" and "equal life" grouping procedures are the two most common. In the average life procedure, a constant annual accrual rate based on the average life of all property in the group is applied to the surviving property. While property having shorter lives than the group average will not be fully depreciated, and likewise, property having longer lives than the group average will be over-depreciated, the ultimate result is that the group will be fully depreciated by the time of the final retirement.[50] Thus, the average life procedure treats each unit as though its life is equal to the average life of the group. In contrast, the equal life procedure treats each unit in the group as though its life was known.[51] Under the equal life procedure the property is divided into subgroups that each has a common life.[52]

3. <u>Application Techniques</u>

The third factor of a depreciation system is the "technique" for applying the depreciation rate. There are two commonly used techniques: "whole life" and "remaining life." The whole life

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[48] *Id.* at 74.

[49] NARUC *supra* n. 9, at 61-62.

[50] *See* Wolf *supra* n. 8, at 74-75.

[51] *Id.* at 75.

[52] *Id.*

technique applies the depreciation rate on the estimated average service life of a group, while the remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.[53]

In choosing the application technique, consideration should be given to the proper level of the accumulated depreciation account. Depreciation accrual rates are calculated using estimates of service life and salvage. Periodically these estimates must be revised due to changing conditions, which cause the accumulated depreciation account to be higher or lower than necessary. Unless some corrective action is taken, the annual accruals will not equal the original cost of the plant at the time of final retirement.[54] Analysts can calculate the level of imbalance in the accumulated depreciation account by determining the "calculated accumulated depreciation," (a.k.a. "theoretical reserve" and referred to in these appendices as "CAD"). The CAD is the calculated balance that would be in the accumulated depreciation account at a point in time using current depreciation parameters.[55] An imbalance exists when the actual accumulated depreciation account does not equal the CAD. The choice of application technique will affect how the imbalance is dealt with.

Use of the whole life technique requires that an adjustment be made to accumulated depreciation after calculation of the CAD. The adjustment can be made in a lump sum or over a period of time. With use of the remaining life technique, however, adjustments to accumulated depreciation are amortized over the remaining life of the property and are automatically included

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[53] NARUC *supra* n. 9, at 63-64.

[54] Wolf *supra* n. 8, at 83.

[55] NARUC *supra* n. 9, at 325.

in the annual accrual.[56] This is one reason that the remaining life technique is popular among practitioners and regulators. The basic formula for the remaining life technique is as follows:[57]

Equation 3:
Remaining Life Accrual

$$Annual\ Accrual = \frac{Gross\ Plant - Accumulated\ Depreciation - Net\ Salvage}{Average\ Remaining\ Life}$$

The remaining life accrual formula is similar to the basic straight-line accrual formula above with two notable exceptions. First, the numerator has an additional factor in the remaining life formula: the accumulated depreciation. Second, the denominator is "average remaining life" instead of "average life." Essentially, the future accrual of plant (gross plant less accumulated depreciation) is allocated over the remaining life of plant. Thus, the adjustment to accumulated depreciation is "automatic" in the sense that it is built into the remaining life calculation.[58]

4. Analysis Model

The fourth parameter of a depreciation system, the "model," relates to the way of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group for depreciation purposes.[59] A continuous property group is created when vintage groups are combined to form a common group. Over time, the characteristics of the property may change, but the continuous property group will continue. The two analysis models

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[56] NARUC *supra* n. 9, at 65 ("The desirability of using the remaining life technique is that any necessary adjustments of [accumulated depreciation] . . . are accrued automatically over the remaining life of the property. Once commenced, adjustments to the depreciation reserve, outside of those inherent in the remaining life rate would require regulatory approval.").

[57] *Id.* at 64.

[58] Wolf *supra* n. 8, at 178.

[59] *See* Wolf *supra* n. 8, at 139 (I added the term "model" to distinguish this fourth depreciation system parameter from the other three parameters).

used among practitioners, the "broad group" and the "vintage group," are two ways of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group.

The broad group model views the continuous property group as a collection of vintage groups that each has the same life and salvage characteristics. Thus, a single survivor curve and a single salvage schedule are chosen to describe all the vintages in the continuous property group. In contrast, the vintage group model views the continuous property group as a collection of vintage groups that may have different life and salvage characteristics. Typically, there is not a significant difference between vintage group and broad group results unless vintages within the applicable property group experienced dramatically different retirement levels than anticipated in the overall estimated life for the group. For this reason, many analysts utilize the broad group procedure because it is more efficient.

APPENDIX B:

IOWA CURVES

Early work in the analysis of the service life of industrial property was based on models that described the life characteristics of human populations.[60] This explains why the word "mortality" is often used in the context of depreciation analysis. In fact, a group of property installed during the same accounting period is analogous to a group of humans born during the same calendar year. Each period the group will incur a certain fraction of deaths / retirements until there are no survivors. Describing this pattern of mortality is part of actuarial analysis and is regularly used by insurance companies to determine life insurance premiums. The pattern of mortality may be described by several mathematical functions, particularly the survivor curve and frequency curve. Each curve may be derived from the other so that if one curve is known, the other may be obtained. A survivor curve is a graph of the percent of units remaining in service expressed as a function of age.[61] A frequency curve is a graph of the frequency of retirements as a function of age. Several types of survivor and frequency curves are illustrated in the figures below.

1. Development

The survivor curves used by analysts today were developed over several decades from extensive analysis of utility and industrial property. In 1931 Edwin Kurtz and Robley Winfrey used extensive data from a range of 65 industrial property groups to create survivor curves representing the life characteristics of each group of property.[62] They generalized the 65 curves

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[60] Wolf *supra* n. 8, at 276.

[61] *Id.* at 23.

[62] *Id.* at 34.

into 13 survivor curve types and published their results in *Bulletin 103: Life Characteristics of Physical Property*. The 13 type curves were designed to be used as valuable aids in forecasting probable future service lives of industrial property. Over the next few years, Winfrey continued gathering additional data, particularly from public utility property, and expanded the examined property groups from 65 to 176.[63] This resulted in 5 additional survivor curve types for a total of 18 curves. In 1935, Winfrey published *Bulletin 125: Statistical Analysis of Industrial Property Retirements*. According to Winfrey, "[t]he 18 type curves are expected to represent quite well all survivor curves commonly encountered in utility and industrial practices."[64] These curves are known as the "Iowa curves" and are used extensively in depreciation analysis in order to obtain the average service lives of property groups. (Use of Iowa curves in actuarial analysis is further discussed in Appendix C.)

In 1942, Winfrey published *Bulletin 155: Depreciation of Group Properties*. In Bulletin 155, Winfrey made some slight revisions to a few of the 18 curve types, and published the equations, tables of the percent surviving, and probable life of each curve at five-percent intervals.[65] Rather than using the original formulas, analysts typically rely on the published tables containing the percentages surviving. This is because absent knowledge of the integration technique applied to each age interval, it is not possible to recreate the exact original published table values. In the 1970s, John Russo collected data from over 2,000 property accounts reflecting

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[63] *Id.*

[64] Robley Winfrey, *Bulletin 125: Statistical Analyses of Industrial Property Retirements* 85, Vol. XXXIV, No. 23 (Iowa State College of Agriculture and Mechanic Arts 1935).

[65] Robley Winfrey, Bulletin 155: Depreciation of Group Properties 121-28, Vol XLI, No. 1 (The Iowa State College Bulletin 1942); see also Wolf supra n. 8, at 305-38 (publishing the percent surviving for each Iowa curve, including "O" type curve, at one percent intervals).

observations during the period 1965 – 1975 as part of his Ph.D. dissertation at Iowa State. Russo essentially repeated Winfrey's data collection, testing, and analysis methods used to develop the original Iowa curves, except that Russo studied industrial property in service several decades after Winfrey published the original Iowa curves. Russo drew three major conclusions from his research:[66]

1. No evidence was found to conclude that the Iowa curve set, as it stands, is not a valid system of standard curves;
2. No evidence was found to conclude that new curve shapes could be produced at this time that would add to the validity of the Iowa curve set; and
3. No evidence was found to suggest that the number of curves within the Iowa curve set should be reduced.

Prior to Russo's study, some had criticized the Iowa curves as being potentially obsolete because their development was rooted in the study of industrial property in existence during the early 1900s. Russo's research, however, negated this criticism by confirming that the Iowa curves represent a sufficiently wide range of life patterns, and that though technology will change over time, the underlying patterns of retirements remain constant and can be adequately described by the Iowa curves.[67]

Over the years, several more curve types have been added to Winfrey's 18 Iowa curves. In 1967, Harold Cowles added four origin-modal curves. In addition, a square curve is sometimes used to depict retirements which are all planned to occur at a given age. Finally, analysts

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[66] *See* Wolf *supra* n. 8, at 37.

[67] *Id.*

commonly rely on several "half curves" derived from the original Iowa curves. Thus, the term "Iowa curves" could be said to describe up to 31 standardized survivor curves.

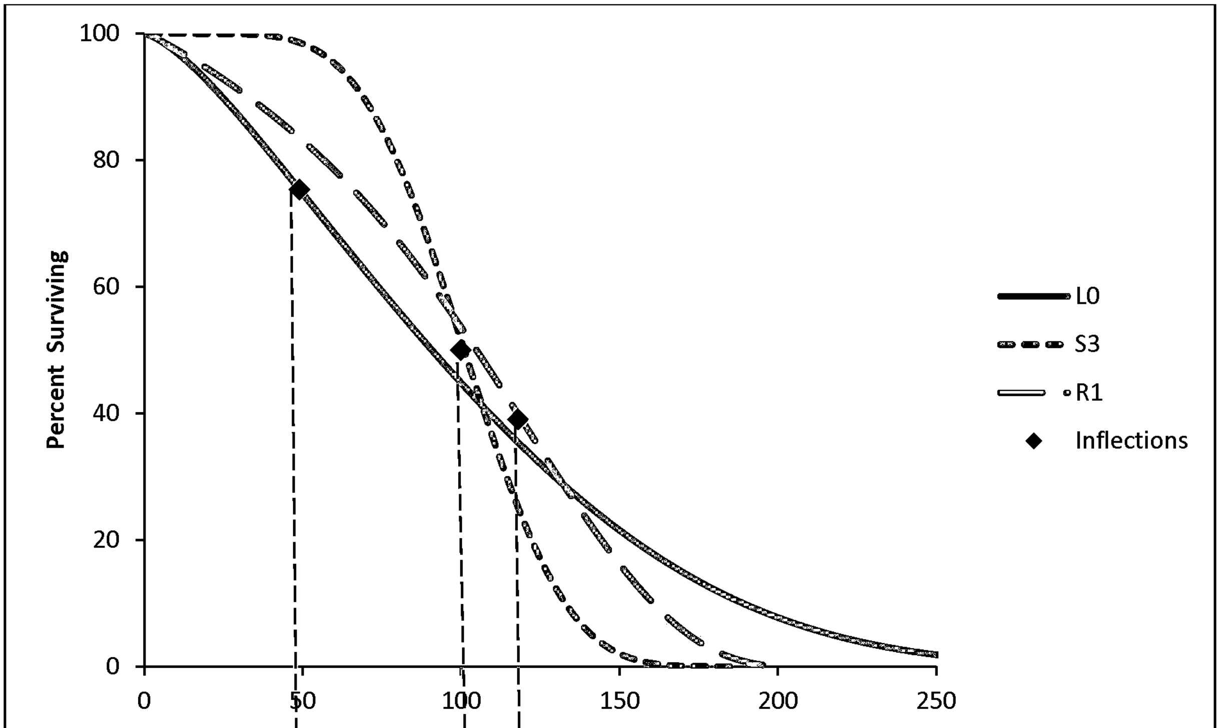
2. Classification

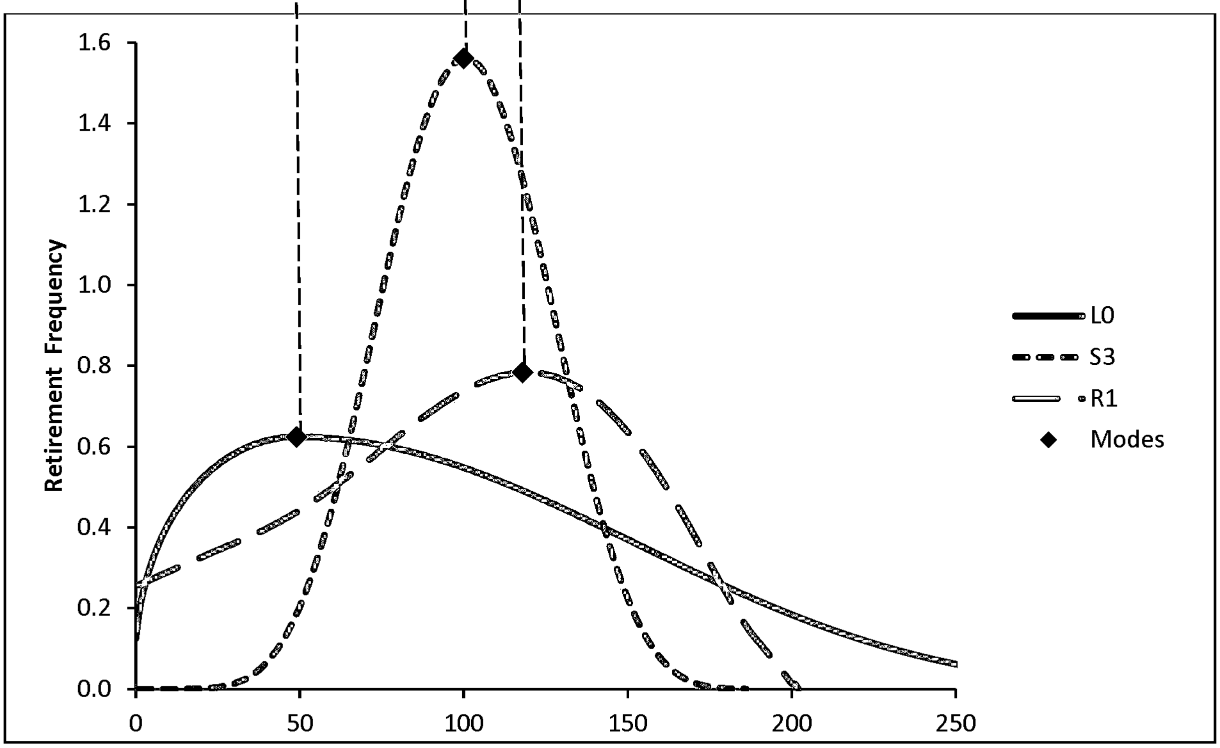
The Iowa curves are classified by three variables: modal location, average life, and variation of life. First, the mode is the percent life that results in the highest point of the frequency curve and the "inflection point" on the survivor curve. The modal age is the age at which the greatest rate of retirement occurs. As illustrated in the figure below, the modes appear at the steepest point of each survivor curve in the top graph, as well as the highest point of each corresponding frequency curve in the bottom graph.

The classification of the survivor curves was made according to whether the mode of the retirement frequency curves was to the left, to the right, or coincident with average service life. There are three modal "families" of curves: six left modal curves (L0, L1, L2, L3, L4, L5); five right modal curves (R1, R2, R3, R4, R5); and seven symmetrical curves (S0, S1, S2, S3, S4, S5, S6).[68] In the figure below, one curve from each family is shown: L0, S3 and R1, with average life at 100 on the x-axis. It is clear from the graphs that the modes for the L0 and R1 curves appear to the left and right of average life respectively, while the S3 mode is coincident with average life.

[68] In 1967, Harold A. Cowles added four origin-modal curves known as "O type" curves. There are also several "half" curves and a square curve, so the total amount of survivor curves commonly called "Iowa" curves is about 31 (see NARUC supra n. 9, at 68).

Figure 12:
Modal Age Illustration





The second Iowa curve classification variable is average life. The Iowa curves were designed using a single parameter of age expressed as a percent of average life instead of actual age. This was necessary in order for the curves to be of practical value. As Winfrey notes:

> Since the location of a particular survivor on a graph is affected by both its span in years and the shape of the curve, it is difficult to classify a group of curves unless one of these variables can be controlled. This is easily done by expressing the age in percent of average life."[69]

Because age is expressed in terms of percent of average life, any particular Iowa curve type can be modified to forecast property groups with various average lives.

The third variable, variation of life, is represented by the numbers next to each letter. A lower number (e.g., L1) indicates a relatively low mode, large variation, and large maximum life; a higher number (e.g., L5) indicates a relatively high mode, small variation, and small maximum life. All three classification variables – modal location, average life, and variation of life – are used to describe each Iowa curve. For example, a 13-L1 Iowa curve describes a group of property with a 13-year average life, with the greatest number of retirements occurring before (or to the left of) the average life, and a relatively low mode. The graphs below show these 18 survivor curves, organized by modal family.

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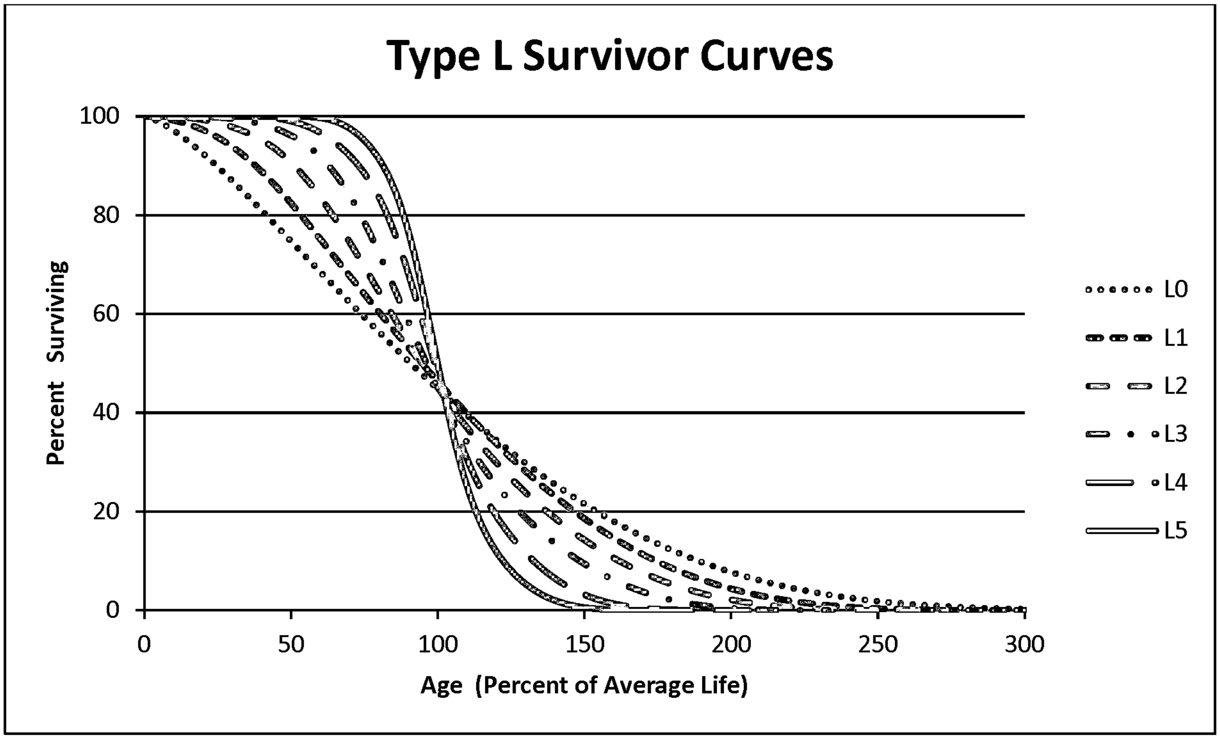
[69] Winfrey *supra* n. 166, at 60.

Figure 13:
Type L Survivor and Frequency Curves



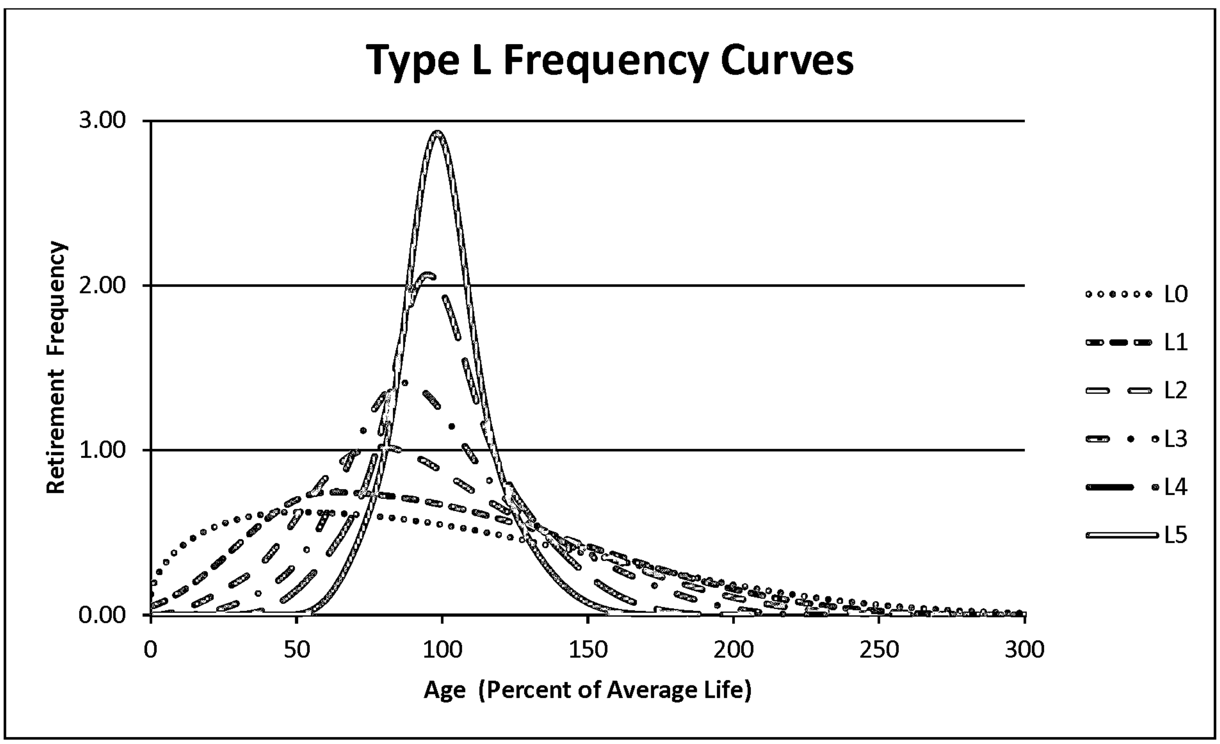
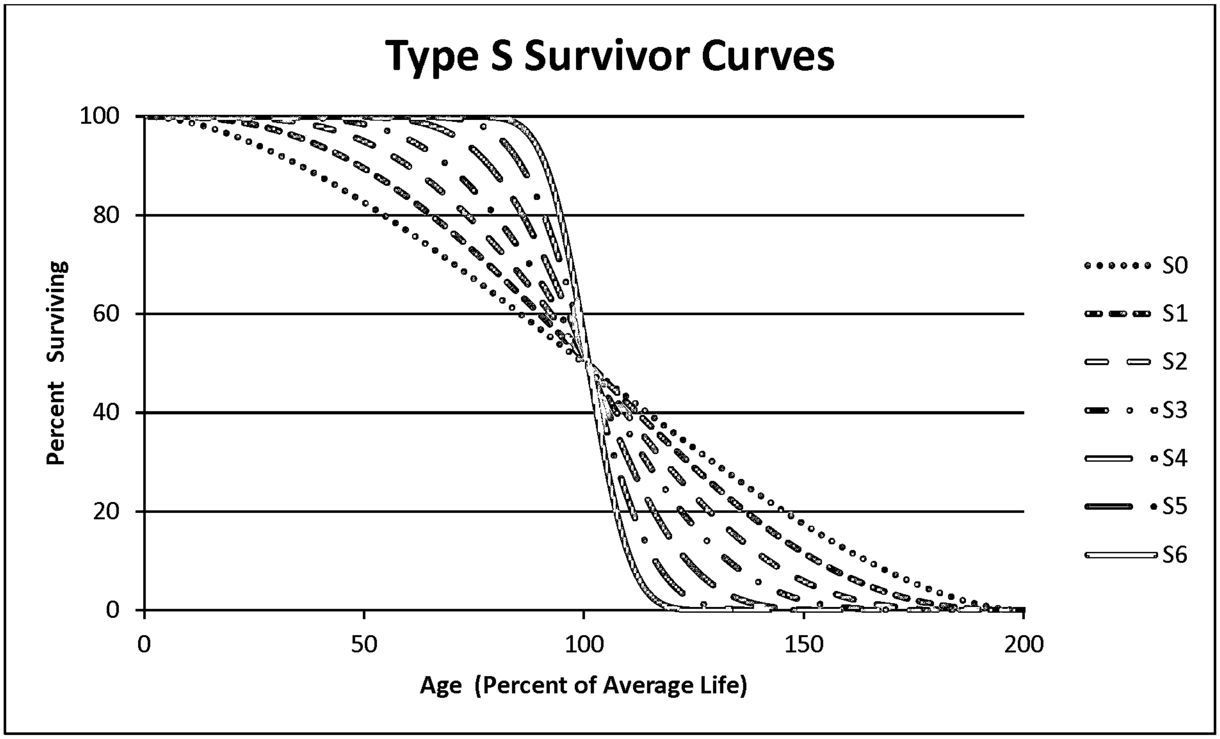


Figure 14:
Type S Survivor and Frequency Curves



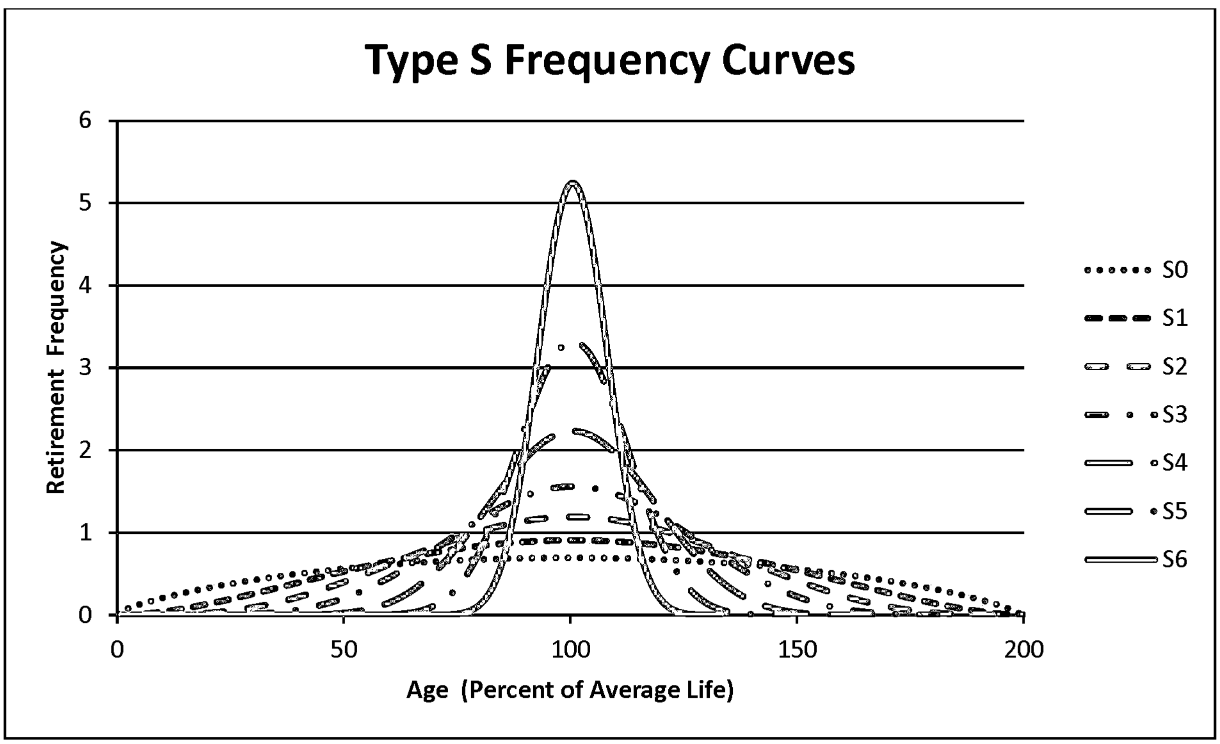
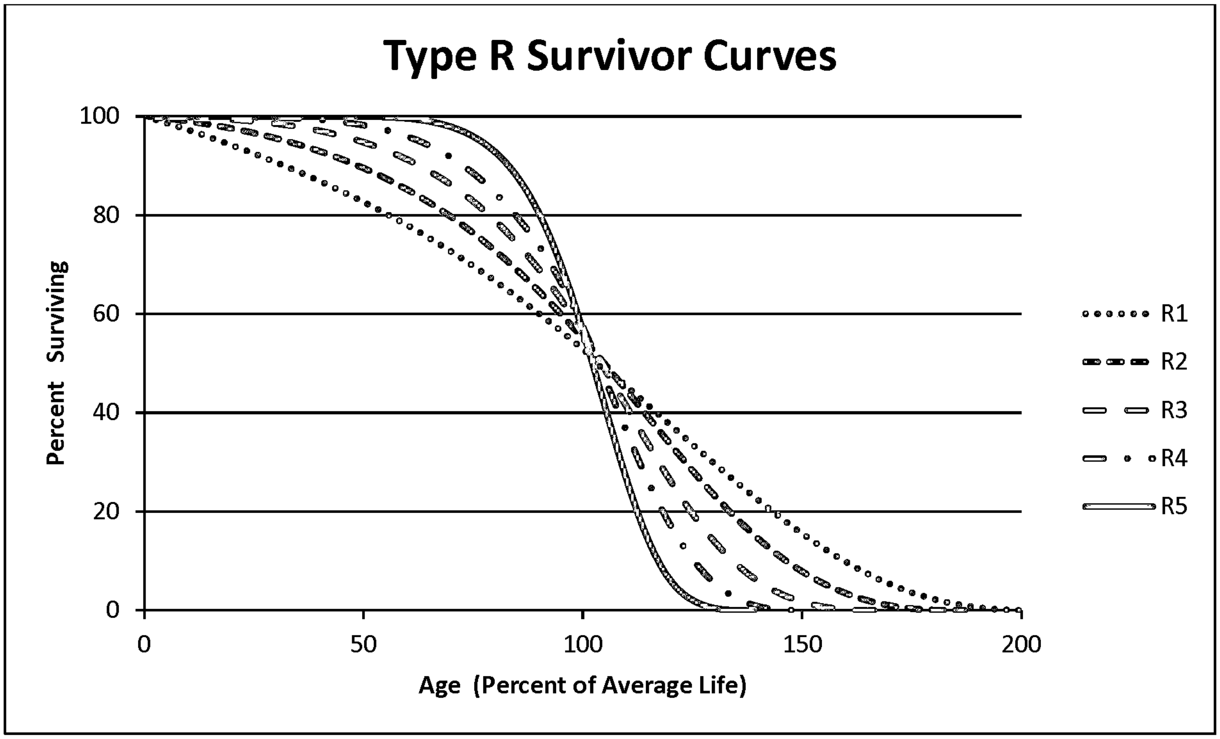
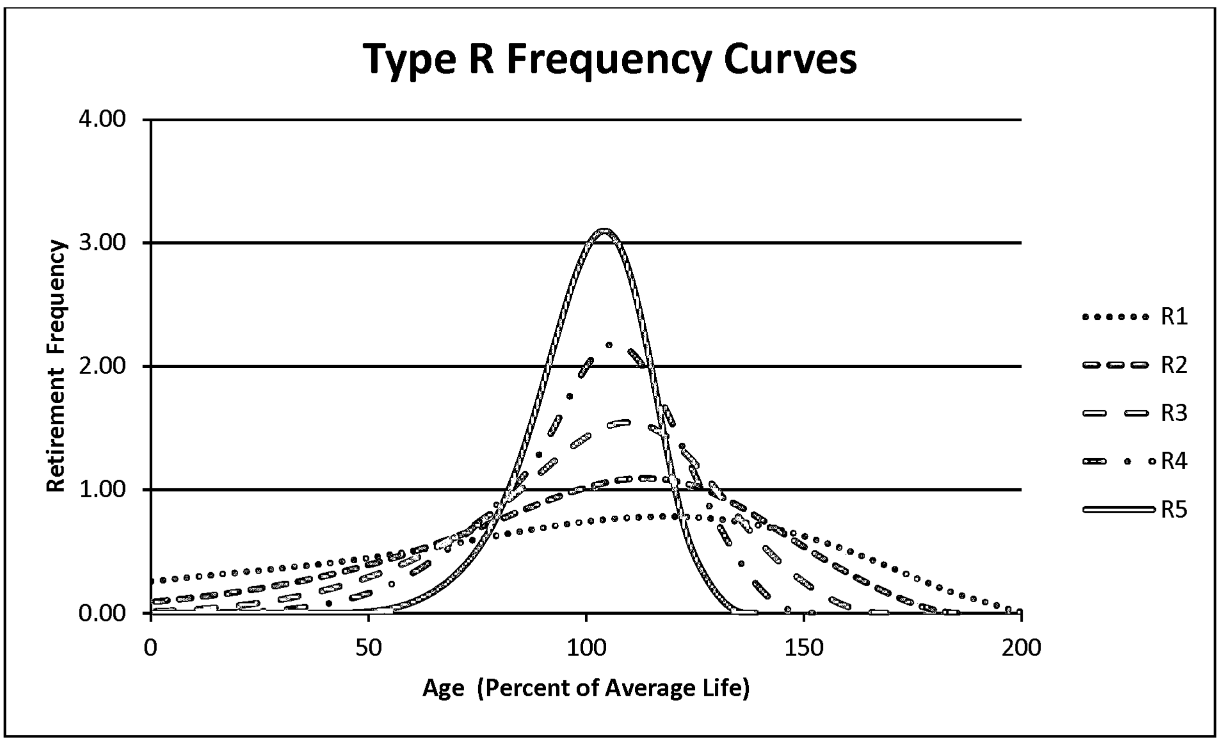


Figure 15:
Type R Survivor and Frequency Curves





As shown in the graphs above, the modes for the L family frequency curves occur to the left of average life (100% on the x-axis), while the S family modes occur at the average, and the R family modes occur after the average.

3. <u>Types of Lives</u>

Several other important statistical analyses and types of lives may be derived from an Iowa curve. These include: 1) average life; 2) realized life; 3) remaining life; and 4) probable life. The figure below illustrates these concepts. It shows the frequency curve, survivor curve, and probable life curve. Age M_x on the x-axis represents the modal age, while age AL_x represents the average age. Thus, this figure illustrates an "L type" Iowa curve since the mode occurs before the average.[70]

First, average life is the area under the survivor curve from age zero to maximum life. Because the survivor curve is measured in percent, the area under the curve must be divided by 100% to convert it from percent-years to years. The formula for average life is as follows:[71]

Equation 4:
Average Life

$$Average\ Life\ = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ 0\ to\ Max\ Life}{100\%}$$

Thus, average life may not be determined without a complete survivor curve. Many property groups being analyzed will not have experienced full retirement. This results in a "stub" survivor

[70] From age zero to age M_x on the survivor curve, it could be said that the percent surviving from this property group is decreasing at an increasing rate. Conversely, from point M_x to maximum on the survivor curve, the percent surviving is decreasing at a decreasing rate.

[71] *See* NARUC *supra* n. 9, at 71.

curve. Iowa curves are used to extend stub curves to maximum life in order for the average life calculation to be made (see Appendix C).

Realized life is similar to average life, except that realized life is the average years of service experienced to date from the vintage's original installations.[72] As shown in the figure below, realized life is the area under the survivor curve from zero to age RL_X. Likewise, unrealized life is the area under the survivor curve from age RL_X to maximum life. Thus, it could be said that average life equals realized life plus unrealized life.

Average remaining life represents the future years of service expected from the surviving property.[73] Remaining life is sometimes referred to as "average remaining life" and "life expectancy." To calculate average remaining life at age x, the area under the estimated future portion of the survivor curve is divided by the percent surviving at age x (denoted S_X). Thus, the average remaining life formula is:

Equation 5:
Average Remaining Life

$$Average\ Remaining\ Life = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ x\ to\ Max\ Life}{S_X}$$

It is necessary to determine average remaining life in order to calculate the annual accrual under the remaining life technique.

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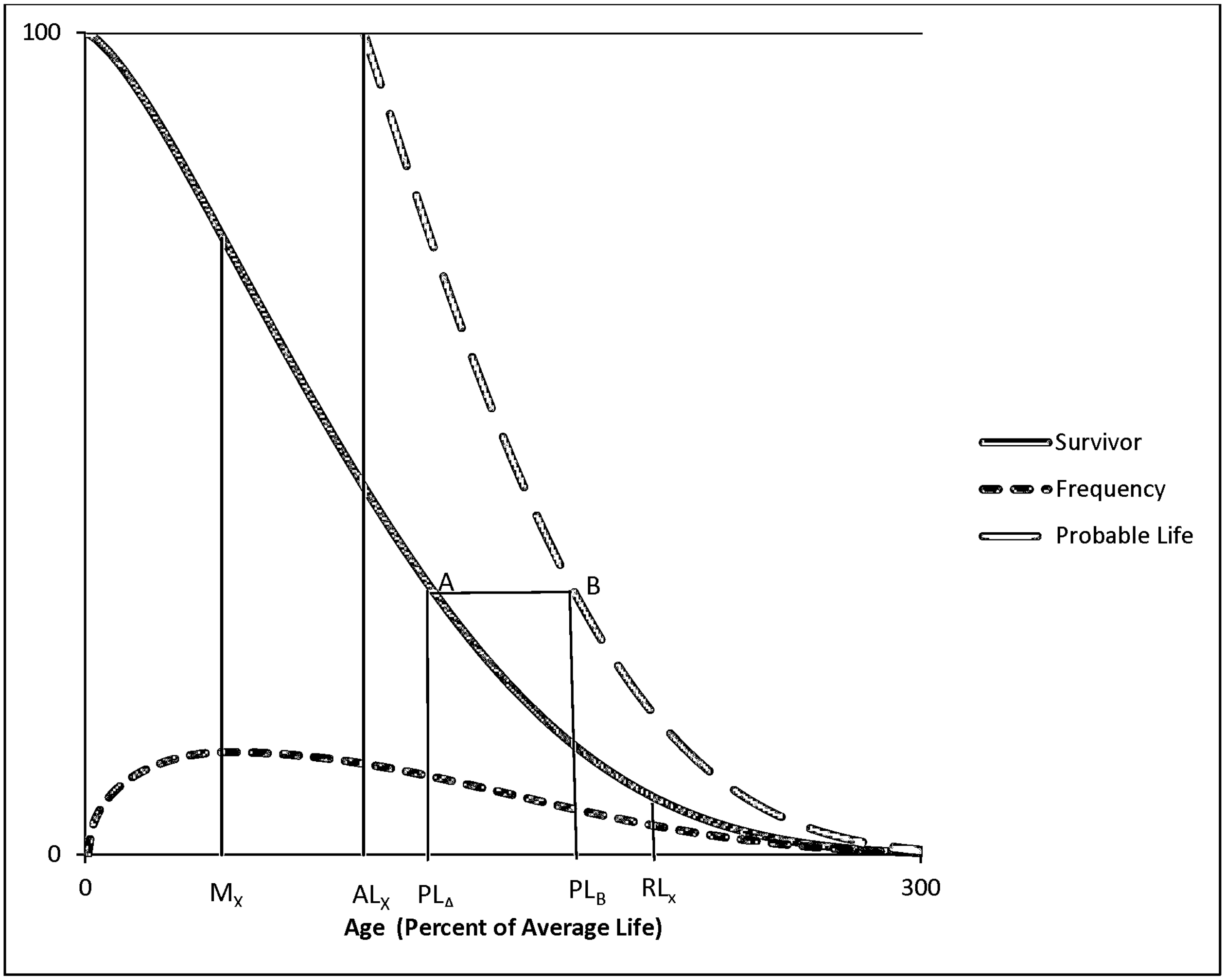
[72] *Id.* at 73.

[73] *Id.* at 74.

Figure 16:
Iowa Curve Derivations



Finally, the probable life may also be determined from the Iowa curve. The probable life of a property group is the total life expectancy of the property surviving at any age and is equal to the remaining life plus the current age.[74] The probable life is also illustrated in this figure. The probable life at age PL_A is the age at point PL_B. Thus, to read the probable life at age PL_A, see the corresponding point on the survivor curve above at point "A," then horizontally to point "B" on

[74] Wolf *supra* n. 8, at 28.

58

the probable life curve, and back down to the age corresponding to point “B.” It is no coincidence that the vertical line from AL_X connects at the top of the probable life curve. This is because at age zero, probable life equals average life.

APPENDIX C:

ACTUARIAL ANALYSIS

Actuarial science is a discipline that applies various statistical methods to assess risk probabilities and other related functions. Actuaries often study human mortality. The results from historical mortality data are used to predict how long similar groups of people who are alive will live today. Insurance companies rely on actuarial analysis in determining premiums for life insurance policies.

The study of human mortality is analogous to estimating service lives of industrial property groups. While some humans die solely from chance, most deaths are related to age; that is, death rates generally increase as age increases. Similarly, physical plant is also subject to forces of retirement. These forces include physical, functional, and contingent factors, as shown in the table below.[75]

Figure 17:
Forces of Retirement

Physical Factors	Functional Factors	Contingent Factors
Wear and tear Decay or deterioration Action of the elements	Inadequacy Obsolescence Changes in technology Regulations Managerial discretion	Casualties or disasters Extraordinary obsolescence

While actuaries study historical mortality data in order to predict how long a group of people will live, depreciation analysts must look at a utility's historical data in order to estimate the average lives of property groups. A utility's historical data is often contained in the Continuing Property Records ("CPR"). Generally, a CPR should contain 1) an inventory of property record

[75] NARUC *supra* n. 9, at 14-15.

units; 2) the association of costs with such units; and 3) the dates of installation and removal of plant. Since actuarial analysis includes the examination of historical data to forecast future retirements, the historical data used in the analysis should not contain events that are anomalous or unlikely to recur.[76] Historical data is used in the retirement rate actuarial method, which is discussed further below.

The Retirement Rate Method

There are several systematic actuarial methods that use historical data in order to calculate observed survivor curves for property groups. Of these methods, the retirement rate method is superior, and is widely employed by depreciation analysts.[77] The retirement rate method is ultimately used to develop an observed survivor curve, which can be fitted with an Iowa curve discussed in Appendix B in order to forecast average life. The observed survivor curve is calculated by using an observed life table ("OLT"). The figures below illustrate how the OLT is developed. First, historical property data are organized in a matrix format, with placement years on the left forming rows, and experience years on the top forming columns. The placement year (a.k.a. "vintage year" or "installation year") is the year of placement of a group of property. The experience year (a.k.a. "activity year") refers to the accounting data for a particular calendar year. The two matrices below use aged data – that is, data for which the dates of placements, retirements, transfers, and other transactions are known. Without aged data, the retirement rate actuarial method may not be employed. The first matrix is the exposure matrix, which shows the exposures

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[76] *Id*. at 112-13.

[77] Anson Marston, Robley Winfrey & Jean C. Hempstead, *Engineering Valuation and Depreciation* 154 (2nd ed., McGraw-Hill Book Company, Inc. 1953).

at the beginning of each year.[78] An exposure is simply the depreciable property subject to retirement during a period. The second matrix is the retirement matrix, which shows the annual retirements during each year. Each matrix covers placement years 2003–2015, and experience years 2008-2015. In the exposure matrix, the number in the 2009 experience column and the 2003 placement row is $192,000. This means at the beginning of 2012, there was $192,000 still exposed to retirement from the vintage group placed in 2003. Likewise, in the retirement matrix, $19,000 of the dollars invested in 2003 was retired during 2012.

Figure 18:
Exposure Matrix

	Experience Years Exposures at January 1 of Each Year (Dollars in 000's)									
Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
2003	261	245	228	211	**192**	173	152	131	131	11.5 - 12.5
2004	267	252	236	220	202	**184**	165	145	297	10.5 - 11.5
2005	304	291	277	263	248	232	**216**	198	536	9.5 - 10.5
2006	345	334	322	310	298	284	270	**255**	**847**	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	1,201	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,581	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,986	5.5 - 6.5
2010			381	369	358	347	336	327	2,404	4.5 - 5.5
2011				386	372	359	346	334	2,559	3.5 - 4.5
2012					395	380	366	352	2,722	2.5 - 3.5
2013						401	385	370	2,866	1.5 - 2.5
2014							410	393	2,998	0.5 - 1.5
2015								416	3,141	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	23,268	

[78] Technically, the last numbers in each column are "gross additions" rather than exposures. Gross additions do not include adjustments and transfers applicable to plant placed in a previous year. Once retirements, adjustments, and transfers are factored in, the balance at the beginning of the next account period is called an "exposure" rather than an addition.

Figure 19:
Retirement Matrix

	Experience Years									
	Retirments During the Year (Dollars in 000's)									
Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total During Age Interval	Age Interval
2003	16	17	18	19	**19**	20	21	23	23	11.5 - 12.5
2004	15	16	17	17	18	**19**	20	21	43	10.5 - 11.5
2005	13	14	14	15	16	17	**17**	18	59	9.5 - 10.5
2006	11	12	12	13	13	14	15	**15**	**71**	8.5 - 9.5
2007	10	11	11	12	12	13	13	14	82	7.5 - 8.5
2008	9	9	10	10	11	11	12	13	91	6.5 - 7.5
2009		11	10	10	9	9	9	8	95	5.5 - 6.5
2010			12	11	11	10	10	9	100	4.5 - 5.5
2011				14	13	13	12	11	93	3.5 - 4.5
2012					15	14	14	13	91	2.5 - 3.5
2013						16	15	14	93	1.5 - 2.5
2014							17	16	100	0.5 - 1.5
2015								18	112	0.0 - 0.5
Total	74	89	104	121	139	157	175	194	1,052	

These matrices help visualize how exposure and retirement data are calculated for each age interval. An age interval is typically one year. A common convention is to assume that any unit installed during the year is installed in the middle of the calendar year (i.e., July 1st). This convention is called the "half-year convention" and effectively assumes that all units are installed uniformly during the year.[79] Adoption of the half-year convention leads to age intervals of 0-0.5 years, 0.5-1.5 years, etc., as shown in the matrices.

The purpose of the matrices is to calculate the totals for each age interval, which are shown in the second column from the right in each matrix. This column is calculated by adding each number from the corresponding age interval in the matrix. For example, in the exposure matrix, the total amount of exposures at the beginning of the 8.5-9.5 age interval is $847,000. This number was calculated by adding the numbers shown on the "stairs" to the left (192+184+216+255=847).

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[79] Wolf *supra* n. 8, at 22.

The same calculation is applied to each number in the column. The amounts retired during the year in the retirements matrix affect the exposures at the beginning of each year in the exposures matrix. For example, the amount exposed to retirement in 2008 from the 2003 vintage is $261,000. The amount retired during 2008 from the 2003 vintage is $16,000. Thus, the amount exposed to retirement in 2009 from the 2003 vintage is $245,000 ($261,000 - $16,000). The company's property records may contain other transactions which affect the property, including sales, transfers, and adjusting entries. Although these transactions are not shown in the matrices above, they would nonetheless affect the amount exposed to retirement at the beginning of each year.

The totaled amounts for each age interval in both matrices are used to form the exposure and retirement columns in the OLT, as shown in the chart below. This chart also shows the retirement ratio and the survivor ratio for each age interval. The retirement ratio for an age interval is the ratio of retirements during the interval to the property exposed to retirement at the beginning of the interval. The retirement ratio represents the probability that the property surviving at the beginning of an age interval will be retired during the interval. The survivor ratio is simply the complement to the retirement ratio (1 – retirement ratio). The survivor ratio represents the probability that the property surviving at the beginning of an age interval will survive to the next age interval.

Figure 20:
Observed Life Table

Age at Start of Interval	Exposures at Start of Age Interval	Retirements During Age Interval	Retirement Ratio	Survivor Ratio	Percent Surviving at Start of Age Interval
A	B	C	D = C / B	E = 1 - D	F
0.0	3,141	112	0.036	0.964	**100.00**
0.5	2,998	100	0.033	0.967	**96.43**
1.5	2,866	93	0.032	0.968	**93.21**
2.5	2,722	91	0.033	0.967	**90.19**
3.5	2,559	93	0.037	0.963	**87.19**
4.5	2,404	100	0.042	0.958	**84.01**
5.5	1,986	95	0.048	0.952	**80.50**
6.5	1,581	91	0.058	0.942	**76.67**
7.5	1,201	82	0.068	0.932	**72.26**
8.5	847	71	0.084	0.916	**67.31**
9.5	536	59	0.110	0.890	**61.63**
10.5	297	43	0.143	0.857	**54.87**
11.5	131	23	0.172	0.828	**47.01**
					38.91
Total	23,268	1,052			

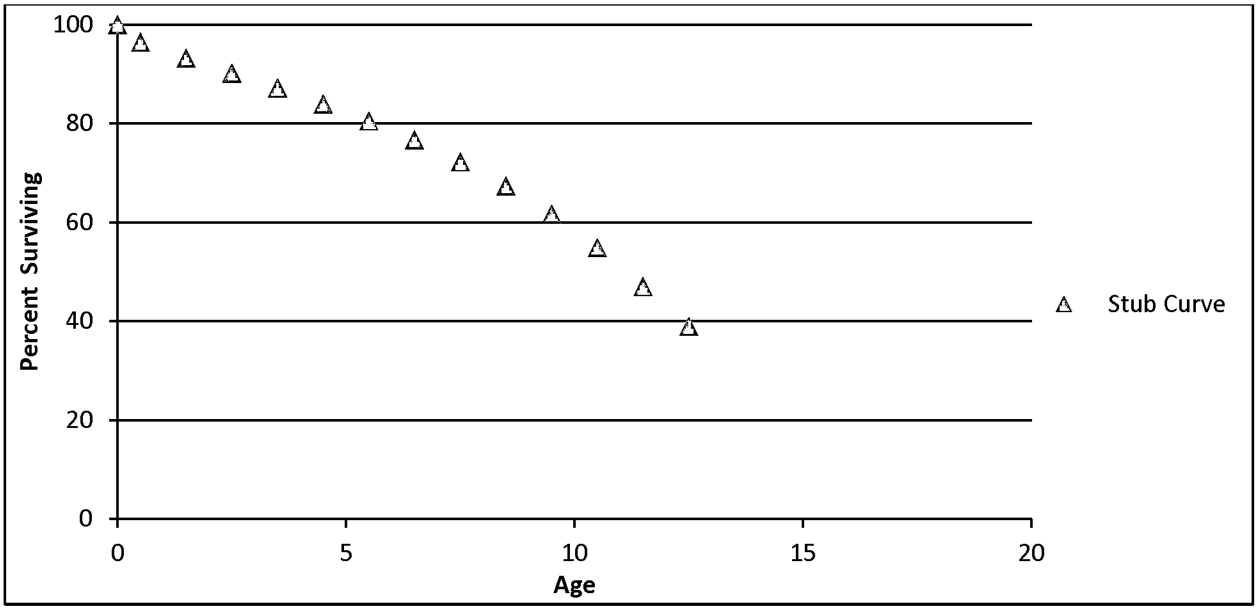
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. For example, the percent surviving at the start of age interval 1.5 is 93.21%, which was calculated by multiplying the percent surviving for age interval 0.5 (96.43%) by the survivor ratio for age interval 0.5 (0.967)[80].

The percentages surviving in Column F are the numbers that are used to form the original survivor curve. This particular curve starts at 100% surviving and ends at 38.91% surviving. An

[80] Multiplying 96.43 by 0.967 does not equal 93.21 exactly due to rounding.

observed survivor curve such as this that does not reach zero percent surviving is called a "stub" curve. The figure below illustrates the stub survivor curve derived from the OLT table above.

Figure 21:
Original "Stub" Survivor Curve



The matrices used to develop the basic OLT and stub survivor curve provide a basic illustration of the retirement rate method in that only a few placement and experience years were used. In reality, analysts may have several decades of aged property data to analyze. In that case, it may be useful to use a technique called "banding" in order to identify trends in the data.

<u>Banding</u>

The forces of retirement and characteristics of industrial property are constantly changing. A depreciation analyst may examine the magnitude of these changes. Analysts often use a technique called "banding" to assist with this process. Banding refers to the merging of several years of data into a single data set for further analysis, and it is a common technique associated with the retirement rate method.[81] There are three primary benefits of using bands in depreciation analysis:

1. Increasing the sample size. In statistical analyses, the larger the sample size in relation to the body of total data, the greater the reliability of the result;

2. Smooth the observed data. Generally, the data obtained from a single activity or vintage year will not produce an observed life table that can be easily fit; and

3. Identify trends. By looking at successive bands, the analyst may identify broad trends in the data that may be useful in projecting the future life characteristics of the property.[82]

Two common types of banding methods are the "placement band" method and the "experience band" method." A placement band, as the name implies, isolates selected placement years for analysis. The figure below illustrates the same exposure matrix shown above, except that only the placement years 2005-2008 are considered in calculating the total exposures at the beginning of each age interval.

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[81] NARUC *supra* n. 9, at 113.

[82] *Id.*

Figure 22:
Placement Bands

Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
	Experience Years Exposures at January 1 of Each Year (Dollars in 000's)									
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	198	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	471	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	788	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	1,133	6.5 - 7.5
2009		377	366	356	346	336	327	319	1,186	5.5 - 6.5
2010			381	369	358	347	336	327	1,237	4.5 - 5.5
2011				386	372	359	346	334	1,285	3.5 - 4.5
2012					395	380	366	352	1,331	2.5 - 3.5
2013						401	385	370	1,059	1.5 - 2.5
2014							410	393	733	0.5 - 1.5
2015								416	375	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,796	

The shaded cells within the placement band equal the total exposures at the beginning of age interval 4.5–5.5 ($1,237). The same placement band would be used for the retirement matrix covering the same placement years of 2005 – 2008. This of course would result in a different OLT and original stub survivor curve than those that were calculated above without the restriction of a placement band.

Analysts often use placement bands for comparing the survivor characteristics of properties with different physical characteristics.[83] Placement bands allow analysts to isolate the effects of changes in technology and materials that occur in successive generations of plant. For example, if in 2005 an electric utility began placing transmission poles with a special chemical treatment that extended the service lives of the poles, an analyst could use placement bands to isolate and analyze the effect of that change in the property group's physical characteristics. While placement

[83] Wolf *supra* n. 8, at 182.

bands are very useful in depreciation analysis, they also possess an intrinsic dilemma. A fundamental characteristic of placement bands is that they yield fairly complete survivor curves for older vintages. However, with newer vintages, which are arguably more valuable for forecasting, placement bands yield shorter survivor curves. Longer "stub" curves are considered more valuable for forecasting average life. Thus, an analyst must select a band width broad enough to provide confidence in the reliability of the resulting curve fit yet narrow enough so that an emerging trend may be observed.[84]

Analysts also use "experience bands." Experience bands show the composite retirement history for all vintages during a select set of activity years. The figure below shows the same data presented in the previous exposure matrices, except that the experience band from 2011 – 2013 is isolated, resulting in different interval totals.

[84] NARUC *supra* n. 9, at 114.

Figure 23:
Experience Bands

	Experience Years									
	Exposures at January 1 of Each Year (Dollars in 000's)									
Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total at Start of Age Interval	Age Interval
2003	261	245	228	211	192	173	152	131		11.5 - 12.5
2004	267	252	236	220	202	184	165	145		10.5 - 11.5
2005	304	291	277	263	248	232	216	198	173	9.5 - 10.5
2006	345	334	322	310	298	284	270	255	376	8.5 - 9.5
2007	367	357	347	335	324	312	299	286	645	7.5 - 8.5
2008	375	366	357	347	336	325	314	302	752	6.5 - 7.5
2009		377	366	356	346	336	327	319	872	5.5 - 6.5
2010			381	369	358	347	336	327	959	4.5 - 5.5
2011				386	372	359	346	334	1,008	3.5 - 4.5
2012					395	380	366	352	1,039	2.5 - 3.5
2013						401	385	370	1,072	1.5 - 2.5
2014							410	393	1,121	0.5 - 1.5
2015								416	1,182	0.0 - 0.5
Total	1919	2222	2514	2796	3070	3333	3586	3827	9,199	

The shaded cells within the experience band equal the total exposures at the beginning of age interval 4.5–5.5 ($1,237). The same experience band would be used for the retirement matrix covering the same experience years of 2011 – 2013. This of course would result in a different OLT and original stub survivor than if the band had not been used. Analysts often use experience bands to isolate and analyze the effects of an operating environment over time.[85] Likewise, the use of experience bands allows analysis of the effects of an unusual environmental event. For example, if an unusually severe ice storm occurred in 2013, destruction from that storm would affect an electric utility's line transformers of all ages. That is, each of the line transformers from each placement year would be affected, including those recently installed in 2012, as well as those installed in 2003. Using experience bands, an analyst could isolate or even eliminate the 2013 experience year from the analysis. In contrast, a placement band would not effectively isolate the

[85] *Id.*

ice storm's effect on life characteristics. Rather, the placement band would show an unusually large rate of retirement during 2013, making it more difficult to accurately fit the data with a smooth Iowa curve. Experience bands tend to yield the most complete stub curves for recent bands because they have the greatest number of vintages included. Longer stub curves are better for forecasting. The experience bands, however, may also result in more erratic retirement dispersion making the curve fitting process more difficult.

Depreciation analysts must use professional judgment in determining the types of bands to use and the band widths. In practice, analysts may use various combinations of placement and experience bands in order to increase the data sample size, identify trends and changes in life characteristics, and isolate unusual events. Regardless of which bands are used, observed survivor curves in depreciation analysis rarely reach zero percent. This is because, as seen in the OLT above, relatively newer vintage groups have not yet been fully retired at the time the property is studied. An analyst could confine the analysis to older, fully retired vintage groups in order to get complete survivor curves, but such analysis would ignore some of the property currently in service and would arguably not provide an accurate description of life characteristics for current plant in service. Because a complete curve is necessary to calculate the average life of the property group, however, curve fitting techniques using Iowa curves or other standardized curves may be employed in order to complete the stub curve.

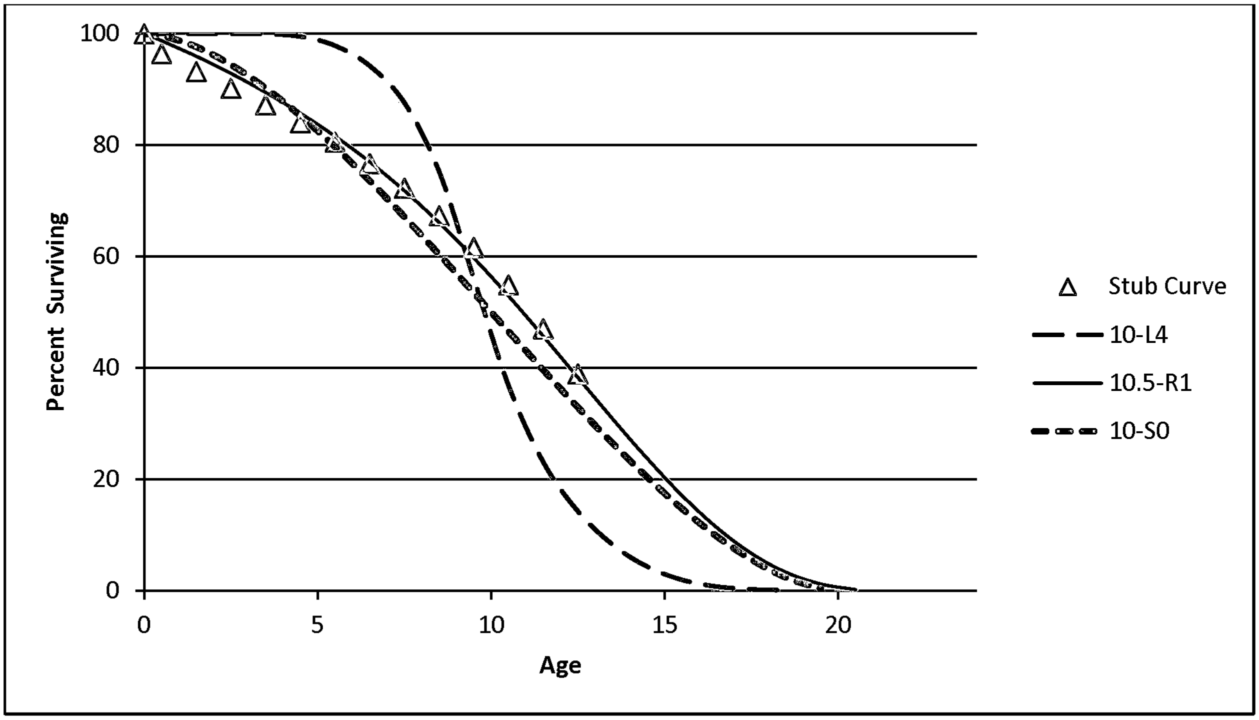
<u>Curve Fitting</u>

Depreciation analysts typically use the survivor curve rather than the frequency curve to fit the observed stub curves. The most commonly used generalized survivor curves used in the curve fitting process are the Iowa curves discussed above. As Wolf notes, if "the Iowa curves are adopted as a model, an underlying assumption is that the process describing the retirement pattern is one of the 22 [or more] processes described by the Iowa curves."[86]

Curve fitting may be done through visual matching or mathematical matching. In visual curve fitting, the analyst visually examines the plotted data to make an initial judgment about the Iowa curves that may be a good fit. The figure below illustrates the stub survivor curve shown above. It also shows three different Iowa curves: the 10-L4, the 10.5-R1, and the 10-S0. Visually, it is clear that the 10.5-R1 curve is a better fit than the other two curves.

[86] Wolf *supra* n. 8, at 46 (22 curves includes Winfrey's 18 original curves plus Cowles's four "O" type curves).

Figure 24:
Visual Curve Fitting



In mathematical fitting, the least squares method is used to calculate the best fit. This mathematical method would be excessively time consuming if done by hand. With the use of modern computer software however, mathematical fitting is an efficient and useful process. The typical logic for a computer program, as well as the software employed for the analysis in this testimony is as follows:

> First (an Iowa curve) curve is arbitrarily selected. . . . If the observed curve is a stub curve, . . . calculate the area under the curve and up to the age at final data point. Call this area the realized life. Then systematically vary the average life of the theoretical survivor curve and calculate its realized life at the age corresponding to the study date. This trial and error procedure ends when you find an average life such that the realized life of the theoretical curve equals the realized life of the observed curve. Call this the average life.
>
> Once the average life is found, calculate the difference between each percent surviving point on the observed survivor curve and the corresponding point on the Iowa curve. Square each difference and sum them. The sum of squares is used as a measure of goodness of fit for that particular Iowa type curve. This procedure is

> repeated for the remaining 21 Iowa type curves. The “best fit” is declared to be the type of curve that minimizes the sum of differences squared.[87]

Mathematical fitting requires less judgment from the analyst and is thus less subjective. Blind reliance on mathematical fitting, however, may lead to poor estimates. Thus, analysts should employ both mathematical and visual curve fitting in reaching their final estimates. This way, analysts may utilize the objective nature of mathematical fitting while still employing professional judgment. As Wolf notes: “The results of mathematical curve fitting serve as a guide for the analyst and speed the visual fitting process. But the results of the mathematical fitting should be checked visually, and the final determination of the best fit be made by the analyst.”[88]

In the graph above, visual fitting was sufficient to determine that the 10.5-R1 Iowa curve was a better fit than the 10-L4 and the 10-S0 curves. Using the sum of least squares method, mathematical fitting confirms the same result. In the chart below, the percentages surviving from the OLT that formed the original stub curve are shown in the left column, while the corresponding percentages surviving for each age interval are shown for the three Iowa curves. The right portion of the chart shows the differences between the points on each Iowa curve and the stub curve. These differences are summed at the bottom. Curve 10.5-R1 is the best fit because the sum of the squared differences for this curve is less than the same sum of the other two curves. Curve 10-L4 is the worst fit, which was also confirmed visually.

---

[87] Wolf *supra* n. 8, at 47.

[88] *Id.* at 48.

Figure 25:
Mathematical Fitting

Age Interval	Stub Curve	Iowa Curves 10-L4	Iowa Curves 10-S0	Iowa Curves 10.5-R1	Squared Differences 10-L4	Squared Differences 10-S0	Squared Differences 10.5-R1
0.0	100.0	100.0	100.0	100.0	0.0	0.0	0.0
0.5	96.4	100.0	99.7	98.7	12.7	10.3	5.3
1.5	93.2	100.0	97.7	96.0	46.1	19.8	7.6
2.5	90.2	100.0	94.4	92.9	96.2	18.0	7.2
3.5	87.2	100.0	90.2	89.5	162.9	9.3	5.2
4.5	84.0	99.5	85.3	85.7	239.9	1.6	2.9
5.5	80.5	97.9	79.7	81.6	301.1	0.7	1.2
6.5	76.7	94.2	73.6	77.0	308.5	9.5	0.1
7.5	72.3	87.6	67.1	71.8	235.2	26.5	0.2
8.5	67.3	75.2	60.4	66.1	62.7	48.2	1.6
9.5	61.6	56.0	53.5	59.7	31.4	66.6	3.6
10.5	54.9	36.8	46.5	52.9	325.4	69.6	3.9
11.5	47.0	23.1	39.6	45.7	572.6	54.4	1.8
12.5	38.9	14.2	32.9	38.2	609.6	36.2	0.4
SUM					**3004.2**	**371.0**	**41.0**

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DAVID J. GARRETT

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EDUCATION

University of Oklahoma — Norman, OK
Master of Business Administration — 2014
Areas of Concentration: Finance, Energy

University of Oklahoma College of Law — Norman, OK
Juris Doctor — 2007
Member, American Indian Law Review

University of Oklahoma — Norman, OK
Bachelor of Business Administration — 2003
Major: Finance

PROFESSIONAL DESIGNATIONS

Society of Depreciation Professionals
Certified Depreciation Professional (CDP)

Society of Utility and Regulatory Financial Analysts
Certified Rate of Return Analyst (CRRA)

The Mediation Institute
Certified Civil / Commercial & Employment Mediator

WORK EXPERIENCE

Resolve Utility Consulting PLLC — Oklahoma City, OK
Managing Member — 2016 – Present
Provide expert analysis and testimony specializing in depreciation and cost of capital issues for clients in utility regulatory proceedings.

Oklahoma Corporation Commission — Oklahoma City, OK
Public Utility Regulatory Analyst — 2012 – 2016
Assistant General Counsel — 2011 – 2012
Represented commission staff in utility regulatory proceedings and provided legal opinions to commissioners. Provided expert analysis and testimony in depreciation, cost of capital, incentive compensation, payroll and other issues.

Perebus Counsel, PLLC — Oklahoma City, OK
Managing Member — 2009 – 2011
Represented clients in the areas of family law, estate planning, debt negotiations, business organization, and utility regulation.

Moricoli & Schovanec, P.C. — Oklahoma City, OK
Associate Attorney — 2007 – 2009
Represented clients in the areas of contracts, oil and gas, business structures and estate administration.

TEACHING EXPERIENCE

University of Oklahoma — Norman, OK
Adjunct Instructor – "Conflict Resolution" — 2014 – 2021
Adjunct Instructor – "Ethics in Leadership"

Rose State College — Midwest City, OK
Adjunct Instructor – "Legal Research" — 2013 – 2015
Adjunct Instructor – "Oil & Gas Law"

PUBLICATIONS

American Indian Law Review — Norman, OK
"Vine of the Dead: Reviving Equal Protection Rites for Religious Drug Use" — 2006
(31 Am. Indian L. Rev. 143)

PROFESSIONAL ASSOCIATIONS

Oklahoma Bar Association — 2007 – Present

Society of Depreciation Professionals — 2014 – Present
Board Member – President — 2017
Participate in management of operations, attend meetings, review performance, organize presentation agenda.

Society of Utility Regulatory Financial Analysts — 2014 – Present

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Pennsylvania Public Utility Commission	Columbia Gas of Pennsylvania, Inc.	R-2022-3031211	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Service Commission of South Carolina	Piedmont Natural Gas Company	2022-89-G	Depreciation rates, service lives, net salvage	South Carolina Office of Regulatory Staff
Pennsylvania Public Utility Commission	UGI Utilities, Inc. - Gas Division	R-2021-3030218	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Utilities Commission of the State of California	Pacific Gas & Electric Company	A.21-06-021	Depreciation rates, service lives, net salvage	The Utility Reform Network
Pennsylvania Public Utility Commission	PECO Energy Company - Gas Division	R-2022-3031113	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Oklahoma Corporation Commission	Oklahoma Gas & Electric Company	PUD 202100164	Cost of capital, depreciation rates, net salvage	Oklahoma Industrial Energy Consumers
Massachusetts Department of Public Utilities	NSTAR Electric Company D/B/A Eversource Energy	D.P.U. 22-22	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Michigan Public Service Company	DTE Electric Company	U-20836	Cost of capital, awarded rate of return, capital structure	Michigan Environmental Council and Citizens Utility Board of Michigan
New York State Public Service Commission	Consolidated Edison Company of New York, Inc.	22-E-0064 22-G-0065	Depreciation rates, service lives, net salvage, depreciation reserve	The City of New York
Pennsylvania Public Utility Commission	Aqua Pennsylvania Wastewater / East Whiteland Township	A-2021-3026132	Fair market value estimates for wastewater assets	Pennsylvania Office of Consumer Advocate
Public Service Commission of South Carolina	Kiawah Island Utility, Inc.	2021-324-WS	Cost of capital, awarded rate of return, capital structure	South Carolina Office of Regulatory Staff
Pennsylvania Public Utility Commission	Aqua Pennsylvania Wastewater / Willistown Township	A-2021-3027268	Fair market value estimates for wastewater assets	Pennsylvania Office of Consumer Advocate
Indiana Utility Regulatory Commission	Northern Indiana Public Service Company	45621	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Arkansas Public Service Commission	Southwestern Electric Power Company	21-070-U	Cost of capital, depreciation rates, net salvage	Western Arkansas Large Energy Consumers

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Federal Energy Regulatory Commission	Southern Star Central Gas Pipeline	RP21-778-002	Depreciation rates, service lives, net salvage	Consumer-Owned Shippers
Railroad Commission of Texas	Participating Texas gas utilities in consolidated proceeding	OS-21-00007061	Securitization of extraordinary gas costs arising from winter storms	The City of El Paso
Public Service Commission of South Carolina	Palmetto Wastewater Reclamation, Inc.	2021-153-S	Cost of capital, awarded rate of return, capital structure, ring-fencing	South Carolina Office of Regulatory Staff
Public Utilties Commission of the State of Colorado	Public Service Company of Colorado	21AL-0317E	Cost of capital, depreciation rates, net salvage	Colorado Energy Consumers
Pennsylvania Public Utility Commission	City of Lancaster - Water Department	R-2021-3026682	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 51802	Depreciation rates, service lives, net salvage	The Alliance of Xcel Municipalities
Pennsylvania Public Utility Commission	The Borough of Hanover - Hanover Municipal Waterworks	R-2021-3026116	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Maryland Public Service Commission	Delmarva Power & Light Company	9670	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Oklahoma Corporation Commission	Oklahoma Natural Gas Company	PUD 202100063	Cost of capital, awarded rate of return, capital structure	Oklahoma Industrial Energy Consumers
Indiana Utility Regulatory Commission	Indiana Michigan Power Company	45576	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	El Paso Electric Company	PUC 52195	Depreciation rates, service lives, net salvage	The City of El Paso
Pennsylvania Public Utility Commission	Aqua Pennsylvania	R-2021-3027385	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Public Service Commission of the State of Montana	NorthWestern Energy	D2021.02.022	Cost of capital, awarded rate of return, capital structure	Montana Consumer Counsel
Pennsylvania Public Utility Commission	PECO Energy Company	R-2021-3024601	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
New Mexico Public Regulation Commission	Southwestern Public Service Company	20-00238-UT	Cost of capital and authorized rate of return	The New Mexico Large Customer Group; Occidental Permian
Oklahoma Corporation Commission	Public Service Company of Oklahoma	PUD 202100055	Cost of capital, depreciation rates, net salvage	Oklahoma Industrial Energy Consumers
Pennsylvania Public Utility Commission	Duquesne Light Company	R-2021-3024750	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Maryland Public Service Commission	Columbia Gas of Maryland	9664	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Indiana Utility Regulatory Commission	Southern Indiana Gas Company, d/b/a Vectren Energy Delivery of Indiana, Inc.	45447	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	Southwestern Electric Power Company	PUC 51415	Depreciation rates, service lives, net salvage	Cities Advocating Reasonable Deregulation
New Mexico Public Regulatory Commission	Avangrid, Inc., Avangrid Networks, Inc., NM Green Holdings, Inc., PNM, and PNM Resources	20-00222-UT	Ring fencing and capital structure	The Albuquerque Bernalillo County Water Utility Authority
Indiana Utility Regulatory Commission	Indiana Gas Company, d/b/a Vectren Energy Delivery of Indiana, Inc.	45468	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utilities Commission of Nevada	Nevada Power Company and Sierra Pacific Power Company, d/b/a NV Energy	20-07023	Construction work in progress	MGM Resorts International, Caesars Enterprise Services, LLC, and the Southern Nevada Water Authority
Massachusetts Department of Public Utilities	Boston Gas Company, d/b/a National Grid	D.P.U. 20-120	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Public Service Commission of the State of Montana	ABACO Energy Services, LLC	D2020.07.082	Cost of capital and authorized rate of return	Montana Consumer Counsel
Maryland Public Service Commission	Washington Gas Light Company	9651	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Florida Public Service Commission	Utilities, Inc. of Florida	20200139-WS	Cost of capital and authorized rate of return	Florida Office of Public Counsel
New Mexico Public Regulatory Commission	El Paso Electric Company	20-00104-UT	Cost of capital, depreciation rates, net salvage	City of Las Cruces and Doña Ana County

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Public Utilities Commission of Nevada	Nevada Power Company	20-06003	Cost of capital, awarded rate of return, capital structure, earnings sharing	MGM Resorts International, Caesars Enterprise Services, LLC, Wynn Las Vegas, LLC, Smart Energy Alliance, and Circus Circus Las Vegas, LLC
Wyoming Public Service Commission	Rocky Mountain Power	20000-578-ER-20	Cost of capital and authorized rate of return	Wyoming Industrial Energy Consumers
Florida Public Service Commission	Peoples Gas System	20200051-GU 20200166-GU	Cost of capital, depreciation rates, net salvage	Florida Office of Public Counsel
Wyoming Public Service Commission	Rocky Mountain Power	20000-539-EA-18	Depreciation rates, service lives, net salvage	Wyoming Industrial Energy Consumers
Public Service Commission of South Carolina	Dominion Energy South Carolina	2020-125-E	Depreciation rates, service lives, net salvage	South Carolina Office of Regulatory Staff
Pennsylvania Public Utility Commission	The City of Bethlehem	2020-3020256	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Railroad Commission of Texas	Texas Gas Services Company	GUD 10928	Depreciation rates, service lives, net salvage	Gulf Coast Service Area Steering Committee
Public Utilities Commission of the State of California	Southern California Edison	A.19-08-013	Depreciation rates, service lives, net salvage	The Utility Reform Network
Massachusetts Department of Public Utilities	NSTAR Gas Company	D.P.U. 19-120	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Georgia Public Service Commission	Liberty Utilities (Peach State Natural Gas)	42959	Depreciation rates, service lives, net salvage	Public Interest Advocacy Staff
Florida Public Service Commission	Florida Public Utilities Company	20190155-EI 20190156-EI 20190174-EI	Depreciation rates, service lives, net salvage	Florida Office of Public Counsel
Illinois Commerce Commission	Commonwealth Edison Company	20-0393	Depreciation rates, service lives, net salvage	The Office of the Illinois Attorney General
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 49831	Depreciation rates, service lives, net salvage	Alliance of Xcel Municipalities
Public Service Commission of South Carolina	Blue Granite Water Company	2019-290-WS	Depreciation rates, service lives, net salvage	South Carolina Office of Regulatory Staff

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Railroad Commission of Texas	CenterPoint Energy Resources	GUD 10920	Depreciation rates and grouping procedure	Alliance of CenterPoint Municipalities
Pennsylvania Public Utility Commission	Aqua Pennsylvania Wastewater / East Norriton Township	A-2019-3009052	Fair market value estimates for wastewater assets	Pennsylvania Office of Consumer Advocate
New Mexico Public Regulation Commission	Southwestern Public Service Company	19-00170-UT	Cost of capital and authorized rate of return	The New Mexico Large Customer Group; Occidental Permian
Indiana Utility Regulatory Commission	Duke Energy Indiana	45253	Cost of capital, depreciation rates, net salvage	Indiana Office of Utility Consumer Counselor
Maryland Public Service Commission	Columbia Gas of Maryland	9609	Depreciation rates, service lives, net salvage	Maryland Office of People's Counsel
Washington Utilities & Transportation Commission	Avista Corporation	UE-190334	Cost of capital, awarded rate of return, capital structure	Washington Office of Attorney General
Indiana Utility Regulatory Commission	Indiana Michigan Power Company	45235	Cost of capital, depreciation rates, net salvage	Indiana Office of Utility Consumer Counselor
Public Utilities Commission of the State of California	Pacific Gas & Electric Company	18-12-009	Depreciation rates, service lives, net salvage	The Utility Reform Network
Oklahoma Corporation Commission	The Empire District Electric Company	PUD 201800133	Cost of capital, authorized ROE, depreciation rates	Oklahoma Industrial Energy Consumers and Oklahoma Energy Results
Arkansas Public Service Commission	Southwestern Electric Power Company	19-008-U	Cost of capital, depreciation rates, net salvage	Western Arkansas Large Energy Consumers
Public Utility Commission of Texas	CenterPoint Energy Houston Electric	PUC 49421	Depreciation rates, service lives, net salvage	Texas Coast Utilities Coalition
Massachusetts Department of Public Utilities	Massachusetts Electric Company and Nantucket Electric Company	D.P.U. 18-150	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Oklahoma Corporation Commission	Oklahoma Gas & Electric Company	PUD 201800140	Cost of capital, authorized ROE, depreciation rates	Oklahoma Industrial Energy Consumers and Oklahoma Energy Results
Public Service Commission of the State of Montana	Montana-Dakota Utilities Company	D2018.9.60	Depreciation rates, service lives, net salvage	Montana Consumer Counsel and Denbury Onshore

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Indiana Utility Regulatory Commission	Northern Indiana Public Service Company	45159	Depreciation rates, grouping procedure, demolition costs	Indiana Office of Utility Consumer Counselor
Public Service Commission of the State of Montana	NorthWestern Energy	D2018.2.12	Depreciation rates, service lives, net salvage	Montana Consumer Counsel
Oklahoma Corporation Commission	Public Service Company of Oklahoma	PUD 201800097	Depreciation rates, service lives, net salvage	Oklahoma Industrial Energy Consumers and Wal-Mart
Nevada Public Utilities Commission	Southwest Gas Corporation	18-05031	Depreciation rates, service lives, net salvage	Nevada Bureau of Consumer Protection
Public Utility Commission of Texas	Texas-New Mexico Power Company	PUC 48401	Depreciation rates, service lives, net salvage	Alliance of Texas-New Mexico Power Municipalities
Oklahoma Corporation Commission	Oklahoma Gas & Electric Company	PUD 201700496	Depreciation rates, service lives, net salvage	Oklahoma Industrial Energy Consumers and Oklahoma Energy Results
Maryland Public Service Commission	Washington Gas Light Company	9481	Depreciation rates, service lives, net salvage	Maryland Office of People's Counsel
Indiana Utility Regulatory Commission	Citizens Energy Group	45039	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	Entergy Texas, Inc.	PUC 48371	Depreciation rates, decommissioning costs	Texas Municipal Group
Washington Utilities & Transportation Commission	Avista Corporation	UE-180167	Depreciation rates, service lives, net salvage	Washington Office of Attorney General
New Mexico Public Regulation Commission	Southwestern Public Service Company	17-00255-UT	Cost of capital and authorized rate of return	HollyFrontier Navajo Refining; Occidental Permian
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 47527	Depreciation rates, plant service lives	Alliance of Xcel Municipalities
Public Service Commission of the State of Montana	Montana-Dakota Utilities Company	D2017.9.79	Depreciation rates, service lives, net salvage	Montana Consumer Counsel
Florida Public Service Commission	Florida City Gas	20170179-GU	Cost of capital, depreciation rates	Florida Office of Public Counsel

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Washington Utilities & Transportation Commission	Avista Corporation	UE-170485	Cost of capital and authorized rate of return	Washington Office of Attorney General
Wyoming Public Service Commission	Powder River Energy Corporation	10014-182-CA-17	Credit analysis, cost of capital	Private customer
Oklahoma Corporation Commission	Public Service Co. of Oklahoma	PUD 201700151	Depreciation, terminal salvage, risk analysis	Oklahoma Industrial Energy Consumers
Public Utility Commission of Texas	Oncor Electric Delivery Company	PUC 46957	Depreciation rates, simulated analysis	Alliance of Oncor Cities
Nevada Public Utilities Commission	Nevada Power Company	17-06004	Depreciation rates, service lives, net salvage	Nevada Bureau of Consumer Protection
Public Utility Commission of Texas	El Paso Electric Company	PUC 46831	Depreciation rates, interim retirements	City of El Paso
Idaho Public Utilities Commission	Idaho Power Company	IPC-E-16-24	Accelerated depreciation of North Valmy plant	Micron Technology, Inc.
Idaho Public Utilities Commission	Idaho Power Company	IPC-E-16-23	Depreciation rates, service lives, net salvage	Micron Technology, Inc.
Public Utility Commission of Texas	Southwestern Electric Power Company	PUC 46449	Depreciation rates, decommissioning costs	Cities Advocating Reasonable Deregulation
Massachusetts Department of Public Utilities	Eversource Energy	D.P.U. 17-05	Cost of capital, capital structure, and rate of return	Sunrun Inc.; Energy Freedom Coalition of America
Railroad Commission of Texas	Atmos Pipeline - Texas	GUD 10580	Depreciation rates, grouping procedure	City of Dallas
Public Utility Commission of Texas	Sharyland Utility Company	PUC 45414	Depreciation rates, simulated analysis	City of Mission
Oklahoma Corporation Commission	Empire District Electric Company	PUD 201600468	Cost of capital, depreciation rates	Oklahoma Industrial Energy Consumers
Railroad Commission of Texas	CenterPoint Energy Texas Gas	GUD 10567	Depreciation rates, simulated plant analysis	Texas Coast Utilities Coalition

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Arkansas Public Service Commission	Oklahoma Gas & Electric Company	160-159-GU	Cost of capital, depreciation rates, terminal salvage	Arkansas River Valley Energy Consumers; Wal-Mart
Florida Public Service Commission	Peoples Gas	160-159-GU	Depreciation rates, service lives, net salvage	Florida Office of Public Counsel
Arizona Corporation Commission	Arizona Public Service Company	E-01345A-16-0036	Cost of capital, depreciation rates, terminal salvage	Energy Freedom Coalition of America
Nevada Public Utilities Commission	Sierra Pacific Power Company	16-06008	Depreciation rates, net salvage, theoretical reserve	Northern Nevada Utility Customers
Oklahoma Corporation Commission	Oklahoma Gas & Electric Co.	PUD 201500273	Cost of capital, depreciation rates, terminal salvage	Public Utility Division
Oklahoma Corporation Commission	Public Service Co. of Oklahoma	PUD 201500208	Cost of capital, depreciation rates, terminal salvage	Public Utility Division
Oklahoma Corporation Commission	Oklahoma Natural Gas Company	PUD 201500213	Cost of capital, depreciation rates, net salvage	Public Utility Division

Summary Accrual Comparison

Exhibit DJG-2

Plant Function		Plant Balance 12/31/2021		ETI Proposed Accrual		Cities Proposed Accrual		Accrual Difference
Steam Production	$	1,238,611,477	$	110,085,796	$	53,959,863	$	(56,125,933)
Other Production		736,186,792		25,593,776		24,752,296		(841,480)
Transmission		2,125,787,700		39,720,926		34,910,714		(4,810,212)
Distribution		2,470,913,519		78,441,061		70,832,483		(7,608,578)
General		81,611,366		2,396,626		2,396,626		-
Total	$	6,653,110,854	$	256,238,184	$	186,851,981	**$**	**(69,386,203)**

Mass Property Parameter Comparison

Account No.	Description	Current Parameters Iowa Curve Type	Current Parameters Iowa Curve AL	Current Parameters Net Salvage	Company Proposed Iowa Curve Type	Company Proposed Iowa Curve AL	Company Proposed Net Salvage	Cities Proposed Iowa Curve Type	Cities Proposed Iowa Curve AL	Cities Proposed Net Salvage
	Transmission Plant									
352.00	Structures & Improv.	R2.5	82	-20%	R3	81	-30%	R3	81	-23%
353.00	Station Equipment	R1	64	-25%	R1	64	-25%	R1	70	-25%
354.00	Towers & Fixtures	R4	75	-5%	R4	75	-10%	R4	79	-6%
355.00	Poles & Fixtures	R1.5	65	-30%	R1.5	70	-45%	R1	77	-34%
356.00	OH Conductors & Devices	R1.5	70	-30%	R1.5	82	-45%	R1.5	82	-34%
	Distribution Plant									
361.00	Structures & Improv.	R2.5	83	-10%	R1.5	80	-15%	R1.5	80	-11%
362.00	Station Equipment	R1	65	-20%	R1	65	-25%	R0.5	70	-21%
364.00	Poles, Towers & Fixtures	R1	43	-30%	R1	45	-45%	R1	47	-34%
365.00	OH Conductors & Devices	R0.5	42	-20%	R1	45	-30%	R1	45	-23%
366.00	UG Conduit	L0.5	60	-10%	R3	50	-15%	R2	60	-11%
367.00	UG Conductors & Devices	R1	42	-1%	R2.5	40	-5%	R2	46	-2%
368.00	Line Transformers	L0	34	-20%	L0.5	37	-30%	L0.5	37	-23%
369.10	Services - Overhead	S4	27	-15%	S4	29	-25%	S4	29	-18%
369.20	Services - Underground	R5	36	-10%	R5	37	-15%	R5	37	-11%
371.00	I.O.C.P	R4	56	-10%	R0.5	32	-15%	R0.5	32	-11%
373.00	Street Lighting & Signal Systems	R2	45	-20%	R0.5	32	-30%	R0.5	32	-23%

Detailed Rate and Accrual Comparison

		[1]	[2]		[3]		[4]	
			ETI Proposal		Cities Proposal		Difference	
Account No.	Description	Plant 12/31/2021	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	Steam Production Plant							
311.00	Structures and Improvements							
	Big Cajun 2 Common	827,847	16.76%	138,764	2.98%	24,679	-13.78%	-114,084
	Big Cajun 2 Unit 3	19,684,801	16.58%	3,263,706	2.82%	554,136	-13.76%	-2,709,570
	Lewis Creek Common	129,103,039	6.55%	8,450,587	6.53%	8,424,715	-0.02%	-25,871
	Lewis Creek Unit 1	3,057,966	5.64%	172,383	5.62%	171,770	-0.02%	-613
	Lewis Creek Unit 2	2,751,578	5.63%	155,048	5.61%	154,496	-0.02%	-551
	Neches	0			0.00%	0	0.00%	0
	Nelson Common	3,472,259	8.86%	307,720	2.88%	100,087	-5.98%	-207,633
	Nelson Unit 6	29,566,424	8.30%	2,454,317	2.70%	796,932	-5.61%	-1,657,385
	Sabine Common	28,082,978	3.79%	1,063,134	3.71%	1,043,169	-0.07%	-19,965
	Sabine Unit 1	1,911,984	35.88%	686,034	6.10%	116,631	-29.78%	-569,403
	Sabine Unit 3	2,138,683	14.16%	302,734	2.94%	62,877	-11.22%	-239,857
	Sabine Unit 4	7,443,522	11.29%	840,112	3.68%	273,922	-7.61%	-566,190
	Sabine Unit 5	9,427,831	3.77%	355,053	3.69%	348,351	-0.07%	-6,703
	Spindletop	1,926,378	3.61%	69,576	3.51%	67,704	-0.10%	-1,872
	System Repair	568,326	3.51%	19,946	3.48%	19,750	-0.03%	-196
	Spindleltop Acquisition	63,917,624		0	0.00%	0	0.00%	0
	Total Structures and Improvements	303,881,239	6.02%	18,279,114	4.00%	12,159,220	-2.01%	-6,119,894
312.00	Boiler Plant Equipment							
	Big Cajun 2 Common	1,012,765	16.85%	170,607	3.00%	30,346	-13.85%	-140,261
	Big Cajun 2 Unit 3	60,534,154	17.57%	10,633,379	2.99%	1,812,596	-14.57%	-8,820,783
	Lewis Creek Common	5,307,683	5.30%	281,443	5.28%	280,380	-0.02%	-1,064
	Lewis Creek Unit 1	39,355,417	5.50%	2,165,638	5.48%	2,157,752	-0.02%	-7,887
	Lewis Creek Unit 2	41,035,809	5.61%	2,303,599	5.59%	2,295,376	-0.02%	-8,223
	Nelson Common	2,891,969	8.15%	235,618	2.64%	76,468	-5.50%	-159,150
	Nelson Unit 6	121,567,392	9.00%	10,946,638	2.93%	3,561,822	-6.07%	-7,384,817
	Sabine Common	23,057,826	3.51%	809,854	3.44%	793,462	-0.07%	-16,393
	Sabine Unit 1	15,552,035	25.73%	4,001,048	5.31%	825,813	-20.42%	-3,175,235
	Sabine Unit 3	32,836,733	11.80%	3,873,232	4.11%	1,349,590	-7.69%	-2,523,642
	Sabine Unit 4	55,955,054	12.43%	6,957,300	5.04%	2,820,135	-7.39%	-4,137,166
	Sabine Unit 5	78,863,803	3.56%	2,810,377	3.49%	2,754,310	-0.07%	-56,067
	Spindletop	114,140	3.32%	3,791	3.22%	3,680	-0.10%	-111
	Total Boiler Plant Equipment	478,084,780	9.45%	45,192,525	3.92%	18,761,728	-5.53%	-26,430,797
312.10	Nelson Railcars	1,061,827	3.69%	123,266	3.87%	41,089	0.18%	-82,178
314.00	Turbogenerator Units							
	Big Cajun 2 Common	316,524	15.82%	50,065	2.81%	8,892	-13.01%	-41,173
	Big Cajun 2 Unit 3	18,427,011	16.74%	3,083,774	2.84%	523,930	-13.89%	-2,559,844
	Lewis Creek Common	1,099,747	6.08%	66,846	6.06%	66,626	-0.02%	-220
	Lewis Creek Unit 1	38,129,257	5.78%	2,202,465	5.76%	2,194,824	-0.02%	-7,641
	Lewis Creek Unit 2	45,063,580	6.03%	2,715,538	6.01%	2,706,508	-0.02%	-9,030
	Nelson Common	150,434	10.01%	15,054	3.26%	4,910	-6.74%	-10,144
	Nelson Unit 6	29,770,611	9.44%	2,809,014	3.07%	915,018	-6.36%	-1,893,996
	Sabine Common	3,799,176	4.91%	186,398	4.84%	183,697	-0.07%	-2,701
	Sabine Unit 1	31,611,967	26.69%	8,438,106	10.85%	3,429,898	-15.84%	-5,008,207
	Sabine Unit 3	34,009,548	12.51%	4,255,781	6.60%	2,244,630	-5.91%	-2,011,150
	Sabine Unit 4	63,788,493	14.19%	9,053,837	5.25%	3,348,896	-8.94%	-5,704,941
	Sabine Unit 5	61,728,419	3.91%	2,412,749	3.84%	2,368,864	-0.07%	-43,885

Detailed Rate and Accrual Comparison

		[1]	[2]		[3]		[4]	
			ETI Proposal		Cities Proposal		Difference	
Account No.	Description	Plant 12/31/2021	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	Total Turbogenerator Units	327,894,767	10.76%	35,289,627	5.49%	17,996,695	-5.27%	-17,292,932
315.00	Accessory Electric Equipment							
	Big Cajun 2 Common	847,724	15.70%	133,070	2.79%	23,631	-12.91%	-109,439
	Big Cajun 2 Unit 3	12,166,066	16.94%	2,061,308	2.88%	350,516	-14.06%	-1,710,792
	Lewis Creek Common	3,879,691	5.06%	196,240	5.04%	195,462	-0.02%	-777
	Lewis Creek Unit 1	6,656,788	5.29%	352,347	5.27%	351,013	-0.02%	-1,334
	Lewis Creek Unit 2	5,445,485	5.66%	308,468	5.64%	307,377	-0.02%	-1,091
	Nelson Common	523,560	10.76%	56,360	3.52%	18,412	-7.25%	-37,948
	Nelson Unit 6	20,861,464	8.17%	1,704,770	2.65%	553,317	-5.52%	-1,151,453
	Sabine Common	6,744,857	3.77%	254,410	3.70%	249,615	-0.07%	-4,795
	Sabine Unit 1	7,364,898	25.28%	1,861,580	7.15%	526,590	-18.13%	-1,334,990
	Sabine Unit 3	9,743,562	12.79%	1,245,911	5.61%	546,614	-7.18%	-699,297
	Sabine Unit 4	8,365,787	11.54%	965,032	2.34%	195,759	-9.20%	-769,272
	Sabine Unit 5	23,128,294	3.68%	850,101	3.60%	833,658	-0.07%	-16,443
	Spindletop	6,071,612	3.37%	204,643	3.27%	198,743	-0.10%	-5,900
	System Repair Shop	95,188	3.51%	3,340	3.47%	3,307	-0.03%	-33
	Total Accessory Electric Equipment	111,894,977	9.11%	10,197,580	3.89%	4,354,014	-5.22%	-5,843,566
316.00	Miscellaneous Power Plant Equipment							
	Big Cajun 2 Common	540,687	16.70%	90,319	2.97%	16,062	-13.73%	-74,257
	Big Cajun 2 Unit 3	829,561	17.91%	148,545	3.06%	25,354	-14.85%	-123,192
	Lewis Creek Common	2,842,564	5.80%	164,881	5.78%	164,312	-0.02%	-570
	Lewis Creek Unit 1	37,396	6.63%	2,480	6.61%	2,473	-0.02%	-7
	Nelson Common	346,939	11.27%	39,091	3.68%	12,782	-7.58%	-26,309
	Nelson Unit 6	1,658,691	8.99%	149,051	2.92%	48,496	-6.06%	-100,555
	Sabine Common	5,766,940	4.21%	242,979	4.14%	238,879	-0.07%	-4,100
	Sabine Unit 1	91,345	25.76%	23,535	9.45%	8,632	-16.31%	-14,903
	Sabine Unit 4	101,334	16.19%	16,408	5.17%	5,239	-11.02%	-11,169
	Sabine Unit 5	75,138	5.54%	4,165	5.47%	4,111	-0.07%	-53
	Spindletop	387,507	3.28%	12,716	3.18%	12,340	-0.10%	-377
	System Production Laboratory	201,820	3.54%	7,144	3.51%	7,074	-0.03%	-70
	System Production Maintenance	2,082,313	3.52%	73,211	3.48%	72,493	-0.03%	-718
	System Production Training	775,378	3.50%	27,169	3.47%	26,901	-0.03%	-267
	System Repair	56,275	3.54%	1,990	3.50%	1,970	-0.03%	-19
	Total Miscellaneous Power Plant Equipment	15,793,887	6.35%	1,003,683	4.10%	647,117	-2.26%	-356,566
	TOTAL STEAM PRODUCTION PLANT	1,238,611,477	8.89%	110,085,796	4.36%	53,959,863	-4.53%	-56,125,933
	Other Production Plant							
341.00	Structures and Improvements							
	Hardin County Common	1,492,258	5.21%	77,779	5.06%	75,553	-0.15%	-2,227
	Hardin County Unit 1	83,536	5.21%	4,354	5.06%	4,229	-0.15%	-125
	Hardin County Unit 2	83,536	5.21%	4,354	5.06%	4,229	-0.15%	-125
	Montgomery County Power Station	40,531,160	3.41%	1,381,437	3.29%	1,335,390	-0.11%	-46,048
	Total Structures and Improvements	42,190,490	3.48%	1,467,925	3.36%	1,419,401	-0.12%	-48,524
342.00	Fuel Holders, Producers, and Accessories							

Detailed Rate and Accrual Comparison

		[1]	[2]		[3]		[4]	
			ETI Proposal		Cities Proposal		Difference	
Account No.	Description	Plant 12/31/2021	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	Hardin County Common	1,738,071	5.21%	90,592	5.06%	87,998	-0.15%	-2,594
	Montgomery County Power Station	9,682,165	3.40%	328,738	3.28%	317,781	-0.11%	-10,958
	Total Fuel Holders, Producers, and Accessories	11,420,236	3.67%	419,330	3.55%	405,778	-0.12%	-13,552
343.00	Prime Movers							
	Hardin County Unit 1	10,548,635	5.21%	549,815	5.06%	534,074	-0.15%	-15,741
	Hardin County Unit 2	10,548,635	5.21%	549,815	5.06%	534,074	-0.15%	-15,741
	Montgomery County Power Station	332,427,455	3.40%	11,287,510	3.28%	10,911,260	-0.11%	-376,250
	Total Prime Movers	353,524,725	3.50%	12,387,140	3.39%	11,979,407	-0.12%	-407,733
34.00	Generators							
	Hardin County Common	495,504	5.21%	25,827	5.06%	25,087	-0.15%	-739
	Hardin County Unit 1	330,662	5.21%	17,235	5.06%	16,741	-0.15%	-493
	Hardin County Unit 2	330,662	5.21%	17,235	5.06%	16,741	-0.15%	-493
	HEB Backup Generator	1,201,959	5.14%	61,766	5.14%	61,766	0.00%	0
	HEB Grocery	1,302,064	5.00%	65,103	5.00%	65,103	0.00%	0
	Montgomery County Power Station	240,926,511	3.40%	8,180,527	3.28%	7,907,843	-0.11%	-272,684
	Total Generators	244,587,362	3.42%	8,367,693	3.31%	8,093,282	-0.11%	-274,411
345.00	Accessory Electrical Equipment							
	Hardin County Common	537,374	5.21%	28,009	5.06%	27,207	-0.15%	-802
	Hardin County Unit 1	1,112,879	5.21%	58,005	5.06%	56,345	-0.15%	-1,661
	Hardin County Unit 2	1,112,879	5.21%	58,005	5.06%	56,345	-0.15%	-1,661
	Montgomery County Power Station	73,471,796	3.40%	2,494,587	3.28%	2,411,434	-0.11%	-83,153
	Total Accessory Electrical Equipment	76,234,929	3.46%	2,638,607	3.35%	2,551,331	-0.11%	-87,276
346.00	Miscellaneous Power Plant Equipment							
	Hardin County Common	1,500,396	5.21%	78,204	5.06%	75,965	-0.15%	-2,239
	Hardin County Unit 1	170,615	5.21%	8,893	5.06%	8,638	-0.15%	-255
	Hardin County Unit 2	170,615	5.21%	8,893	5.06%	8,638	-0.15%	-255
	Montgomery County Power Station	6,387,425	3.40%	217,091	3.29%	209,855	-0.11%	-7,236
	Total Miscellaneous Power Plant Equipment	8,229,051	3.80%	313,080	3.68%	303,096	-0.12%	-9,985
	TOTAL OTHER PRODUCTION PLANT	736,186,792	3.48%	25,593,776	3.36%	24,752,296	-0.11%	-841,480
	Transmission Plant							
350.00	Land Rights	59,793,615	1.08%	647,079	1.08%	647,079	0.00%	0
352.00	Structures & Improv.	86,807,346	1.60%	1,388,580	1.50%	1,305,430	-0.10%	-83,150
353.00	Station Equipment	976,935,145	1.89%	18,460,832	1.71%	16,675,594	-0.18%	-1,785,239
354.00	Towers & Fixtures	31,662,294	1.23%	388,763	1.04%	328,379	-0.19%	-60,384
355.00	Poles & Fixtures	629,338,371	2.06%	12,934,619	1.68%	10,585,987	-0.37%	-2,348,632
356.00	OH Conductors & Devices	340,726,426	1.73%	5,892,764	1.57%	5,359,956	-0.16%	-532,808
358.00	UG Conductors & Devices	321,717	1.83%	5,894	1.83%	5,894	0.00%	0
359.00	Roads & Trails	202,785	1.18%	2,395	1.18%	2,395	0.00%	0
	TOTAL TRANSMISSION PLANT	2,125,787,700	1.87%	39,720,926	1.64%	34,910,714	-0.23%	-4,810,212

Detailed Rate and Accrual Comparison

		[1]	[2]		[3]		[4]	
			ETI Proposal		Cities Proposal		Difference	
Account No.	Description	Plant 12/31/2021	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	Distribution Plant							
360.20	Land Rights	12,665,251	1.82%	230,111	1.82%	230,111	0.00%	0
361.00	Structures & Improv.	37,631,098	1.49%	558,950	1.43%	538,185	-0.06%	-20,765
362.00	Station Equipment	324,622,671	2.04%	6,624,601	1.76%	5,720,851	-0.28%	-903,750
364.00	Poles, Towers & Fixtures	377,431,110	3.53%	13,337,026	3.04%	11,490,372	-0.49%	-1,846,653
365.00	OH Conductors & Devices	430,865,089	3.13%	13,467,605	2.93%	12,629,943	-0.19%	-837,662
366.00	UG Conduit	79,707,995	2.55%	2,033,794	1.89%	1,503,721	-0.67%	-530,073
367.00	UG Conductors & Devices	190,943,365	3.03%	5,792,134	2.36%	4,507,254	-0.67%	-1,284,880
368.00	Line Transformers	620,423,858	3.74%	23,174,334	3.51%	21,769,994	-0.23%	-1,404,340
369.10	Services - Overhead	110,706,160	5.21%	5,767,751	4.81%	5,326,930	-0.40%	-440,821
369.20	Services - Underground	91,471,905	3.72%	3,398,357	3.54%	3,239,347	-0.17%	-159,010
370.00	Meters (Customer)	6,257,237	6.82%	426,691	6.82%	426,691	0.00%	0
370.10	Meters (Substation)	2,728,020	11.44%	312,029	11.44%	312,029	0.00%	0
370.15	Smart Meters	110,562,286	14.29%		14.29%	0	0.00%	0
371.00	I.O.C.P	42,146,922	4.51%	1,900,563	4.29%	1,806,099	-0.22%	-94,464
373.00	Street Lighting & Signal Systems	32,750,554	4.33%	1,417,115	4.06%	1,330,955	-0.26%	-86,160
	TOTAL DISTRIBUTION PLANT	2,470,913,519	3.17%	78,441,061	2.87%	70,832,483	-0.31%	-7,608,578
	General Plant							
390.00	Structures & Improvements	64,055,161	2.58%	1,649,599	2.58%	1,649,599	0.00%	0
397.20	Microwave & Fiber Optic	17,556,205	4.26%	747,027	4.26%	747,027	0.00%	0
	TOTAL GENERAL PLANT	81,611,366	2.94%	2,396,626	2.94%	2,396,626	0.00%	0
	TOTAL DEPRECIABLE PLANT STUDIED	**6,653,110,854**	**3.85%**	**256,238,184**	**2.81%**	**186,851,981**	**-1.04%**	**-69,386,203**

[1], [2] See depreciation study
[3] Exhibit DJG-4
[4] = [3] - [2] ; Adjustments are to the proposed annual depreciation accrual corresponding to plant balances as of the depreciation study date

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]
Account No.	Description	Original Cost	Iowa Curve Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Total Accrual	Rate
	Steam Production Plant										
311.00	Structures and Improvements										
	Big Cajun 2 Common	827,847	SQ -	22	-13%	931,423	388,479	542,945	22.00	24,679	**2.98%**
	Big Cajun 2 Unit 3	19,684,801	SQ -	22	-38%	27,073,442	14,882,443	12,190,999	22.00	554,136	**2.82%**
	Lewis Creek Common	129,103,039	SQ -	13	-1%	131,008,887	21,487,588	109,521,299	13.00	8,424,715	**6.53%**
	Lewis Creek Unit 1	3,057,966	SQ -	13	-1%	3,103,109	870,092	2,233,016	13.00	171,770	**5.62%**
	Lewis Creek Unit 2	2,751,578	SQ -	13	-1%	2,792,198	783,747	2,008,451	13.00	154,496	**5.61%**
	Neches	0			-5%	0	0				
	Nelson Common	3,472,259	SQ -	21	-9%	3,777,423	1,675,600	2,101,822	21.00	100,087	**2.88%**
	Nelson Unit 6	29,566,424	SQ -	21	-9%	32,164,907	15,429,327	16,735,581	21.00	796,932	**2.70%**
	Sabine Common	28,082,978	SQ -	18	-3%	28,885,611	10,108,576	18,777,035	18.00	1,043,169	**3.71%**
	Sabine Unit 1	1,911,984	SQ -	2	-3%	1,966,630	619,029	1,347,601	5.97 *	116,631	**6.10%**
	Sabine Unit 3	2,138,683	SQ -	5	-3%	2,199,808	713,505	1,486,304	11.27 *	62,877	**2.94%**
	Sabine Unit 4	7,443,522	SQ -	5	-3%	7,656,264	3,550,958	4,105,306	13.16 *	273,922	**3.68%**
	Sabine Unit 5	9,427,831	SQ -	18	-3%	9,697,285	3,426,972	6,270,314	18.00	348,351	**3.69%**
	Spindletop	1,926,378	SQ -	30	-15%	2,208,569	177,443	2,031,126	30.00	67,704	**3.51%**
	System Repair	568,326	SQ -	18	-4%	588,314	232,816	355,499	18.00	19,750	**3.48%**
	Spindleltop Acquisition	63,917,624	SQ -	30	0%	63,917,624	63,917,624				
	Total Structures and Improvements	303,881,239			-5%	317,971,495	138,264,197	179,707,298	14.78	12,159,220	**4.00%**
312.00	Boiler Plant Equipment										
	Big Cajun 2 Common	1,012,765	SQ -	22	-13%	1,139,478	471,866	667,612	22.00	30,346	**3.00%**
	Big Cajun 2 Unit 3	60,534,154	SQ -	22	-38%	83,255,497	43,378,394	39,877,103	22.00	1,812,596	**2.99%**
	Lewis Creek Common	5,307,683	SQ -	13	-1%	5,386,036	1,741,101	3,644,936	13.00	280,380	**5.28%**
	Lewis Creek Unit 1	39,355,417	SQ -	13	-1%	39,936,391	11,885,620	28,050,771	13.00	2,157,752	**5.48%**
	Lewis Creek Unit 2	41,035,809	SQ -	13	-1%	41,641,589	11,801,699	29,839,890	13.00	2,295,376	**5.59%**
	Nelson Common	2,891,969	SQ -	21	-9%	3,146,133	1,540,297	1,605,836	21.00	76,468	**2.64%**
	Nelson Unit 6	121,567,392	SQ -	21	-9%	132,251,500	57,453,244	74,798,256	21.00	3,561,822	**2.93%**
	Sabine Common	23,057,826	SQ -	18	-3%	23,716,836	9,434,525	14,282,311	18.00	793,462	**3.44%**
	Sabine Unit 1	15,552,035	SQ -	2	-3%	15,996,524	8,193,445	7,803,079	5.97 *	825,813	**5.31%**
	Sabine Unit 3	32,836,733	SQ -	5	-3%	33,775,232	14,829,278	18,945,954	11.27 *	1,349,590	**4.11%**
	Sabine Unit 4	55,955,054	SQ -	5	-3%	57,554,293	23,483,839	34,070,454	13.16 *	2,820,135	**5.04%**
	Sabine Unit 5	78,863,803	SQ -	18	-3%	81,117,791	31,540,217	49,577,575	18.00	2,754,310	**3.49%**
	Spindletop	114,140	SQ -	30	-15%	130,860	20,450	110,410	30.00	3,680	**3.22%**
	Total Boiler Plant Equipment	478,084,780			-9%	519,048,161	215,773,975	303,274,186	16.16	18,761,728	**3.92%**
312.10	Nelson Railcars	1,061,827			0%	1,061,827	198,962	862,865	21.00	41,089	**3.87%**
314.00	Turbogenerator Units										
	Big Cajun 2 Common	316,524	SQ -	22	-13%	356,126	160,496	195,629	22.00	8,892	**2.81%**
	Big Cajun 2 Unit 3	18,427,011	SQ -	22	-38%	25,343,544	13,817,076	11,526,468	22.00	523,930	**2.84%**
	Lewis Creek Common	1,099,747	SQ -	13	-1%	1,115,982	249,843	866,139	13.00	66,626	**6.06%**
	Lewis Creek Unit 1	38,129,257	SQ -	13	-1%	38,692,130	10,159,422	28,532,708	13.00	2,194,824	**5.76%**
	Lewis Creek Unit 2	45,063,580	SQ -	13	-1%	45,728,818	10,544,218	35,184,600	13.00	2,706,508	**6.01%**
	Nelson Common	150,434	SQ -	21	-9%	163,655	60,537	103,118	21.00	4,910	**3.26%**
	Nelson Unit 6	29,770,611	SQ -	21	-9%	32,387,039	13,171,651	19,215,388	21.00	915,018	**3.07%**

Depreciation Rate Development

Account No.	Description	[1] Original Cost	[2] Iowa Curve Type	Iowa Curve AL	[3] Net Salvage	[4] Depreciable Base	[5] Book Reserve	[6] Future Accruals	[7] Remaining Life		[8] Total Accrual	[9] Total Rate
	Sabine Common	3,799,176	SQ	18	-3%	3,907,760	601,209	3,306,550	18.00		183,697	**4.84%**
	Sabine Unit 1	31,611,967	SQ	2	-3%	32,515,461	16,043,783	16,471,678	5.97	*	3,429,898	**10.85%**
	Sabine Unit 3	34,009,548	SQ	5	-3%	34,981,567	14,137,879	20,843,689	11.27	*	2,244,630	**6.60%**
	Sabine Unit 4	63,788,493	SQ	5	-3%	65,611,617	21,158,722	44,452,895	13.16	*	3,348,896	**5.25%**
	Sabine Unit 5	61,728,419	SQ	18	-3%	63,492,665	20,853,107	42,639,559	18.00		2,368,864	**3.84%**
	Total Turbogenerator Units	327,894,767			-5%	344,296,365	120,957,944	223,338,421	12.41		17,996,695	**5.49%**
315.00	Accessory Electric Equipment											
	Big Cajun 2 Common	847,724	SQ	22	-13%	953,788	433,909	519,879	22.00		23,631	**2.79%**
	Big Cajun 2 Unit 3	12,166,066	SQ	22	-38%	16,732,569	9,021,217	7,711,352	22.00		350,516	**2.88%**
	Lewis Creek Common	3,879,691	SQ	13	-1%	3,936,964	1,395,955	2,541,009	13.00		195,462	**5.04%**
	Lewis Creek Unit 1	6,656,788	SQ	13	-1%	6,755,057	2,191,893	4,563,164	13.00		351,013	**5.27%**
	Lewis Creek Unit 2	5,445,485	SQ	13	-1%	5,525,873	1,529,978	3,995,895	13.00		307,377	**5.64%**
	Nelson Common	523,560	SQ	21	-9%	569,573	182,928	386,645	21.00		18,412	**3.52%**
	Nelson Unit 6	20,861,464	SQ	21	-9%	22,694,901	11,075,237	11,619,664	21.00		553,317	**2.65%**
	Sabine Common	6,744,857	SQ	18	-3%	6,937,630	2,444,564	4,493,066	18.00		249,615	**3.70%**
	Sabine Unit 1	7,364,898	SQ	2	-3%	7,575,393	3,946,480	3,628,913	5.97	*	526,590	**7.15%**
	Sabine Unit 3	9,743,562	SQ	5	-3%	10,022,040	3,917,170	6,104,870	11.27	*	546,614	**5.61%**
	Sabine Unit 4	8,365,787	SQ	5	-3%	8,604,887	3,886,783	4,718,104	13.16	*	195,759	**2.34%**
	Sabine Unit 5	23,128,294	SQ	18	-3%	23,789,319	8,783,474	15,005,844	18.00		833,658	**3.60%**
	Spindletop	6,071,612	SQ	30	-15%	6,961,028	998,741	5,962,287	30.00		198,743	**3.27%**
	System Repair Shop	95,188	SQ	18	-4%	98,536	39,007	59,529	18.00		3,307	**3.47%**
	Total Accessory Electric Equipment	111,894,977			-8%	121,157,559	49,847,339	71,310,220	16.38		4,354,014	**3.89%**
316.00	Miscellaneous Power Plant Equipment											
	Big Cajun 2 Common	540,687	SQ	22	-13%	608,336	254,969	353,367	22.00		16,062	**2.97%**
	Big Cajun 2 Unit 3	829,561	SQ	22	-38%	1,140,935	583,157	557,778	22.00		25,354	**3.06%**
	Lewis Creek Common	2,842,564	SQ	13	-1%	2,884,526	748,472	2,136,054	13.00		164,312	**5.78%**
	Lewis Creek Unit 1	37,396	SQ	13	-1%	37,948	5,802	32,147	13.00		2,473	**6.61%**
	Nelson Common	346,939	SQ	21	-9%	377,430	109,013	268,417	21.00		12,782	**3.68%**
	Nelson Unit 6	1,658,691	SQ	21	-9%	1,804,467	786,057	1,018,410	21.00		48,496	**2.92%**
	Sabine Common	5,766,940	SQ	18	-3%	5,931,763	1,631,946	4,299,817	18.00		238,879	**4.14%**
	Sabine Unit 1	91,345	SQ	2	-3%	93,955	48,054	45,901	5.97	*	8,632	**9.45%**
	Sabine Unit 4	101,334	SQ	5	-3%	104,230	23,485	80,745	13.16	*	5,239	**5.17%**
	Sabine Unit 5	75,138	SQ	18	-3%	77,285	3,281	74,004	18.00		4,111	**5.47%**
	Spindletop	387,507	SQ	30	-15%	444,272	74,081	370,192	30.00		12,340	**3.18%**
	System Production Laboratory	201,820	SQ	22	-4%	208,918	81,577	127,341	18.00		7,074	**3.51%**
	System Production Maintenance	2,082,313	SQ	18	-4%	2,155,550	850,684	1,304,866	18.00		72,493	**3.48%**
	System Production Training	775,378	SQ	18	-4%	802,648	318,427	484,221	18.00		26,901	**3.47%**
	System Repair	56,275	SQ	18	-4%	58,254	22,791	35,462	18.00		1,970	**3.50%**
	Total Miscellaneous Power Plant Equipment	15,793,887			-6%	16,730,520	5,541,798	11,188,722	17.29		647,117	**4.10%**
	TOTAL STEAM PRODUCTION PLANT	1,238,611,477			-7%	1,320,265,927	530,584,215	789,681,712	14.63		53,959,863	**4.36%**

Other Production Plant

Depreciation Rate Development

Account No.	Description	[1] Original Cost	[2] Iowa Curve Type	AL	[3] Net Salvage	[4] Depreciable Base	[5] Book Reserve	[6] Future Accruals	[7] Remaining Life	[8] Total Accrual	[9] Total Rate
341.00	Structures and Improvements										
	Hardin County Common	1,492,258	SQ -	20	-4%	1,548,357	37,306	1,511,051	20.00	75,553	**5.06%**
	Hardin County Unit 1	83,536	SQ -	20	-4%	86,676	2,088	84,588	20.00	4,229	**5.06%**
	Hardin County Unit 2	83,536	SQ -	20	-4%	86,676	2,088	84,588	20.00	4,229	**5.06%**
	Montgomery County Power Station	40,531,160	SQ -	30	-1%	40,915,813	854,125	40,061,687	30.00	1,335,390	**3.29%**
	Total Structures and Improvements	42,190,490			-1%	42,637,522	895,609	41,741,914	29.41	1,419,401	**3.36%**
342.00	Fuel Holders, Producers, and Accessories										
	Hardin County Common	1,738,071	SQ -	20	-4%	1,803,411	43,452	1,759,959	20.00	87,998	**5.06%**
	Montgomery County Power Station	9,682,165	SQ -	30	-1%	9,774,052	240,636	9,533,416	30.00	317,781	**3.28%**
	Total Fuel Holders, Producers, and Accessories	11,420,236			-1%	11,577,463	284,088	11,293,375	27.83	405,778	**3.55%**
343.00	Prime Movers										
	Hardin County Unit 1	10,548,635	SQ -	20	-4%	10,945,193	263,716	10,681,477	20.00	534,074	**5.06%**
	Hardin County Unit 2	10,548,635	SQ -	20	-4%	10,945,193	263,716	10,681,477	20.00	534,074	**5.06%**
	Montgomery County Power Station	332,427,455	SQ -	30	-1%	335,582,293	8,244,499	327,337,794	30.00	10,911,260	**3.28%**
	Total Prime Movers	353,524,725			-1%	357,472,678	8,771,930	348,700,748	29.11	11,979,407	**3.39%**
34.00	Generators										
	Hardin County Common	495,504	SQ -	20	-4%	514,132	12,388	501,744	20.00	25,087	**5.06%**
	Hardin County Unit 1	330,662	SQ -	20	-4%	343,093	8,267	334,826	20.00	16,741	**5.06%**
	Hardin County Unit 2	330,662	SQ -	20	-4%	343,093	8,267	334,826	20.00	16,741	**5.06%**
	HEB Backup Generator	1,201,959	SQ -	18	0%	1,201,959	90,172	1,111,787	18.00	61,766	**5.14%**
	HEB Grocery	1,302,064	SQ -	20	0%	1,302,064		1,302,064	20.00	65,103	**5.00%**
	Montgomery County Power Station	240,926,511	SQ -	30	-1%	243,212,977	5,977,686	237,235,291	30.00	7,907,843	**3.28%**
	Total Generators	244,587,362			-1%	246,917,317	6,096,778	240,820,539	29.76	8,093,282	**3.31%**
345.00	Accessory Electrical Equipment										
	Hardin County Common	537,374	SQ -	20	-4%	557,576	13,434	544,141	20.00	27,207	**5.06%**
	Hardin County Unit 1	1,112,879	SQ -	20	-4%	1,154,716	27,822	1,126,894	20.00	56,345	**5.06%**
	Hardin County Unit 2	1,112,879	SQ -	20	-4%	1,154,716	27,822	1,126,894	20.00	56,345	**5.06%**
	Montgomery County Power Station	73,471,796	SQ -	30	-1%	74,169,066	1,826,032	72,343,034	30.00	2,411,434	**3.28%**
	Total Accessory Electrical Equipment	76,234,929			-1%	77,036,074	1,895,110	75,140,963	29.45	2,551,331	**3.35%**
346.00	Miscellaneous Power Plant Equipment										
	Hardin County Common	1,500,396	SQ -	20	-4%	1,556,801	37,510	1,519,291	20.00	75,965	**5.06%**
	Hardin County Unit 1	170,615	SQ -	20	-4%	177,029	4,265	172,764	20.00	8,638	**5.06%**
	Hardin County Unit 2	170,615	SQ -	20	-4%	177,029	4,265	172,764	20.00	8,638	**5.06%**
	Montgomery County Power Station	6,387,425	SQ -	30	-1%	6,448,044	152,396	6,295,648	30.00	209,855	**3.29%**
	Total Miscellaneous Power Plant Equipment	8,229,051			-2%	8,358,903	198,437	8,160,466	26.92	303,096	**3.68%**
	TOTAL OTHER PRODUCTION PLANT	736,186,792			-1%	743,999,956	18,141,952	725,858,004	29.32	24,752,296	**3.36%**

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]
Account No.	Description	Original Cost	Iowa Curve Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Total Accrual	Rate
	Transmission Plant										
350.00	Land Rights	59,793,615	R3	85	0%	59,793,615	19,889,803	39,903,812	61.67	647,079	**1.08%**
352.00	Structures & Improv.	86,807,346	R3	81	-23%	106,773,035	11,373,767	95,399,268	73.08	1,305,430	**1.50%**
353.00	Station Equipment	976,935,145	R1	70	-25%	1,221,168,932	196,787,218	1,024,381,714	61.43	16,675,594	**1.71%**
354.00	Towers & Fixtures	31,662,294	R4	79	-6%	33,562,032	18,492,698	15,069,334	45.89	328,379	**1.04%**
355.00	Poles & Fixtures	629,338,371	R1	77	-34%	843,313,417	93,084,492	750,228,925	70.87	10,585,987	**1.68%**
356.00	OH Conductors & Devices	340,726,426	R1.5	82	-34%	456,573,411	79,532,061	377,041,350	70.34	5,359,956	**1.57%**
358.00	UG Conductors & Devices	321,717	R2	50	0%	321,717	110,656	211,061	35.81	5,894	**1.83%**
359.00	Roads & Trails	202,785	R5	65	0%	202,785	137,467	65,318	27.27	2,395	**1.18%**
	TOTAL TRANSMISSION PLANT	2,125,787,700			-28%	2,721,708,944	419,408,162	2,302,300,782	65.95	34,910,714	**1.64%**
	Distribution Plant										
360.20	Land Rights	12,665,251	R3	70	0%	12,665,251	3,939,676	8,725,574	37.92	230,111	**1.82%**
361.00	Structures & Improv.	37,631,098	R1.5	80	-11%	41,770,518	2,757,025	39,013,493	72.49	538,185	**1.43%**
362.00	Station Equipment	324,622,671	R0.5	70	-21%	392,793,432	44,050,336	348,743,097	60.96	5,720,851	**1.76%**
364.00	Poles, Towers & Fixtures	377,431,110	R1	47	-34%	505,757,688	85,899,483	419,858,205	36.54	11,490,372	**3.04%**
365.00	OH Conductors & Devices	430,865,089	R1	45	-23%	529,964,060	75,215,068	454,748,992	36.01	12,629,943	**2.93%**
366.00	UG Conduit	79,707,995	R2	60	-11%	88,475,874	15,801,026	72,674,848	48.33	1,503,721	**1.89%**
367.00	UG Conductors & Devices	190,943,365	R2	46	-2%	194,762,232	44,400,235	150,361,997	33.36	4,507,254	**2.36%**
368.00	Line Transformers	620,423,858	L0.5	37	-23%	763,121,345	89,877,298	673,244,047	30.93	21,769,994	**3.51%**
369.10	Services - Overhead	110,706,160	S4	29	-18%	130,633,268	36,988,216	93,645,052	17.58	5,326,930	**4.81%**
369.20	Services - Underground	91,471,905	R5	37	-11%	101,533,814	26,995,149	74,538,665	23.01	3,239,347	**3.54%**
370.00	Meters (Customer)	6,257,237	L0	17	-5%	6,570,098	1,090,951	5,479,147	12.84	426,691	**6.82%**
370.10	Meters (Substation)	2,728,020	L0	17	-5%	2,864,421	1,411,740	1,452,681	4.66	312,029	**11.44%**
370.15	Smart Meters	110,562,286	SQ	7	0%	110,562,286	21,462,382				**14.29%**
371.00	I.O.C.P	42,146,922	R0.5	32	-11%	46,783,083	14,550,150	32,232,933	17.85	1,806,099	**4.29%**
373.00	Street Lighting & Signal Systems	32,750,554	R0.5	32	-23%	40,283,181	4,869,360	35,413,821	26.61	1,330,955	**4.06%**
	TOTAL DISTRIBUTION PLANT	2,470,913,519			-20%	2,968,540,552	469,308,096	2,410,132,552	34.03	70,832,483	**2.87%**
	General Plant										
390.00	Structures & Improvements	64,055,161	R1.5	50	-15%	73,663,435	19,654,050	54,009,385	32.74	1,649,599	**2.58%**
397.20	Microwave & Fiber Optic	17,556,205	S4	23	0%	17,556,205	6,631,032	10,925,174	14.62	747,027	**4.26%**
	TOTAL GENERAL PLANT	81,611,366			-12%	91,219,640	26,285,082	64,934,558	27.09	2,396,626	**2.94%**
	TOTAL DEPRECIABLE PLANT STUDIED	**6,653,110,854**			**-18%**	**7,845,735,020**	**1,463,727,507**	**6,292,907,609**	**33.68**	**186,851,981**	**2.81%**

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]
Account No.	Description	Original Cost	Iowa Curve Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Total Accrual	Rate

[1] Company depreciation study
[2] Average life and Iowa curve shape developed through actuarial analysis and professional judgment
[3] Weighted net salvage for life span accounts from weighted net salvage exhibit; net salvage for mass accounts developed through statistical analysis and professional judgment
[4] = [1]*(1-[3])
[5] Company depreciation study
[6] = [4] - [5]
[7] Composite remaining life based on Iowa cuve in [2]; see remaining life exhibit for detailed calculations
[8] = [6] / [7]
[9] = [8] / [1]
*Remaining lives based on calculated recovery period at current rates - see direct testimony of Cities witness Mark Garrett, Exhibit MG-2.

Terminal Net Salvage Adjustment

Units	[1] Original Cost	[2] Proposed Removal Cost	[3] Contingency Costs	[4] Adjusted Removal Cost	[5] ETI Ownership %	[6] ETI Net Removal Cost	[7] Net Salvage
Big Cajun 2 Common	3,545,547	105,912,599	10,020,600	95,891,999	14%	443,604	-12.5%
Big Cajun 2 Unit 3	111,641,594	9,063,464	2,014,500	7,048,964	42%	41,904,392	-37.5%
Lewis Creek	323,766,000	5,622,951	843,443	4,779,508	100%	4,779,508	-1.5%
Nelson	210,809,742	30,996,553	4,529,000	26,467,553	70%	18,527,287	-8.8%
Sabine	511,590,206	21,321,644	6,700,000	14,621,644	100%	14,621,644	-2.9%
Spindletop	8,499,637	1,492,892	247,800	1,245,092	100%	1,245,092	-14.6%
System Production	3,059,511	126,595	18,989	107,606	100%	107,606	-3.5%
System Repair	719,789	29,783	4,467	25,316	100%	25,316	-3.5%
Total	1,173,632,026	174,566,481	24,378,799	150,187,682		81,654,449	

[1] Total original cost per unit as of depreciation study date

[2] Company proposed net removal cost from Exhibit SCM-2 and assumed ETI ownership removal cost from Appendix D2

[3] Contingency factor of 10% proposed by Mr. McHone in Exhibit SCM-2 and based on assumed ETI ownership removal cost from Appendix D2

[4] = [2] - [3]

[5] ETI unit ownership percentage

[6] = [4] * [5]

[7] = [6] / [1] * -1 ; net salvage rates applied in Exhibit DJG-4

Account 353 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] Company R1-64	[5] Cities R1-70	[6] Company SSD	[7] Garrett SSD
0.0	1,018,765,889	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	991,041,850	99.93%	99.80%	99.82%	0.0000	0.0000
1.5	831,261,090	99.86%	99.39%	99.44%	0.0000	0.0000
2.5	688,427,281	99.71%	98.97%	99.06%	0.0001	0.0000
3.5	652,275,185	99.38%	98.54%	98.67%	0.0001	0.0000
4.5	583,375,233	99.18%	98.11%	98.28%	0.0001	0.0001
5.5	456,773,198	98.89%	97.66%	97.87%	0.0002	0.0001
6.5	431,954,747	97.79%	97.21%	97.46%	0.0000	0.0000
7.5	418,318,229	97.05%	96.75%	97.05%	0.0000	0.0000
8.5	395,153,387	96.68%	96.28%	96.62%	0.0000	0.0000
9.5	377,334,486	96.41%	95.80%	96.19%	0.0000	0.0000
10.5	350,296,201	96.07%	95.31%	95.75%	0.0001	0.0000
11.5	336,112,347	95.65%	94.81%	95.30%	0.0001	0.0000
12.5	328,559,338	95.13%	94.30%	94.85%	0.0001	0.0000
13.5	313,703,085	94.49%	93.79%	94.38%	0.0000	0.0000
14.5	306,610,330	93.96%	93.27%	93.91%	0.0000	0.0000
15.5	282,959,012	93.22%	92.73%	93.44%	0.0000	0.0000
16.5	258,903,865	92.48%	92.19%	92.95%	0.0000	0.0000
17.5	251,177,819	91.63%	91.64%	92.46%	0.0000	0.0001
18.5	217,569,688	91.20%	91.09%	91.97%	0.0000	0.0001
19.5	194,185,699	89.88%	90.52%	91.46%	0.0000	0.0003
20.5	172,472,384	89.13%	89.95%	90.95%	0.0001	0.0003
21.5	167,605,501	88.52%	89.37%	90.43%	0.0001	0.0004
22.5	162,463,172	88.23%	88.78%	89.91%	0.0000	0.0003
23.5	155,307,107	87.61%	88.18%	89.37%	0.0000	0.0003
24.5	152,839,802	86.83%	87.57%	88.84%	0.0001	0.0004
25.5	145,605,506	86.41%	86.95%	88.29%	0.0000	0.0004
26.5	142,652,186	85.97%	86.32%	87.73%	0.0000	0.0003
27.5	141,886,940	85.58%	85.68%	87.17%	0.0000	0.0003
28.5	138,358,332	85.13%	85.03%	86.60%	0.0000	0.0002
29.5	139,070,601	84.41%	84.37%	86.02%	0.0000	0.0003
30.5	136,994,691	83.86%	83.70%	85.43%	0.0000	0.0002
31.5	135,393,214	82.96%	83.01%	84.83%	0.0000	0.0004
32.5	133,426,892	81.74%	82.32%	84.23%	0.0000	0.0006
33.5	132,610,879	81.29%	81.61%	83.61%	0.0000	0.0005
34.5	132,228,778	80.89%	80.88%	82.98%	0.0000	0.0004
35.5	112,848,362	80.55%	80.15%	82.35%	0.0000	0.0003
36.5	105,359,065	79.60%	79.40%	81.70%	0.0000	0.0004
37.5	94,586,298	78.79%	78.64%	81.04%	0.0000	0.0005
38.5	87,748,881	78.33%	77.86%	80.37%	0.0000	0.0004
39.5	74,775,345	77.18%	77.07%	79.69%	0.0000	0.0006
40.5	61,060,697	76.86%	76.26%	79.00%	0.0000	0.0005
41.5	57,685,709	75.80%	75.44%	78.29%	0.0000	0.0006
42.5	51,115,653	75.57%	74.60%	77.58%	0.0001	0.0004
43.5	49,377,234	75.15%	73.75%	76.85%	0.0002	0.0003
44.5	49,157,768	74.45%	72.88%	76.11%	0.0002	0.0003
45.5	46,024,230	74.04%	72.00%	75.36%	0.0004	0.0002
46.5	45,122,208	73.63%	71.10%	74.59%	0.0006	0.0001
47.5	43,854,835	72.71%	70.18%	73.81%	0.0006	0.0001
48.5	42,193,627	72.25%	69.25%	73.02%	0.0009	0.0001
49.5	36,139,767	70.69%	68.30%	72.21%	0.0006	0.0002
50.5	28,118,089	69.57%	67.34%	71.39%	0.0005	0.0003
51.5	26,346,649	69.08%	66.36%	70.56%	0.0007	0.0002
52.5	24,886,835	66.17%	65.36%	69.72%	0.0001	0.0013
53.5	22,800,291	65.61%	64.35%	68.86%	0.0002	0.0011
54.5	21,424,815	64.78%	63.33%	67.99%	0.0002	0.0010
55.5	19,916,525	62.98%	62.29%	67.10%	0.0000	0.0017
56.5	19,333,646	62.55%	61.23%	66.20%	0.0002	0.0013

Account 353 Curve Fitting

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**Company R1-64**	**Cities R1-70**	**Company SSD**	**Garrett SSD**
57.5	18,784,182	62.32%	60.16%	65.29%	0.0005	0.0009
58.5	18,391,261	62.22%	59.08%	64.37%	0.0010	0.0005
59.5	16,683,589	62.01%	57.98%	63.43%	0.0016	0.0002
60.5	16,114,572	60.38%	56.87%	62.48%	0.0012	0.0004
61.5	14,574,721	60.22%	55.75%	61.52%	0.0020	0.0002
62.5	13,169,926	59.75%	54.62%	60.55%	0.0026	0.0001
63.5	12,387,744	59.73%	53.47%	59.56%	0.0039	0.0000
64.5	10,469,513	59.64%	52.32%	58.57%	0.0054	0.0001
65.5	8,417,982	59.37%	51.15%	57.56%	0.0068	0.0003
66.5	7,726,898	59.12%	49.97%	56.54%	0.0084	0.0007
67.5	5,744,484	59.04%	48.79%	55.51%	0.0105	0.0012
68.5	5,753,475	59.04%	47.60%	54.47%	0.0131	0.0021
69.5	4,309,651	58.96%	46.40%	53.42%	0.0158	0.0031
70.5	4,241,950	58.96%	45.19%	52.37%	0.0190	0.0043
71.5	4,044,147	58.96%	43.98%	51.30%	0.0224	0.0059
72.5	4,041,003	58.96%	42.76%	50.23%	0.0262	0.0076
73.5	3,977,777	58.81%	41.54%	49.15%	0.0298	0.0093
74.5	3,746,856	58.80%	40.32%	48.06%	0.0342	0.0115
75.5	3,717,567	58.66%	39.09%	46.96%	0.0383	0.0137
76.5	3,652,089	58.66%	37.87%	45.86%	0.0432	0.0164
77.5	3,138,294	58.65%	36.65%	44.76%	0.0484	0.0193
78.5	1,064,840	52.14%	35.42%	43.65%	0.0279	0.0072
79.5	1,064,840	52.14%	34.20%	42.53%	0.0322	0.0092
80.5	1,016,301	52.14%	32.99%	41.42%	0.0367	0.0115
81.5	1,016,301	52.14%	31.78%	40.30%	0.0415	0.0140
82.5	1,023,293	52.14%	30.57%	39.18%	0.0465	0.0168
83.5	8,043	52.14%	29.38%	38.06%	0.0518	0.0198
84.5	8,043	52.14%	28.19%	36.94%	0.0574	0.0231
85.5	8,043	52.14%	27.01%	35.82%	0.0632	0.0266
86.5	6,992	52.14%	25.84%	34.71%	0.0692	0.0304
87.5	6,992	52.14%	24.69%	33.59%	0.0754	0.0344
88.5	6,992	52.14%	23.55%	32.48%	0.0818	0.0386
89.5	6,992	52.14%	22.42%	31.38%	0.0883	0.0431
90.5			21.31%	30.28%		
Sum of Squared Differences				[8]	1.0130	0.3906
Up to 1% of Beginning Exposures				[9]	0.0251	0.0203

[1] Age in years using half-year convention
[2] Dollars exposed to retirement at the beginning of each age interval
[3] Observed life table based on the Company's property records. These numbers form the original survivor curve.
[4] The Company's selected Iowa curve to be fitted to the OLT.
[5] My selected Iowa curve to be fitted to the OLT.
[6] = ([4] - [3])^2. This is the squared difference between each point on the Company's curve and the observed survivor curve.
[7] = ([5] - [3])^2. This is the squared difference between each point on my curve and the observed survivor curve.
[8] = Sum of squared differences. The smallest SSD represents the best mathematical fit.