BEFORE THE CORPORATION COMMISSION OF THE STATE OF OKLAHOMA

APPLICATION OF PUBLIC SERVICE COMPANY OF OKLAHOMA, AN OKLAHOMA CORPORATION, FOR AN ADJUSTMENT IN ITS RATES AND CHARGES AND THE ELECTRIC SERVICE RULES, REGULATIONS AND CONDITIONS OF SERVICE FOR ELECTRIC SERVICE IN THE STATE OF OKLAHOMA AND TO APPROVE A FORMULA BASE RATE PROPOSAL	CAUSE NO. PUD 2022-000093

RESPONSIVE TESTIMONY OF

DAVID J. GARRETT

PART II – DEPRECIATION

ON BEHALF OF
OKLAHOMA INDUSTRIAL ENERGY CONSUMERS

MARCH 7, 2023

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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 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 have testified in numerous regulatory proceedings in multiple jurisdictions on the issues 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]

Q. Have your qualifications as an expert witness been accepted by the Oklahoma Corporation Commission?

A. Yes. I have testified before the Oklahoma Corporation Commission (the "Commission") many times and my qualifications have been accepted each time.

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

A. I am testifying on behalf of Oklahoma Industrial Energy Consumers ("OIEC").

Q. Describe the scope and organization of your testimony.

A. In this case, I am testifying on the two primary capital recovery mechanisms for regulated utilities – return on equity and depreciation – regarding the pending application of Public Service Company of Oklahoma ("PSO" or the "Company"). Collectively, these issues are voluminous, so I am submitting two separate responsive testimony documents – Part I and Part II. Part I of my responsive testimony addresses rate of return, cost of capital and related issues, and I respond to the Direct Testimony of Company witnesses Adrien McKenzie and Christopher Garcia. Part II of my responsive testimony (this document) addresses depreciation rates and related issues, and I respond to the Direct Testimony of Company witness Jason Cash. The exhibits attached to Part I of my testimony have a prefix of "DJG-1," and the exhibits attached to Part II of my testimony have a prefix of "DJG-2."

[1] Exhibit DJG-1-1.

II. EXECUTIVE SUMMARY

Q. Summarize the key points of your testimony.

A. In this case, PSO is proposing a substantial increase to its annual depreciation accrual in the amount of $47.4 million.[2] As demonstrated by the evidence presented in this testimony, it would not be reasonable to accept PSO's proposed depreciation rates, as doing so would result in an excessive increase in rates. The table below summarizes OIEC's proposed adjustments to PSO's proposed depreciation accrual by plant function.[3]

Figure 1:
Summary Depreciation Expense Adjustment

Plant Function	PSO Proposal Rate	PSO Proposal Accrual	OIEC Proposed Rate	OIEC Proposed Accrual	OIEC Adjustment Rate	OIEC Adjustment Adjustment
Production	6.12%	$ 108,111,657	3.22%	$ 56,905,614	-2.90%	$ (51,206,044)
Transmission	2.70%	29,794,582	2.70%	29,794,582	0.00%	-
Distribution	3.00%	89,916,398	2.95%	88,367,616	-0.05%	(1,548,782)
General	4.93%	11,076,940	4.93%	11,076,940	0.00%	-
Total Plant Studied	**3.92%**	**$ 238,899,578**	**3.06%**	**$ 186,144,752**	**-0.87%**	**$ (52,754,826)**

Accepting my proposed depreciation rates would result in an adjustment reducing PSO's proposed depreciation accrual by $52.7 million. In addition, I support OIEC's recommendation to reject PSO's proposal to amortize its software assets over five years, rather than the 10-year period that has been previously approved by the Commission. The

[2] Direct Testimony of Jason A. Cash, p. 4, Table 1.

[3] *See* Exhibit DJG-2-1. The depreciation accrual adjustments apply to PSO's plant balances as of December 31, 2021. For OIEC's proposed adjustments to PSO's depreciation expense, please see the direct testimony of OIEC witness Mark E. Garrett.

estimated impact of this adjustment is $15.8 million.[4] The primary factors comprising OIEC's adjustments are summarized below:

1. <u>Retaining 2040 Retirement Date for Northeast Unit 3 Cost Recovery</u>

PSO plans on retiring Northeast Unit 3 in 2026. In previous cases, PSO proposed, and the Commission approved, a retirement date of 2040 for Northeast Unit 3. Regardless of the planned early retirement date of Northeast Unit 3, OIEC is recommending the continued use of the 2040 date for cost recovery purposes.

2. <u>Contingency Costs</u>

PSO is proposing the recovery of contingency costs as part of its demolition cost estimates. This proposal adds more than $22 million to PSO's estimated demolition costs. Contingency costs are not known or measurable by definition. The Commission has specifically denied recovery of these costs in prior cases. It should also deny them in this case.

3. <u>Demolition Cost Escalation</u>

PSO proposes to escalate the present value of its demolition cost estimates to the future retirement date of each of its generating units. This decision would add more than $50 million to its terminal net salvage cost estimates. The Commission has specifically denied the inclusion of such escalation factors in prior cases, and it should also deny them in this case.

4. <u>Mass Property Service Lives</u>

For several transmission and distribution accounts, PSO is proposing service lives that are shorter than those indicated by the Company's historical retirement data, which results in unreasonably high proposed depreciation rates and expense for these accounts.

5. <u>Software Amortization Period</u>

PSO has failed to provide any evidence demonstrating that the average service life of its software assets is only five years. Many utilities utilize amortization periods as long as 15 years for their software assets. I recommend the Commission continue utilizing the currently-approved 10-year amortization period for these assets.

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[4] *See* Direct Testimony of Jason A. Cash, p. 16, lines 12-14; *see also* Direct Testimony of Mark E. Garrett for OIEC's quantification of the adjustment to amortization expense.

The impact to OIEC's overall depreciation accrual adjustment caused by each of these issues is summarized in the table below.

Figure 2:
Broad Issue Impacts

Issue	Impact ($Mil)
1. Retain 2040 Retirement Date for Northeast Unit 3 for cost recovery purposes	$44.2
2. Remove contingency costs from PSO's demolition cost estimates	$2.7
3. Remove escalation factors from present value demolition cost estimates	$4.3
4. Adjust service lives for several mass property accounts based on PSO's retirement data	$1.5
5. Continuing using a 10-year amortization period for software assets.	$15.8
Total	**$68.5 million**

Each of these issues will be further discussed in my testimony. Adopting these adjustments would provide economic relief to ratepayers in the face of an otherwise significant rate increase proposed by PSO.

III. REGULATORY STANDARDS

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

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

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:

> [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 Commission must 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

[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 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).

depreciation expense. The cost allocation concept also satisfies several fundamental accounting principles, including verifiability, neutrality, and the matching principle.[9] The 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 method of allocation; 2) a procedure for applying the method of allocation; 3) a technique of applying

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

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

[11] Wolf *supra* n. 9, at 73.

the depreciation rate; and 4) a model for analyzing the characteristics of vintage property groups.[12] In this case, I used the straight-line method, the average life procedure, the 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 legal 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. Has the Commission adopted rates developed under this depreciation system?

A. Yes. The Commission has adopted depreciation rates developed by various parties using the same or substantially similar depreciation system I have employed in this case.

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

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[12] *See* Wolf *supra* n. 9, at 70, 140.

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 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.

Q. Please describe the Company's depreciable assets in this case.

A. The Company's depreciable assets can be divided into two main groups: life span property (i.e., production plant) and mass property (i.e., transmission and distribution plant). The analytical process is slightly different for each type of property, as discussed further below.

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,

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[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).

[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.

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 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. Northeast Unit 3 Retirement Date

Q. Please summarize the Company's proposal regarding its Northeast Unit 3 plant.

A. According to PSO, the Northeast Unit 3 plant will retire in 2026.[16] Its previous retirement date was 2040, which was approved by the Commission in Cause No. PUD 201500208.[17] The Company is proposing to accelerate the depreciation cost recovery for Northeast from its previous retirement date of 2040 to 2026, which effectively adds about $44 million to its proposed annual depreciation accrual.

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[16] *See* Direct Testimony of Jason A. Cash, p. 3, line 13.

[17] See Order No. 657877 in Cause No. PUD 201500208 (Nov. 10, 2016).

Q. Please describes the Commission's prior ruling regarding the retirement date of Northeast Unit 3.

A. In the Final Order in PSO's rate case filed in 2015, the Commission held that "PSO should be denied cost recovery for the accelerated depreciation that PSO seeks to recover for Northeastern Units 3 and 4 over the 2016 to 2026 period and that, to mitigate rate increases, depreciation for the undepreciated, "original" costs of these two units should continue on its current pace to 2040."[18] In its 2021 rate case, the Company also proposed to accelerate the retirement date of Northeastern Unit 3 to 2026, but stipulating parties in that case agreed on depreciation rates were not based on an accelerated retirement date.[19]

Q. Do your proposed depreciation rates for Northeast Unit 3 use a remaining life to 2040?

A. Yes. The remaining life depreciation rates I calculate for the Northeast Unit 3 accounts use a terminal retirement date of 2040. For the substantive arguments in support of OIEC's position regarding the depreciable life of Northeast Unit 3, please see the responsive testimony of OIEC witness Mark E. Garrett.[20]

B. <u>Terminal Net Salvage (Dismantling Cost) Analysis</u>

Q. Describe the meaning of terminal net salvage.

A. When a production plant reaches the end of its useful life, a utility may decide to decommission the plant. In that case, the utility may sell some of the remaining assets.

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[18] *Id*. at p. 5.

[19] Joint Stipulation and Settlement Agreement, Cause No. PUD 202100055.

[20] *See also* Exhibit DJG-2-5 through Exhibit DJG-2-10 for the remaining life calculations for the Northeast Unit 3 accounts.

The proceeds from this transaction are called "gross salvage." The corresponding expense associated with dismantling 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. Describe how electric utilities typically support terminal net salvage recovery for production assets?

A. Typically, when a utility is requesting the recovery of a substantial amount of terminal net salvage costs, it supports those costs with site-specific dismantling studies.

Q. Did PSO provide dismantling studies in this case to support its proposed net salvage rates for production plant?

A. Yes. PSO provided dismantling studies conducted by Sargent & Lundy for each of its generating units.[21]

Q. Do you agree with PSO's proposed dismantling costs and terminal net salvage rates?

A. No. I am recommending two adjustments to the Company's proposed dismantling costs, which are both consistent with Commission precedent. First, I recommend the removal of contingency costs included in the dismantling studies. Second, I propose that the annual escalation factors applied to the present value dismantling cost be removed in calculating the terminal net salvage rates for each plant. Each of these adjustments is discussed in more detail below.

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[21] *See* Exhibit JAC-3.

Q. Has the Commission consistently rejected the use of contingency costs and escalation factors in the determination of production net salvage rates?

Yes. In PSO's 2015 rate case[22] and PSO's 2017 rate case,[23] the Commission adopted proposed net salvage rates that specifically excluded contingency costs and escalation factors. Below I provide my arguments opposing the use of contingency and escalation factors in determining production net salvage rates.

1. Contingency Factor

Q. Describe the contingency costs included in the Company's dismantling studies.

A. PSO's dismantling studies include direct and indirect cost estimates to dismantle the Company's generating facilities, which include labor, material, and scrap value estimates. However, in addition to these cost estimates, the Company applies a 15% contingency factor to all direct costs for each generating unit. This means that the total direct and indirect costs are increased by 15%.[24]

Q. What is the total amount of the contingency costs included in the dismantling studies and incorporated into the Company's proposed depreciation rates?

A. The total amount of contingency costs PSO proposes to charge to customers is \$22.6 million.[25] This translates to an impact of about \$2.6 million per year for current customers.

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[22] Final Order (No. 662059), Cause No. PUD 201500273.

[23] Final Order (No. 672846), Cause No. PUD 201700151.

[24] Exhibit JAC-3.

[25] Exhibit DJG-2-4.

Q. Are contingency costs similar to other costs at issue in a utility regulatory proceeding?

A. No. Unlike most costs at issue in a rate case, which may be directly tied to some verifiable expense, or may be known and measurable, contingency costs by definition are *unknown* and cannot be measured. A utility's premise behind dismantling contingency costs could be summarized as follows: "since the exact amount of future dismantling costs are unknown, we are going to increase those cost estimates by 15% and charge ratepayers today." This premise is antithetical to fundamental ratemaking principles. Ratepayers should not be charged for completely unknown and unmeasurable future costs.

Q. Could the same argument in favor of positive contingency costs be made for negative contingency costs?

A. Yes. If a future cost is unknown, then such cost estimate could also be *reduced* by 15% in favor of customers – in order to ensure they are not prematurely overcharged for such costs. This approach could arguably be more fair from a ratemaking perspective, however, in this case I recommend that neither a positive nor negative contingency factor be applied to the Company's base dismantling cost estimates.

Q. Do the terminal net salvage rates you propose for PSO's generating units include any contingency costs?

A. No. My calculated terminal net salvage rates are included in my exhibits.[26]

[26] *See* Exhibit DJG-2-4.

2. Escalation Factor

Q. Describe the annual cost escalation factor applied by Mr. Cash to the present-value dismantling estimates.

A. The dismantling cost estimates provided by Sargent & Lundy are stated in 2021, present-value dollars. Mr. Cash applied an annual inflation rate of 2.4% to these costs for each of PSO's generating units included in the dismantling studies.[27]

Q. How much additional costs would these escalation factor add to PSO's proposed dismantling costs if approved?

A. The escalation factors would add about $50 million of additional costs to PSO's estimated dismantling costs. This translates to an impact of about $4.3 million per year for current customers.

Q. Do you agree with Mr. Cash's proposal to escalate the proposed dismantling costs?

A. No. There are two important reasons the Commission should disallow the cost escalation factor applied by Mr. Cash. First, it is not appropriate to escalate a cost that is already unknown and uncertain. We do not know the actual retirement dates for the Company's generating facilities, and we also do not know whether each facility will be completely dismantled at those retirement dates under the assumptions inherent in the dismantling studies. Some plants might be sold, converted, or otherwise reused in such a way that would be less costly and not require a complete brownfield demolition. If we are to assume that PSO is a going concern (and we should), then complete brownfield demolitions of each one of PSO's generating facilities at their estimated retirement dates is unlikely. The

[27] Direct Testimony of Jason A. Cash, p. 11.

second problem with the Company's cost escalation factor is more technical. In my opinion, it is not proper to charge current ratepayers for a future cost that has not been discounted to present value. The "time value of money" concept is a cornerstone of finance and valuation. For example, the Discounted Cash Flow Model, which is used to estimate the cost of equity, applies a growth rate to a company's dividends many years into the future. However, that dividend stream is then discounted back to the current year by a discount rate in order to arrive at the present value of an asset. Likewise, accounting for AROs involves escalating the present value of an estimated future cost, but then the cost is discounted back to present value by a discount rate in order to calculate the depreciation expense to charge to current ratepayers. In contrast to these calculations, PSO proposes to escalate the present value of its dismantling costs decades into the future and expects current ratepayers to pay the future value of these costs with their present-day dollars. This proposal completely disregards the elemental "time value of money" principle. For these reasons, the Commission should exclude the escalation factor applied by Mr. Cash when determining appropriate net salvage and depreciation rates for PSO's production accounts.

Q. Do the terminal net salvage rates you propose for PSO's generating units include any escalation factor?

A. No. My calculated terminal net salvage rates are included in my exhibits.[28]

[28] *See* Exhibit DJG-2-4.

Q. Has the Commission consistently rejected contingency and escalation factors in production net salvage rates?

A. Yes. For example, in PSO's 2015 rate case, the company proposed the inclusion of escalation and contingency factors in calculating PSO's terminal net salvage. In rejecting PSO's proposed escalation factor, the ALJ found as follows:

> The ALJ adopts Staff witness Garrett's recommendation that the Commission should deny the proposed escalation of demolition costs in this case because (1) the escalated costs do not appear to be calculated in the same manner as other calculations; (2) the Company did not offer any testimony in support of the escalation factor; (3) an escalation factor that does not consider any improvements in technology or economic efficiencies likely overstates future costs; (4) it is inappropriate to apply an escalation factor to demolition costs that are likely overstated; (5) asking ratepayers to pay for future costs that may not occur, are not known and measurable changes within the meaning of 17 O.S. § 284; and (6) the Commission has not approved escalated demolition costs in previous cases.[29]

Likewise, in rejecting PSO's proposed contingency factors, the ALJ found as follows:

> In its demolition cost study, S&L applied a 15% contingency factor to its cost estimates, and a negative 15% contingency factor to its scrap metal value estimates. The Company provides little justification for this contingency factor other than the plants might experience uncertainties and unplanned occurrences. This reasoning fails to consider the fact that certain occurrences could reduce estimated costs.[30]

Likewise, the Commission rejected contingency and escalation factors in OG&E's 2015 rate case[31] and PSO's 2017 rate case.[32]

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[29] Report and Recommendation of the Administrative Law Judge p. 164, filed May 31, 2016 in Cause No. PUD 201500208 (emphasis added).

[30] *Id.*

[31] Final Order (No. 662059), pp. 8-10, Cause No. PUD 201500273 (in this case, the Commission adopted depreciation rates for OG&E's generating units proposed by OIEC witness Jacob Pous, which did not include contingency costs or escalation factors).

[32] Final Order (No. 672846), pp. 5-7, Cause No. PUD 201700151 (in this case, the Commission adopted depreciation rates proposed by AG witness William Dunkel, which did not include contingency costs or escalation factors).

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.

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

A. I used all of the Company's property data and created 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."[33] 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.

Q. Discuss the general differences between your service life estimates and the Company's service life estimates for the accounts to which you propose adjustments.

A. While the Company and I used similar curve-fitting approaches in this case, the curves I selected for these accounts provide a better mathematical fit to the observed data and

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[33] Wolf *supra* n. 9, at 46.

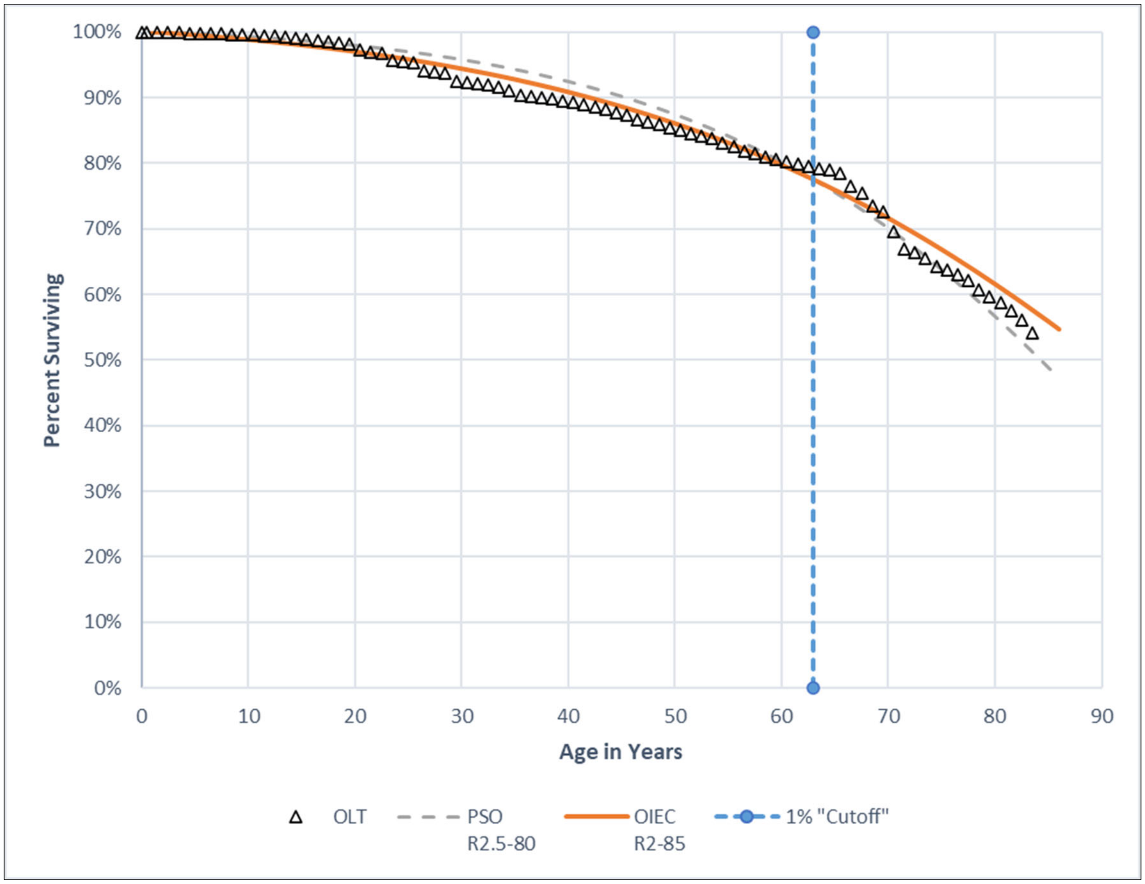
provide a more reasonable and accurate representation of the mortality characteristics for each account in my opinion. In each of the following accounts, the Company has selected a curve that underestimates the average remaining life of the assets in the account, which results in unreasonably high depreciation rates. The analysis of each selected account is presented below.

1. <u>Account 366 – Underground Conduit</u>

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

A. The OLT curve for this account and other accounts discussed in this section is constructed using the Company's historical property data. The graph below shows the two different Iowa curves selected by Mr. Cash and me to best represent the average remaining life for the assets in this account. For this account, Mr. Cash selected the R2.5-80 Iowa curve, and I selected the R2-85 Iowa curve. Both Iowa curves are displayed in the graph below along with the OLT curve for this account.

Figure 3:
Account 366 – Underground Conduit



The vertical dotted line represents the truncation point based on the 1% cutoff discussed above. The data points on the OLT curve occurring to the right of this line are statistically less relevant the other data points on the OLT curve due to the relatively low amount of dollars exposed to retirement associated with data points at the tail-end of the OLT curve. As shown in the graph, both selected Iowa curves have relatively similar shapes, and from a visual perspective, provide relatively close fits to the OLT curve. We can use mathematical curve fitting techniques to determine which of the two selected Iowa curves provides the closer fit to PSO's the observed historical data in this account.

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

A. Yes. Selected Iowa curves based on visual curve fitting techniques can be confirmed and bolstered by checking them mathematically. 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, the SSD between PSO's Iowa curve and the truncated OLT curve is 0.0170, and the SSD between the R2-85 curve I selected and the truncated OLT curve is 0.0068, which means it results in the closer fit.[34]

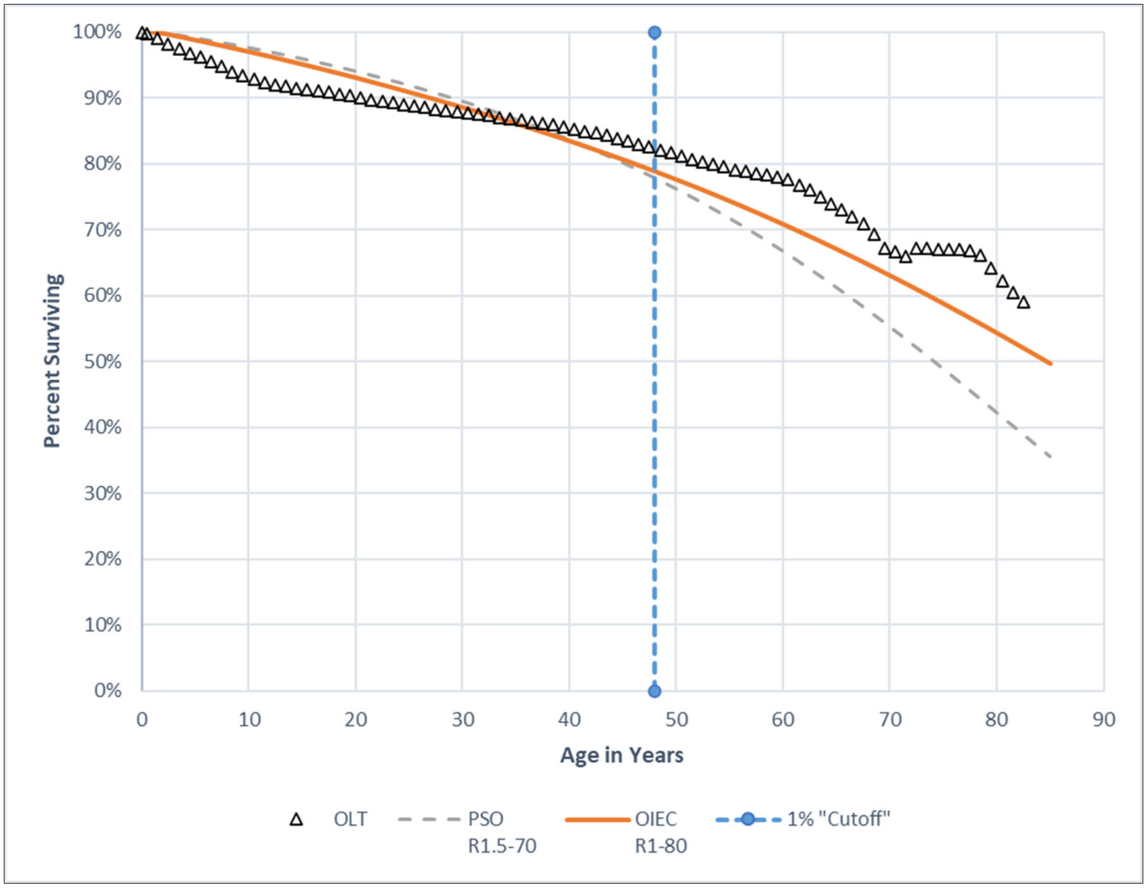
2. Account 367 – Underground Conductor

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

A. For this account, I selected the R1-80 Iowa curve, and Mr. Cash selected the R1.5-70 Iowa curve. The graph below shows these two curves with the OLT curve.

[34] Exhibit DJG-2-11.

Figure 4:
Account 367 – Underground Conductor



From a visual perspective, it is clear that the R1-80 curve I selected provides a closer fit throughout the majority of the OLT curve for this account. This is due to the flatter trajectory of the R1-shaped curve relative to the R1.5 curve. We can use mathematical curve fitting to confirm the results.

Q. Does your selected curve provide a better mathematical fit to the truncated OLT curve?

A. Yes. Proper mathematical curve fitting techniques should consider the statistical relevance of the data points to which the SSD calculation will be applied. When we consider the most statistically relevant portion of the OLT curve for this account, the R1-80 curve I selected provides the better mathematical fit. Specifically, the Company's curve has an SSD of 0.0434 and the R1-80 curve I selected has an SSD of 0.0294 when applied to the truncated OLT curve, which means it results in the closer fit.[35]

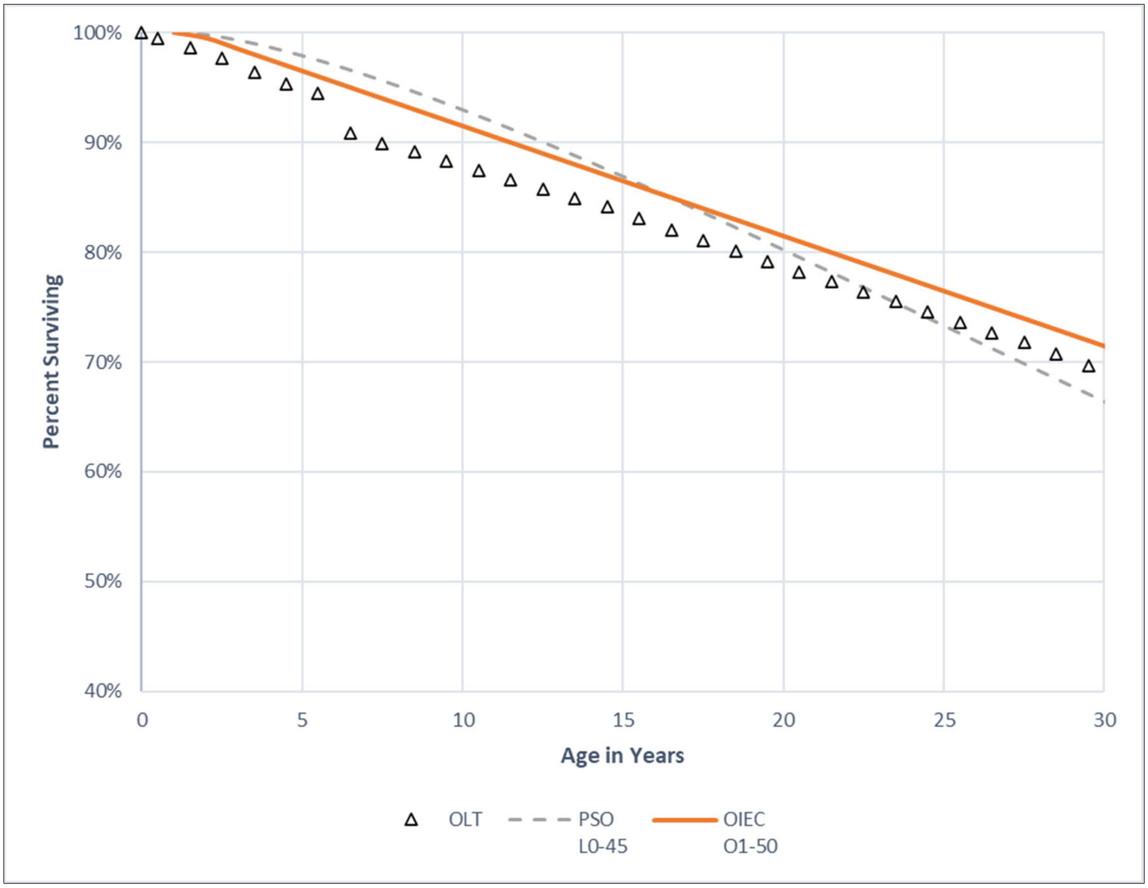
3. Account 373 – Street Lighting and Signal Systems

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

A. Mr. Cash selected the L0-45 Iowa curve for this account, and I selected the O1-50 Iowa curve. The graph below shows these two Iowa curves juxtaposed with the OLT curve.

[35] Exhibit DJG-2-12.

Figure 5:
Account 373 – Street Lighting and Signal Systems



The Company's decision to rely on a shorter placement and observation band for this account (1991-2021) results in a lower amount of retirement experience. In PSO's prior case, the historical data indicated an average service life of at least 50 years.[36] In this case, I am basing my analysis on the same period on which Mr. Cash selected. Even with the shorter banding period considered, the data indicate that the average life is longer than the 45-year life selected by Mr. Cash.

[36] Testimony of David J. Garrett, Cause No. PUD 202100055, p. 31.

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

A. Yes. The SSD for PSO's curve is 0.202, and the SSD for the O1-50 curve I selected is 0.0059.[37]

Q. Describe the impact to PSO's proposed depreciation accrual for this account if your recommended service life is adopted.

A. Adopting my proposed service life for this account would result in an adjustment reducing PSO's proposed depreciation accrual by $168,390.[38]

VII. INTANGIBLE PLANT: SOFTWARE

Q. Describe the Company's proposed service life for its software accounts.

A. The software assets at issue were not included in the depreciation study, but are included in the Company's schedules in Account 303.[39] The Company is proposing to reduce the amortization period for these assets from 10 years to five years, which would increase the annual depreciation accrual by $15.8 million.[40] The original cost balance in these account totals more than $180 million.[41]

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[37] Exhibit DJG-2-13.

[38] Exhibit DJG-2-2.

[39] Sch. I-2.

[40] Direct Testimony of Jason A. Cash, pp. 14-16.

[41] Sch. I-2.

Q. Has the Company provided any evidence to support the idea that it's software assets have a service life of only five years?

A. No. Before further discussing the Company's software accounts, it is instructive to consider the amount of information provided by the Company in its application (and in discovery) in this case related to its service life proposals for its other mass property accounts. For many accounts included in the depreciation study (particularly the accounts to which I do not propose an adjustment), the Company generally met its burden to make a convincing showing that its proposed depreciation rates were not excessive for those accounts. For example, the Company provided adequate historical retirement and net salvage data to generally support its service life and net salvage proposals. In contrast, the Company has not provided any support for its proposed service life for software assets. In discovery, PSO was asked to provide a list of its software systems, the year they were installed, and the year they were physically retired, among other information.[42] In response the Company acknowledged that "[n]o study was prepared as part of this depreciation study showing the useful life of the Company's software."[43] PSO also acknowledged that "[t]he Company maintains a list of installed software products but not their costs, installation dates or utilization period."[44] Thus, the Company has not provided adequate support for its service life proposal.

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[42] OIEC's Seventh Set of Data Requests to PSO, 19-22; see also PUD's Sixth Set of Data Requests to PSO, 6-4.

[43] Response to PUD 6-4(a).

[44] Response to OIEC 7-20.

Q. Do you agree with the Company's proposal regarding this account?

A. No. By selecting a five-year amortization period for its software accounts, the Company is suggesting that its software programs will actually remain in service only five years, on average. While a five-year service life estimate might be appropriate for basic consumer software systems, it is clearly insufficient to accurately describe the service life of major software systems at issue. Unlike basic consumer software systems, large enterprise software systems can be customized to the specific needs of the company. These modular systems require substantial upfront engineering costs along with periodic maintenance and support fees to ensure that the system performs reliably over a long period of time. For example, many utility companies rely on Enterprise Resource Planning ("ERP") systems comprising a suite of modular applications that collect and integrate data from different facets of the firm.

Q. Are you aware of service life estimates of Enterprise Resource Planning software systems of 20 years or more?

A. Yes. ERP systems are designed to provide long term solutions to companies. SAP is one of several providers of ERP systems.[45] According to a report by CGI Consulting Services, SAP systems can last 25 – 30 years.[46] Given the extremely high installation costs for these complex systems as well as the annual maintenance fees, it is not surprising that companies using ERP systems would demand that the systems last longer than 10 years.

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[45] SAP ERP is enterprise resource planning software developed by the German company SAP SE.

[46] *Taking the Long View to SAP Value*, CGI, "Enlightened Managed Services Series," CGI Group Inc. 2011 p. 2.

Q. Have utility companies recognized that their ERP systems can last at least 20 years?

A. Yes. Florida Power & Light ("FP&L") is one of many utilities that utilize ERP systems. In 2011, FP&L implemented SAP's ERP system to replace its previous accounting system.[47] FP&L had previously amortized its software over a five-year period. FP&L, however, requested that the amortization period be extended to 20 years in order to reflect the much longer lifespan of the new ERP system.[48] Kim Ousdahl, FP&L's Vice President, Controller and Chief Accounting Officer, gave the following testimony regarding FP&L's software account:

> In 2011, the Company implemented a new general ledger accounting system (SAP) to replace its legacy system. . . . FPL's policy for accounting for new software requires . . . amortization on a straight-line basis over a period of five years, which is the current amortization period approved for this account. The Company is requesting to extend the amortization period of this system from five to twenty years in order to more appropriately recognize the longer benefit period expected from this major business system.[49]

While a five-year average life may have been appropriate for older, more basic software systems, it does not reflect the much longer service life of newer, more complex systems.

Q. Has the Commission previously adopted your proposal for a 10-year service life for Account 303?

A. Yes. In PSO's 2017 rate case, the company proposed a five-year service life with essentially no evidence, as is the case here.[50] The Oklahoma commission found:

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[47] Petition for Rate Increase by Florida Power & Light Company, Docket No. 120015-EI, Testimony & Exhibits of Kim Ousdahl. p. 14.

[48] *Id*.

[49] *Id*.

[50] Final Order (No. 672864), Attach. 1, p. 29 of 239, entered 1-31-2018, Before the Oklahoma Corporation Commission, Cause No. PUD 201700151.

> Mr. Garrett . . . recommended a 10-year amortization period instead of the 5-year amortization period PSO proposed [for Account 303]. Mr. Garrett's analysis was clear and convincing. . . . Based upon the evidence in the record, the Commission accepts the recommendation of Mr. David Garrett pertaining to Account 303.[51]

Relaying on similar arguments to those I present in this case, the Oklahoma commission found that a 10-year service life was clearly more appropriate than the five-year service life proposed by the company for its software accounts. The Commission has not overturned its ruling for a 10-year service life for PSO's software account.

Q. What is your recommendation regarding PSO's software accounts?

A. I recommend the Commission continue to adopt a 10-year amortization period for the software assets at issue until the Company can provide sufficient evidence demonstrating that these assets have a useful life of only five years.

Q. Does this conclude your testimony?

A. Yes.

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[51] *Id*.

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.[52] 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.[53] The figure below illustrates the basic concept of a depreciation system and includes some of the available parameters.[54]

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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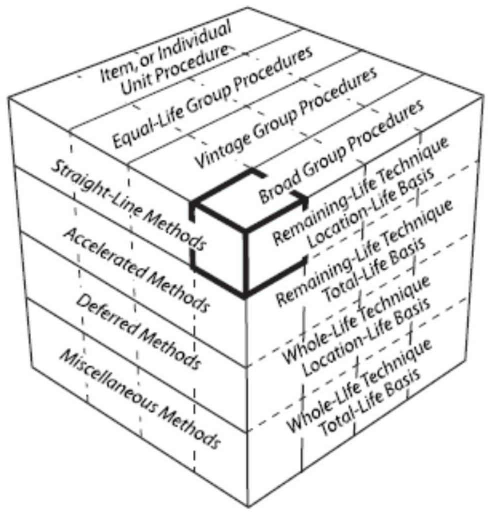
[52] Wolf *supra* n. 9, at 69-70.

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

[54] 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 6:
The Depreciation System Cube



1. <u>Allocation Methods</u>

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.[55] 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.[56] The basic formula for the straight-line method is as follows:[57]

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[55] NARUC *supra* n. 10, at 56.

[56] *Id*.

[57] *Id*.

Equation 1:
Straight-Line Accrual

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

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.[58] 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:[59]

Equation 2:
Straight-Line Rate

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

2. Grouping Procedures

The "procedure" refers to the way the allocation method is applied through subdividing the total property into groups.[60] 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

[58] *Id*. at 57.

[59] *Id*. at 56.

[60] Wolf *supra* n. 9, 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.[61] 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.[62]

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.[63] 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.[64] Under the equal life procedure the property is divided into subgroups that each has a common life.[65]

3. Application Techniques

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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[61] *Id*. at 74.

[62] NARUC *supra* n. 10, at 61-62.

[63] *See* Wolf *supr*a n. 9, at 74-75.

[64] *Id*. at 75.

[65] *Id*.

technique applies the depreciation rate on the estimated average service life of group, while the remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.[66]

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.[67] 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 <u>current</u> depreciation parameters.[68] 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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[66] NARUC *supra* n. 10, at 63-64.

[67] Wolf *supra* n. 9, at 83.

[68] NARUC *supra* n. 10, at 325.

in the annual accrual.[69] 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:[70]

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.[71]

4. <u>Analysis Model</u>

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.[72] 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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[69] NARUC *supra* n. 10, 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.").

[70] *Id*. at 64.

[71] Wolf *supra* n. 9, at 178.

[72] *See* Wolf *supra* n. 9, 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 from 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.[73] 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.[74] 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.[75] They generalized the 65 curves

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[73] Wolf *supra* n. 9, at 276.

[74] *Id*. at 23.

[75] *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.[76] 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."[77] 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.[78] 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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[76] *Id*.

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

[78] 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. 9, 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:[79]

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.[80]

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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[79] *See* Wolf *supra* n. 9, at 37.

[80] *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).[81] 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.

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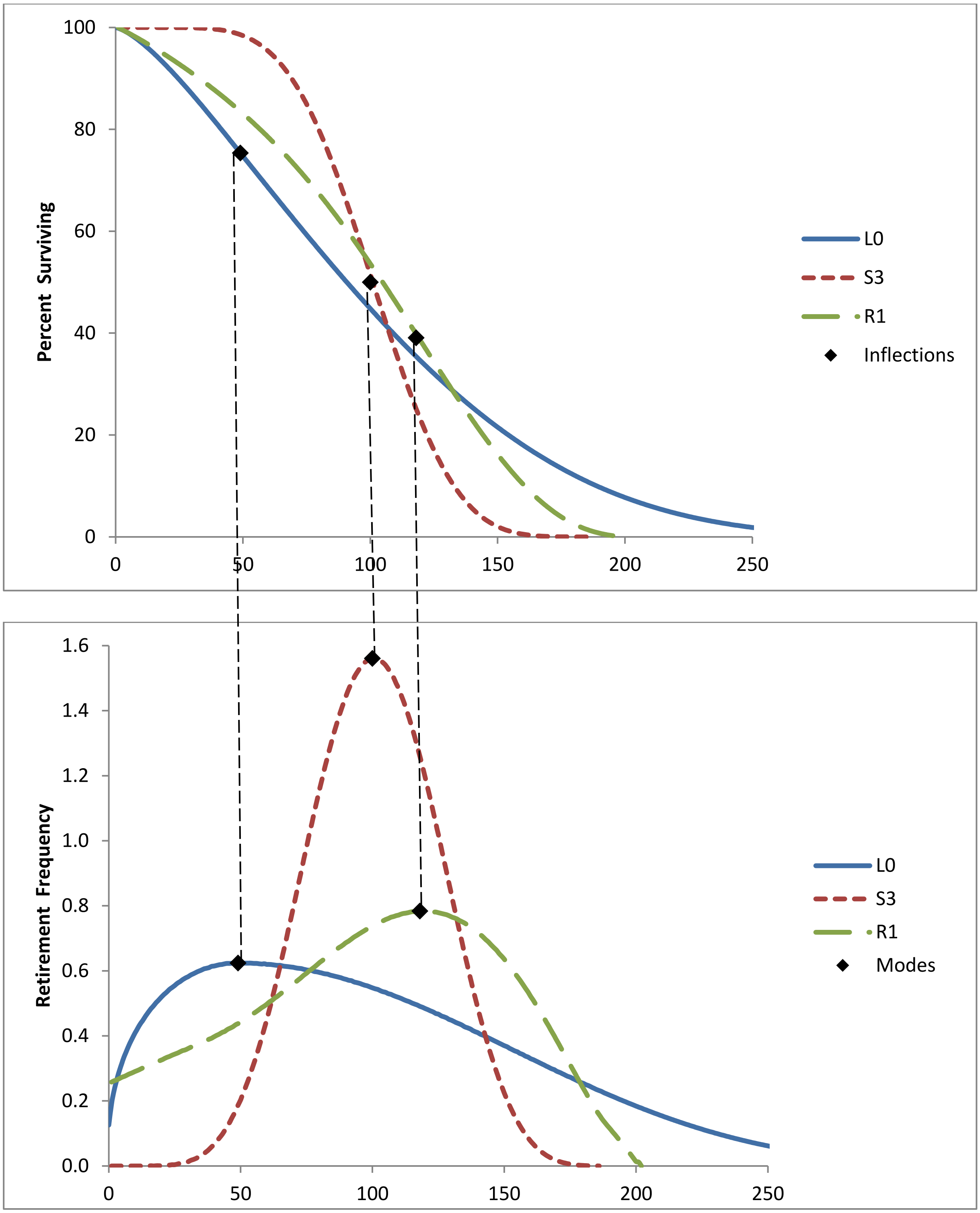
[81] In 1967, Harold A. Cowles added four origin-modal curves known as "O type" curves. There are also several "half" curves and a square curve, so the total amount of survivor curves commonly called "Iowa" curves is about 31 (see NARUC supra n. 10, at 68).

Figure 7:
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."[82]

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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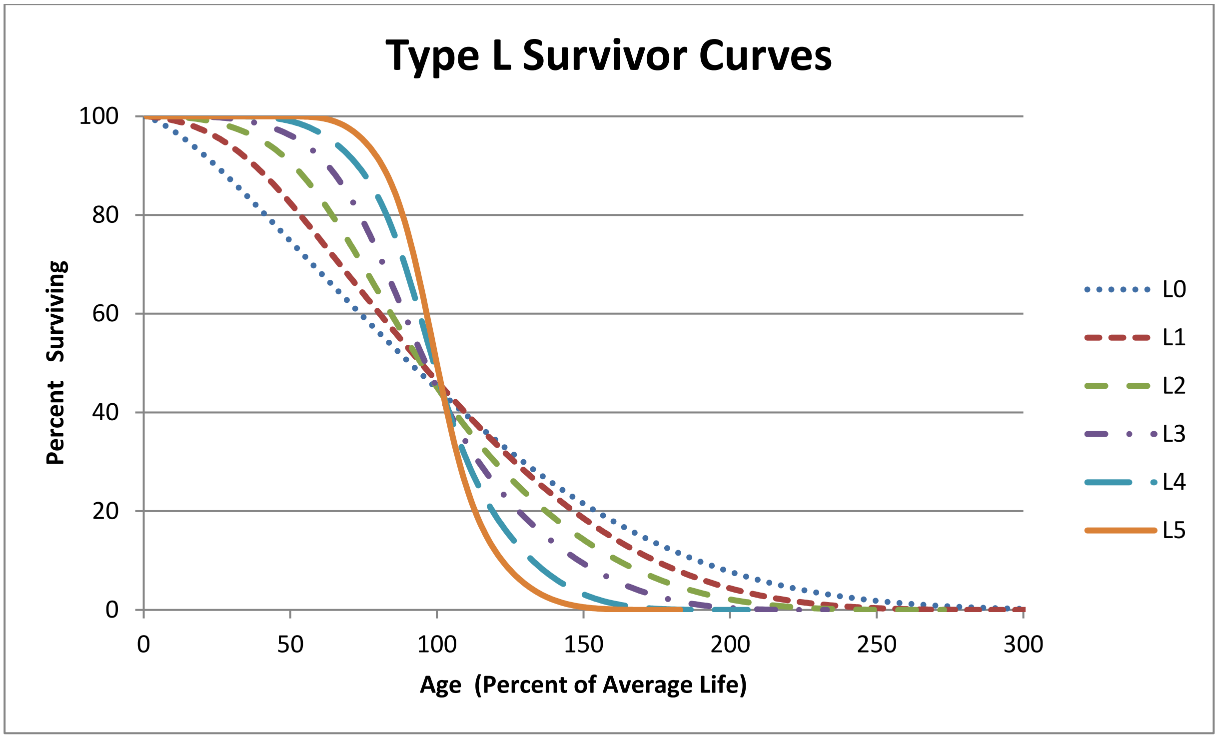
[82] Winfrey, *Bulletin 125: Statistical Analyses of Industrial Property Retirements* 60, Vol. XXXIV, No. 23 (Iowa State College of Agriculture and Mechanic Arts 1935).

Figure 8:
Type L Survivor and Frequency Curves



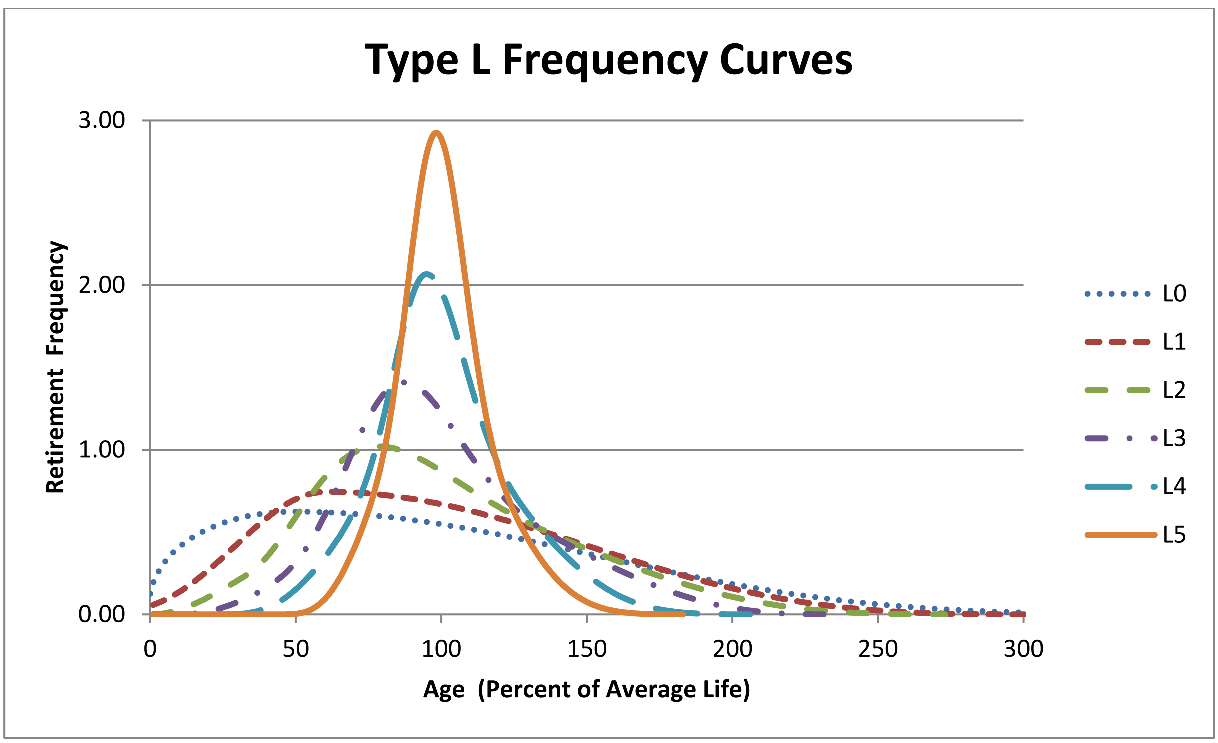
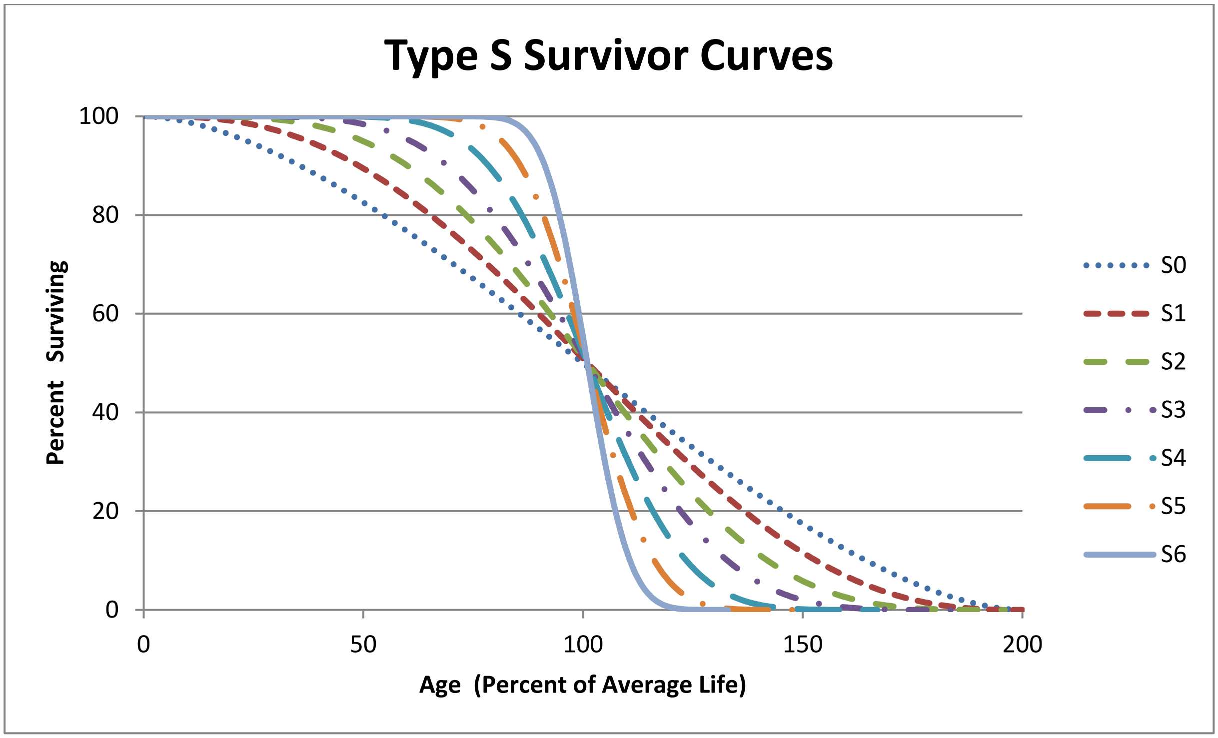


Figure 9:
Type S Survivor and Frequency Curves



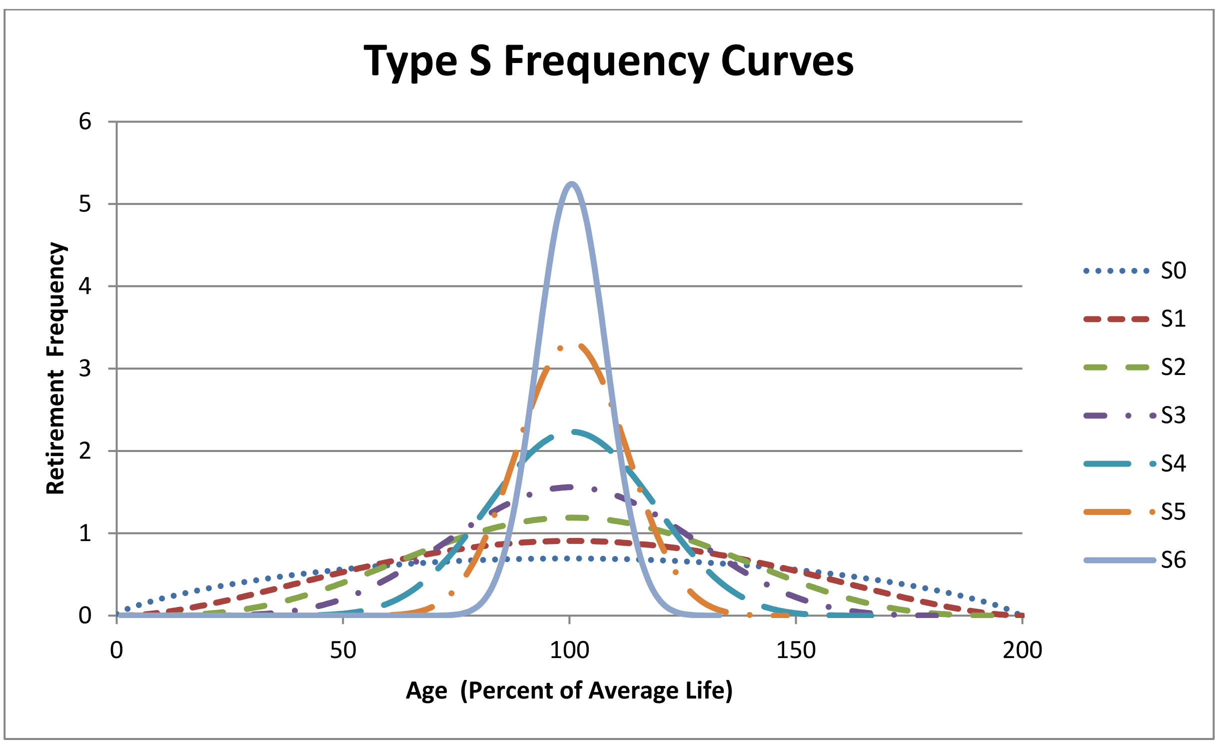
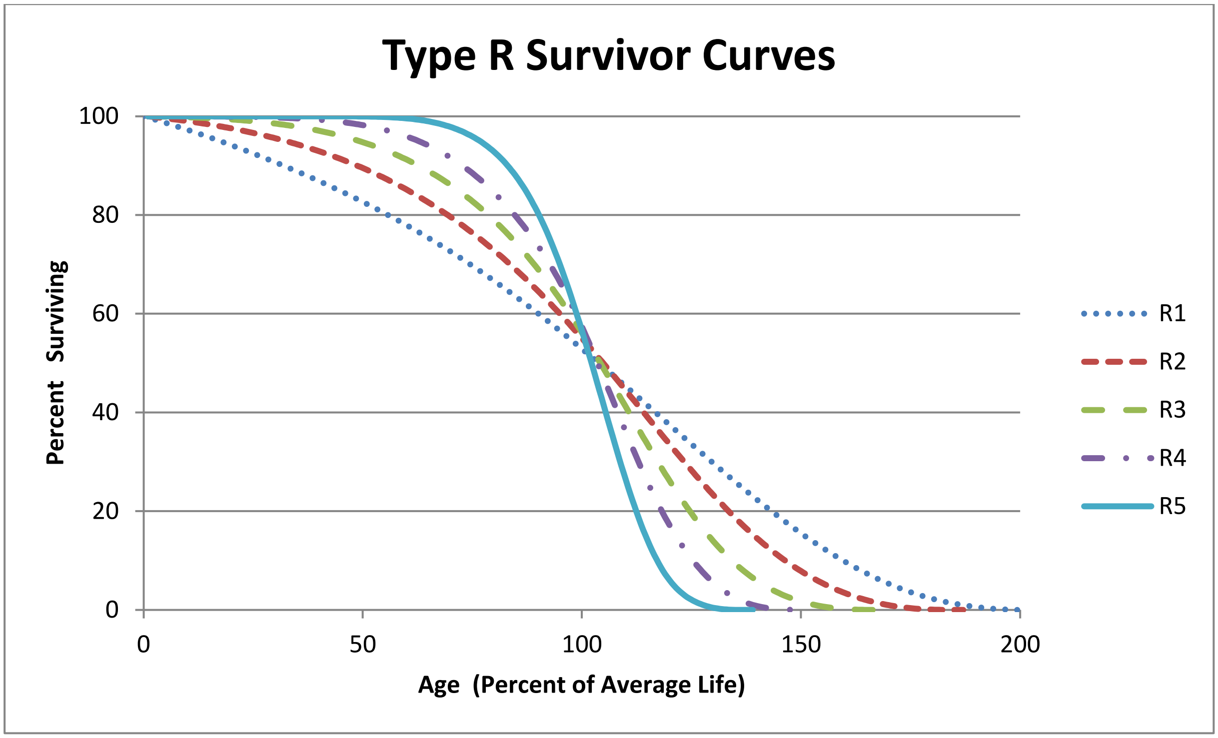
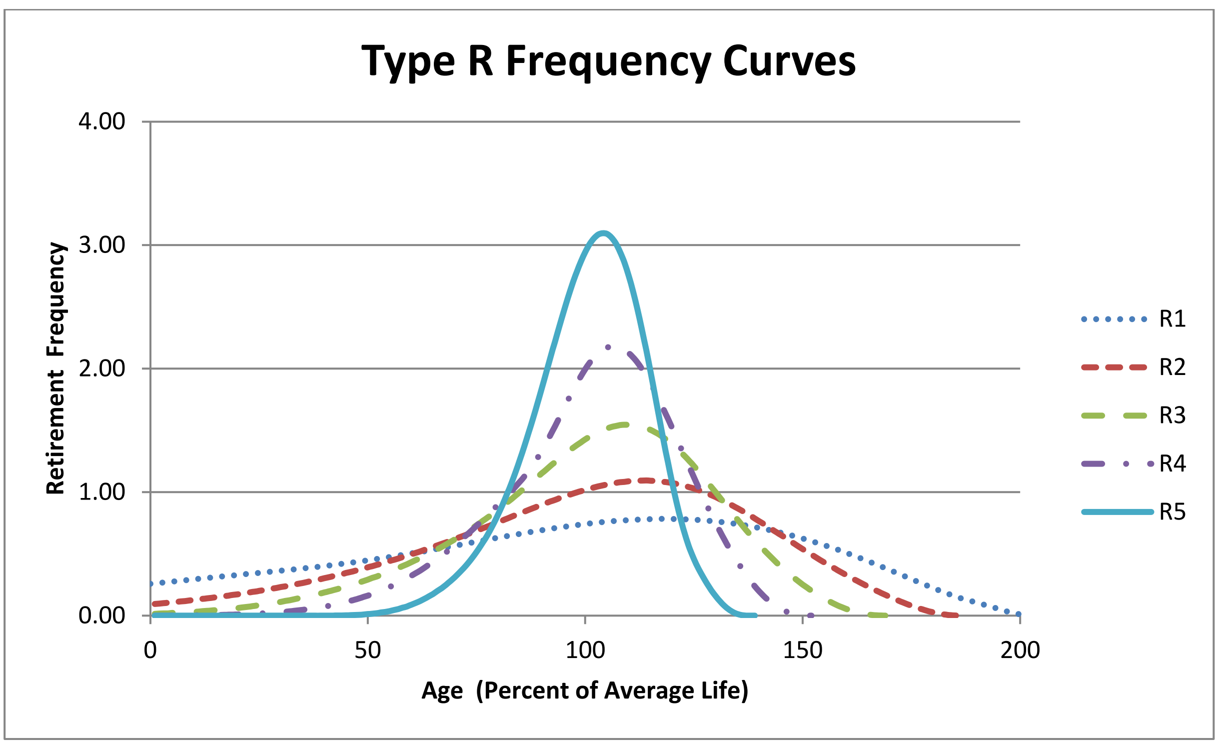


Figure 10:
Type R Survivor and Frequency Curves





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. Types of Lives

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.[83]

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:[84]

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

[83] 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.

[84] *See* NARUC *supra* n. 10, 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.[85] 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.[86] 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 potion 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

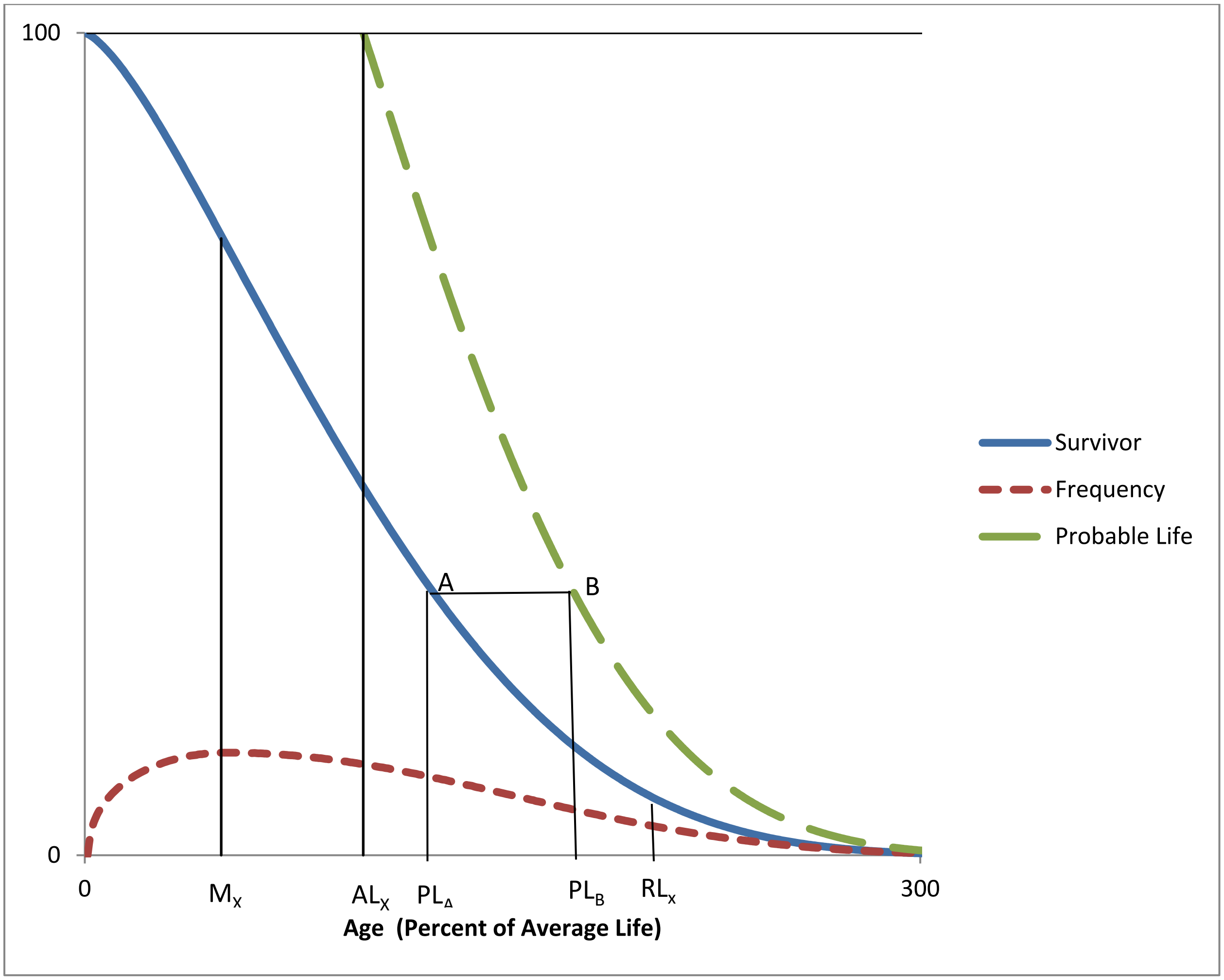
$$Average\ Remaining\ Life = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ x\ to\ Max\ Life}{S_X}$$

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

[85] *Id*. at 73.

[86] *Id*. at 74.

Figure 11:
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.[87] 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

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[87] Wolf *supra* n. 9, at 28.

corresponding point on the survivor curve above at point "A," then horizontally to point "B" on 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 of 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.[88]

Figure 12:
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

[88] NARUC *supra* n. 10, at 14-15.

Property Records ("CPR"). Generally, a CPR should contain 1) an inventory of property record 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.[89] 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 calculating observed survivor curves for property groups. Of these methods, the retirement rate method is superior, and is widely employed by depreciation analysts.[90] 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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[89] *Id*. at 112-13.

[90] 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.[91] 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 13:
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	

[91] 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 14:
Retirement Matrix

Placement Years	Experience Years Retirments During the Year (Dollars in 000's) 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.[92] 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).

[92] Wolf *supra* n. 9, 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 15:
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			

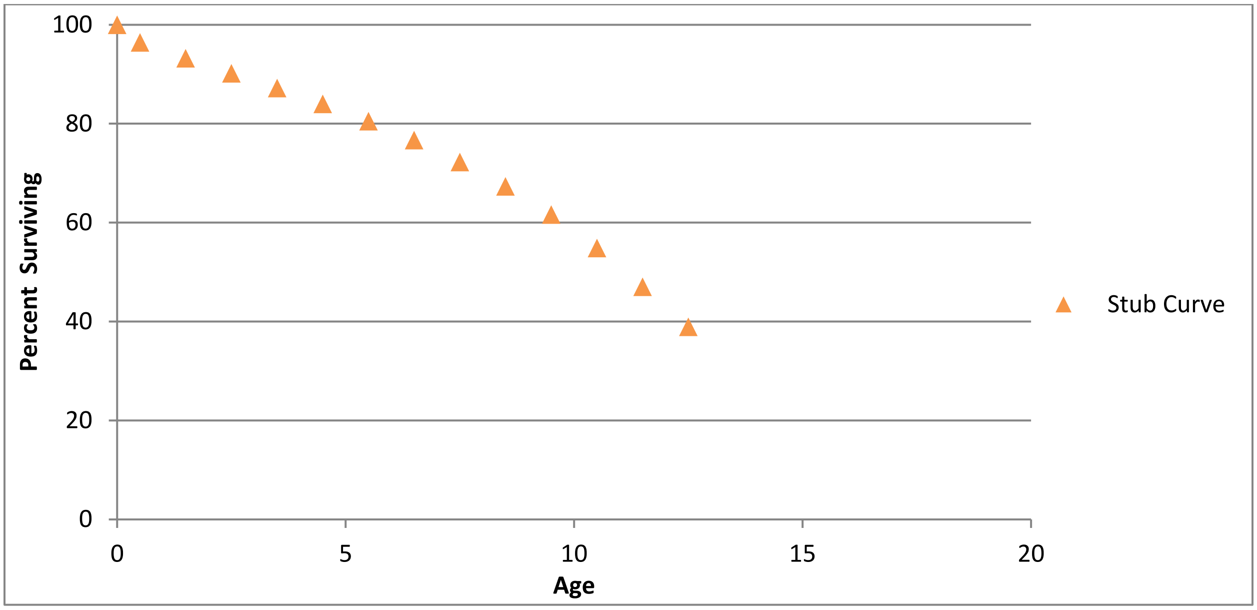
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. 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)[93].

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

[93] 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 16:
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.

Banding

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.[94] 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.[95]

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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[94] NARUC *supra* n. 10, at 113.

[95] *Id*.

Figure 17:
Placement 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	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.[96] 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

[96] Wolf *supra* n. 9, 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.[97]

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.

[97] NARUC *supra* n. 10, at 114.

Figure 18:
Experience 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	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.[98] 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

[98] *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 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.

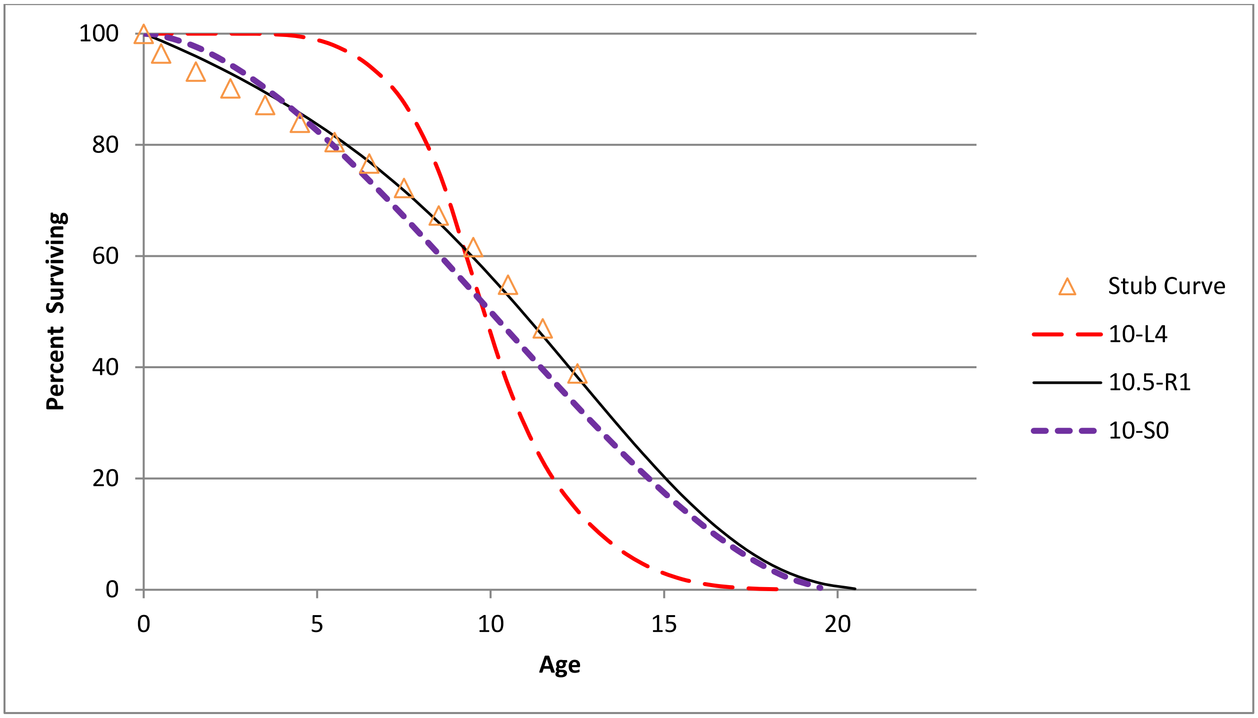
Curve Fitting

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."[99]

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.

[99] Wolf *supra* n. 9, at 46 (22 curves includes Winfrey's 18 original curves plus Cowles's four "O" type curves).

Figure 19:
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.[100]

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."[101]

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.

---

[100] Wolf *supra* n. 9, at 47.

[101] *Id*. at 48.

Figure 20:
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**

Summary Depreciation Accrual Adjustment

Exhibit DJG-2-1

Plant Function	Plant Balance 12/31/2021	Current Parameters Rate	Current Parameters Accrual	PSO Proposal Rate	PSO Proposal Accrual	OIEC Proposed Rate	OIEC Proposed Accrual	OIEC Adjustment Rate	OIEC Adjustment Adjustment
Production	$ 1,766,326,529	3.50%	$ 61,841,418	6.12%	$ 108,111,657	3.22%	$ 56,905,614	-2.90%	$ (51,206,044)
Transmission	1,103,913,601	2.62%	28,915,206	2.70%	29,794,582	2.70%	29,794,582	0.00%	-
Distribution	2,996,322,714	2.99%	89,703,233	3.00%	89,916,398	2.95%	88,367,616	-0.05%	(1,548,782)
General	224,705,470	4.90%	11,016,333	4.93%	11,076,940	4.93%	11,076,940	0.00%	-
Total Plant Studied	**$ 6,091,268,314**	**3.14%**	**$ 191,476,190**	**3.92%**	**$ 238,899,578**	**3.06%**	**$ 186,144,752**	**-0.87%**	**$ (52,754,826)**

Detailed Rate Comparison

		[1]	[2]		[3]		[4]		[5]		[6]	
			Current Parameters		PSO Proposal		OIEC Proposal		OIEC less Current Rates		OIEC less Proposed Rates	
Account No.	Description	Original Cost	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	STEAM PRODUCTION PLANT											
	Coal Plants											
	NORTHEASTERN UNIT 3											
311.00	Structures & Improvements	20,459,054	2.55%	521,706	11.51%	2,354,752	2.85%	582,287	0.30%	60,581	-8.66%	-1,772,465
312.00	Boiler Plant Equipment	377,388,950	3.29%	12,416,096	13.62%	51,391,400	3.32%	12,546,384	0.03%	130,288	-10.29%	-38,845,016
314.00	Turbogenerator Units	46,210,041	2.13%	984,274	8.51%	3,931,368	2.04%	942,683	-0.09%	-41,591	-6.47%	-2,988,686
315.00	Accessory Electrical Equipment	21,241,864	1.47%	312,255	6.98%	1,482,269	1.63%	345,240	0.16%	32,985	-5.35%	-1,137,029
316.00	Misc. Power Plant Equip.	18,490,776	2.61%	482,609	11.18%	2,068,000	2.79%	514,988	0.18%	32,379	-8.40%	-1,553,012
	Total	483,790,685	3.04%	14,716,940	12.66%	61,227,789	3.09%	14,931,581	0.04%	214,641	-9.57%	-46,296,208
	RAIL SPUR											
310.10	Rail Spur - Land Rights	939,196	3.77%	35,408	15.86%	148,952	15.86%	148,952	12.09%	113,544	0.00%	0
312.00	Rail Spur	22,359,915	1.34%	299,623	4.08%	912,071	4.08%	912,071	2.74%	612,448	0.00%	0
312.11	Rail Cars	5,255,850	0.14%	7,358	0.22%	11,825	0.22%	11,825	0.08%	4,467	0.00%	0
	Total	28,554,961	1.20%	342,389	3.76%	1,072,848	3.76%	1,072,848	2.56%	730,459	0.00%	0
	Total Coal Plants	512,345,646	2.94%	15,059,329	12.16%	62,300,636	3.12%	16,004,429	0.18%	945,100	-9.04%	-46,296,208
	Gas & Combined Cycle Plants											
	COMANCHE											
311.30	Structures & Improvements	6,704,510	3.48%	233,317	3.54%	237,582	3.39%	227,429	-0.09%	-5,888	-0.15%	-10,153
312.30	Boiler Plant Equipment	67,644,421	5.05%	3,416,043	5.10%	3,449,876	4.94%	3,343,944	-0.11%	-72,099	-0.16%	-105,932
314.30	Turbogenerator Units	70,935,172	3.56%	2,525,292	3.87%	2,746,136	3.71%	2,630,380	0.15%	105,088	-0.16%	-115,755
315.30	Accessory Electrical Equipment	8,187,651	3.06%	250,542	3.35%	274,304	3.20%	261,850	0.14%	11,308	-0.15%	-12,455
316.30	Misc. Power Plant Equip.	3,341,338	3.69%	123,295	4.17%	139,263	4.01%	133,833	0.32%	10,538	-0.16%	-5,431
	Total	156,813,092	4.18%	6,548,489	4.37%	6,847,161	4.21%	6,597,436	0.03%	48,947	-0.16%	-249,725
	NORTHEASTERN UNITS 1 AND 2											
311.30	Structures & Improvements	12,292,372	3.13%	384,751	3.20%	393,914	2.89%	355,157	-0.24%	-29,594	-0.32%	-38,757
312.30	Boiler Plant Equipment	95,535,595	3.02%	2,885,175	3.05%	2,916,170	2.73%	2,610,689	-0.29%	-274,486	-0.32%	-305,481
314.30	Turbogenerator Units	145,165,291	3.50%	5,080,785	3.57%	5,181,825	3.23%	4,681,945	-0.27%	-398,840	-0.34%	-499,880
315.30	Accessory Electrical Equipment	16,655,163	3.34%	556,282	3.57%	594,670	3.24%	540,299	-0.10%	-15,983	-0.33%	-54,371
316.30	Misc. Power Plant Equip.	8,714,145	2.95%	257,067	3.05%	265,904	2.72%	237,249	-0.23%	-19,818	-0.33%	-28,654
	Total	278,362,566	3.29%	9,164,060	3.36%	9,352,483	3.03%	8,425,340	-0.27%	-738,720	-0.33%	-927,144
	RIVERSIDE UNITS 1 AND 2											
311.30	Structures & Improvements	11,565,514	3.78%	437,176	3.98%	459,760	3.17%	366,406	-0.61%	-70,770	-0.81%	-93,354
312.30	Boiler Plant Equipment	78,252,346	2.67%	2,089,338	2.87%	2,242,150	2.06%	1,610,176	-0.61%	-479,162	-0.81%	-631,974
314.30	Turbogenerator Units	72,855,844	3.11%	2,265,817	3.21%	2,338,744	2.39%	1,744,653	-0.72%	-521,164	-0.82%	-594,091
315.30	Accessory Electrical Equipment	11,374,701	2.13%	242,281	2.26%	257,572	1.46%	166,486	-0.67%	-75,795	-0.80%	-91,086

Detailed Rate Comparison

		[1]	[2]		[3]		[4]		[5]		[6]	
			Current Parameters		PSO Proposal		OIEC Proposal		OIEC less Current Rates		OIEC less Proposed Rates	
Account No.	Description	Original Cost	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
316.30	Misc. Power Plant Equip.	8,662,195	5.02%	434,842	5.21%	450,915	4.34%	375,921	-0.68%	-58,921	-0.87%	-74,994
	Total	182,710,600	2.99%	5,469,454	3.15%	5,749,142	2.33%	4,263,642	-0.66%	-1,205,812	-0.81%	-1,485,499
	SOUTHWESTERN UNITS 1-3											
311.30	Structures & Improvements	9,152,384	6.24%	571,109	6.30%	576,590	5.24%	479,259	-1.00%	-91,850	-1.06%	-97,332
312.30	Boiler Plant Equipment	38,097,233	5.79%	2,205,830	5.70%	2,171,201	4.65%	1,770,863	-1.14%	-434,967	-1.05%	-400,338
314.30	Turbogenerator Units	38,083,445	5.99%	2,281,198	5.87%	2,235,316	4.83%	1,838,386	-1.16%	-442,812	-1.04%	-396,931
315.30	Accessory Electrical Equipment	11,625,747	6.13%	712,658	6.09%	708,016	5.05%	587,391	-1.08%	-125,267	-1.04%	-120,625
316.30	Misc. Power Plant Equip.	2,407,489	7.20%	173,339	8.20%	197,490	6.96%	167,477	-0.24%	-5,862	-1.25%	-30,013
	Total	99,366,298	5.98%	5,944,134	5.93%	5,888,613	4.87%	4,843,374	-1.11%	-1,100,760	-1.05%	-1,045,238
	TULSA UNITS 2 AND 4											
311.30	Structures & Improvements	8,337,534	4.83%	402,703	5.12%	426,896	4.50%	375,079	-0.33%	-27,624	-0.62%	-51,817
312.30	Boiler Plant Equipment	27,146,446	4.32%	1,172,726	4.39%	1,192,889	3.75%	1,018,147	-0.57%	-154,579	-0.64%	-174,742
314.30	Turbogenerator Units	31,925,874	3.70%	1,181,257	3.70%	1,180,851	3.08%	983,732	-0.62%	-197,525	-0.62%	-197,119
315.30	Accessory Electrical Equipment	10,683,227	5.97%	637,789	6.16%	658,481	5.54%	591,425	-0.43%	-46,364	-0.63%	-67,056
316.30	Misc. Power Plant Equip.	3,575,851	5.92%	211,690	6.52%	232,970	5.75%	205,761	-0.17%	-5,929	-0.76%	-27,209
	Total	81,668,932	4.42%	3,606,165	4.52%	3,692,086	3.89%	3,174,144	-0.53%	-432,021	-0.63%	-517,942
	Total Gas & Combined Cycle	798,921,488	3.85%	30,732,302	3.95%	31,529,485	3.42%	27,303,936	-0.43%	-3,428,366	-0.53%	-4,225,549
	Total Steam Production Plant	1,311,267,134	3.49%	45,791,631	7.16%	93,830,121	3.30%	43,308,365	-0.19%	-2,483,266	-3.85%	-50,521,756
	OTHER PRODUCTION PLANT											
	WELEETKA											
341.00	Structures & Improvements	922,151	22.15%	204,256	5.82%	53,710	5.12%	47,240	-17.03%	-157,016	-0.70%	-6,470
342.00	Fuel Holders, Producers & Access.	1,383,128	8.46%	117,013	2.74%	37,940	2.05%	28,319	-6.41%	-88,694	-0.70%	-9,620
344.00	Generators	16,445,048	10.27%	1,688,906	3.23%	531,615	2.53%	416,241	-7.74%	-1,272,665	-0.70%	-115,374
345.00	Accessory Electrical Equip.	567,519	40.32%	228,824	13.21%	74,986	12.48%	70,849	-27.84%	-157,975	-0.73%	-4,137
346.00	Misc. Power Plant Equip.	2,690,372	16.95%	456,018	4.54%	122,234	3.85%	103,468	-13.10%	-352,550	-0.70%	-18,766
	Total	22,008,218	12.25%	2,695,017	3.73%	820,484	3.03%	666,118	-9.22%	-2,028,899	-0.70%	-154,367
	COMANCHE - Diesel								0.00%	0	0.00%	0
342.00	Fuel Holders, Producers & Access.	2,994	2.35%	70	2.35%	70	2.20%	66	-0.15%	-4	-0.15%	-4
344.00	Generators	819,929	1.34%	10,987	1.36%	11,118	1.21%	9,892	-0.13%	-1,095	-0.15%	-1,226
346.00	Misc. Power Plant Equip.	62,659	5.68%	3,559	6.10%	3,822	5.94%	3,724	0.26%	165	-0.16%	-98
	Total	885,582	1.65%	14,616	1.69%	15,011	1.54%	13,682	-0.11%	-934	-0.15%	-1,329
	NORTHEASTERN U1 AND 2 - Diesel								0.00%	0	0.00%	0
342.00	Fuel Holders, Producers & Access.	63,289	1.80%	1,139	1.84%	1,165	1.53%	967	-0.27%	-172	-0.31%	-197
344.00	Generators	761,445	5.05%	38,453	5.71%	43,512	5.40%	41,122	0.35%	2,669	-0.31%	-2,389

Detailed Rate Comparison

		[1]	[2]		[3]		[4]		[5]		[6]	
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Account No.	Description	Original Cost	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
345.00	Accessory Electrical Equip.	83,558	2.69%	2,248	2.73%	2,280	2.40%	2,006	-0.29%	-242	-0.33%	-274
346.00	Misc. Power Plant Equip.	3,019	1.12%	34	1.11%	34	0.80%	24	-0.32%	-10	-0.31%	-9
	Total	911,311	4.59%	41,874	5.16%	46,990	4.84%	44,121	0.25%	2,247	-0.31%	-2,869
	NORTHEASTERN UNIT 3 - Diesel											
344.00	Generators	437,950	2.82%	12,350	2.96%	12,964	0.62%	2,704	-2.20%	-9,646	-2.34%	-10,259
	Total	437,950	2.82%	12,350	2.96%	12,964	0.62%	2,704	-2.20%	-9,646	-2.34%	-10,259
	RIVERSIDE - Diesel											
342.00	Fuel Holders, Producers & Access.	24,392	3.88%	946	3.94%	960	3.16%	770	-0.72%	-176	-0.78%	-190
344.00	Generators	470,175	1.51%	7,100	1.64%	7,700	0.86%	4,047	-0.65%	-3,053	-0.78%	-3,653
345.00	Accessory Electrical Equip.	68,642	4.39%	3,013	4.53%	3,107	3.64%	2,499	-0.75%	-514	-0.89%	-608
	Total	563,209	1.96%	11,059	2.09%	11,767	1.30%	7,316	-0.66%	-3,743	-0.79%	-4,450
	SOUTHWESTERN - Diesel											
342.00	Fuel Holders, Producers & Access.	58,811	2.87%	1,688	2.89%	1,698	2.15%	1,262	-0.72%	-426	-0.74%	-437
344.00	Generators	212,484	1.39%	2,954	1.48%	3,153	0.73%	1,557	-0.66%	-1,397	-0.75%	-1,596
	Total	271,295	1.71%	4,642	1.79%	4,852	1.04%	2,819	-0.67%	-1,823	-0.75%	-2,033
	TULSA - Diesel											
342.00	Fuel Holders, Producers & Access.	70,372	1.73%	1,217	1.75%	1,228	1.14%	802	-0.59%	-415	-0.61%	-426
344.00	Generators	608,404	1.67%	10,160	1.69%	10,279	1.08%	6,598	-0.59%	-3,562	-0.61%	-3,681
	Total	678,776	1.68%	11,377	1.70%	11,508	1.09%	7,401	-0.59%	-3,976	-0.61%	-4,107
	WELEETKA - Diesel											
342.00	Fuel Holders, Producers & Access.	10,291	9.65%	993	2.42%	249	1.72%	177	-7.93%	-816	-0.69%	-71
344.00	Generators	666,380	8.90%	59,308	2.10%	14,011	1.41%	9,376	-7.49%	-49,932	-0.70%	-4,635
345.00	Accessory Electrical Equip.	36,296	4.45%	1,615	1.81%	658	1.11%	403	-3.34%	-1,212	-0.70%	-255
346.00	Misc. Power Plant Equip.	63,417	65.61%	41,608	23.27%	14,755	22.57%	14,315	-43.04%	-27,293	-0.69%	-440
	Total	776,384	13.33%	103,524	3.82%	29,673	3.13%	24,271	-10.21%	-79,253	-0.70%	-5,402
	RIVERSIDE - Units 3&4											
342.00	Fuel Holders, Producers & Access.	9,797,993	2.59%	253,768	2.65%	259,790	2.21%	216,762	-0.38%	-37,006	-0.44%	-43,028
344.00	Generators	47,610,475	2.62%	1,247,394	2.90%	1,378,971	2.44%	1,160,847	-0.18%	-86,547	-0.46%	-218,124
345.00	Accessory Electrical Equip.	4,945,633	3.32%	164,195	3.48%	172,167	3.00%	148,470	-0.32%	-15,725	-0.48%	-23,697
346.00	Misc. Power Plant Equip.	182,932	2.91%	5,323	2.95%	5,395	2.51%	4,591	-0.40%	-732	-0.44%	-803
	Total	62,537,033	2.67%	1,670,680	2.90%	1,816,322	2.45%	1,530,670	-0.22%	-140,010	-0.46%	-285,652
	SOUTHWESTERN - Units 4&5											
341.00	Structures & Improvements	4,849,168	3.51%	170,206	3.51%	170,213	3.13%	151,883	-0.38%	-18,323	-0.38%	-18,330
344.00	Generators	45,397,880	2.77%	1,257,521	2.78%	1,262,701	2.43%	1,102,561	-0.34%	-154,960	-0.35%	-160,140

Detailed Rate Comparison

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Account No.	Description	Original Cost	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
345.00	Accessory Electrical Equip.	9,669,243	2.40%	232,062	2.63%	253,916	2.26%	218,729	-0.14%	-13,333	-0.36%	-35,187
346.00	Misc. Power Plant Equip.	45,733	3.00%	1,372	3.61%	1,649	3.25%	1,487	0.25%	115	-0.35%	-162
	Total	59,962,024	2.77%	1,661,161	2.82%	1,688,479	2.46%	1,474,660	-0.31%	-186,501	-0.36%	-213,819
	NORTH CENTRAL WIND											
344.00	Generators - Sundance	128,742,456	3.21%	4,132,633	3.21%	4,132,633	3.21%	4,132,633	0.00%	0	0.00%	0
344.00	Generators - Maverick	177,285,157	3.21%	5,690,854	3.21%	5,690,854	3.21%	5,690,854	0.00%	0	0.00%	0
344.00	Generators - Traverse	0	3.21%	0	3.21%	0	3.21%	0	0.00%	0	0.00%	0
	Total	306,027,613	3.21%	9,823,487	3.21%	9,823,487	3.21%	9,823,486	0.00%	-1	0.00%	-1
	Total Other Production Plant	455,059,395	3.53%	16,049,787	3.14%	14,281,536	2.99%	13,597,249	-0.54%	-2,452,538	-0.15%	-684,287
	Total Production Plant	1,766,326,529	3.50%	61,841,418	6.12%	108,111,657	3.22%	56,905,614	-0.28%	-4,935,804	-2.90%	-51,206,044
	TRANSMISSION PLANT											
350.10	Land Rights	46,098,428	1.18%	543,961	1.19%	547,684	1.19%	547,684	0.01%	3,723	0.00%	0
352.00	Structures & Improvements	18,540,896	1.77%	328,174	1.85%	343,693	1.85%	343,693	0.08%	15,519	0.00%	0
353.00	Station Equipment	483,286,253	1.81%	8,747,481	1.82%	8,773,911	1.82%	8,773,911	0.01%	26,430	0.00%	0
354.00	Towers & Fixtures	17,650,043	2.71%	478,316	2.72%	479,394	2.72%	479,394	0.01%	1,078	0.00%	0
355.00	Poles & Fixtures	337,092,307	4.06%	13,685,948	4.20%	14,157,131	4.20%	14,157,131	0.14%	471,183	0.00%	0
356.00	OH Conductor & Devices	201,173,759	2.55%	5,129,931	2.73%	5,491,421	2.73%	5,491,421	0.18%	361,490	0.00%	0
358.00	Underground Conductor	71,915	1.94%	1,395	1.87%	1,348	1.87%	1,348	-0.07%	-47	0.00%	0
	Total Transmission Plant	1,103,913,601	2.62%	28,915,206	2.70%	29,794,582	2.70%	29,794,582	0.08%	879,376	0.00%	0
	DISTRIBUTION PLANT											
360.10	Land Rights	2,825,149	1.10%	31,077	1.10%	30,947	1.10%	30,947	0.00%	-130	0.00%	0
361.00	Structures & Improvements	21,826,570	2.53%	552,212	2.53%	552,124	2.53%	552,124	0.00%	-88	0.00%	0
362.00	Station Equipment	485,615,195	1.35%	6,555,805	1.36%	6,613,699	1.36%	6,613,699	0.01%	57,894	0.00%	0
364.00	Poles, Towers, & Fixtures	508,465,504	3.78%	19,219,996	3.77%	19,148,623	3.77%	19,148,623	-0.01%	-71,373	0.00%	0
365.00	Overhead Conductor & Devices	518,633,650	3.35%	17,374,227	3.38%	17,527,473	3.38%	17,527,473	0.03%	153,246	0.00%	0
366.00	Underground Conduit	106,786,748	2.07%	2,210,486	2.02%	2,153,429	1.87%	1,998,085	-0.20%	-212,401	-0.15%	-155,343
367.00	Underground Conductor	410,266,021	1.86%	7,630,948	1.85%	7,608,175	1.56%	6,403,492	-0.30%	-1,227,456	-0.29%	-1,204,682
368.00	Line Transformers	404,536,594	3.41%	13,794,698	3.43%	13,880,250	3.43%	13,880,250	0.02%	85,552	0.00%	0
369.00	Services	302,499,534	2.72%	8,227,987	2.71%	8,207,259	2.71%	8,207,259	-0.01%	-20,728	0.00%	0
370.00	Meters	19,889,703	8.84%	1,758,250	8.47%	1,684,205	8.47%	1,684,205	-0.37%	-74,045	0.00%	0
370.16	AMI - Meters	95,005,560	9.64%	9,158,536	9.76%	9,277,023	9.76%	9,277,023	0.12%	118,487	0.00%	0
371.00	Installations on Custs. Prem.	52,562,250	3.22%	1,692,504	3.26%	1,713,814	3.26%	1,713,814	0.04%	21,310	0.00%	0
373.00	Street Lighting & Signal Sys.	67,410,236	2.22%	1,496,507	2.25%	1,519,378	1.97%	1,330,622	-0.25%	-165,885	-0.28%	-188,757
	Total Distribution Plant	2,996,322,714	2.99%	89,703,233	3.00%	89,916,398	2.95%	88,367,616	-0.04%	-1,335,617	-0.05%	-1,548,782

Detailed Rate Comparison

		[1]	[2]		[3]		[4]		[5]		[6]	
			Current Parameters		PSO Proposal		OIEC Proposal		OIEC less Current Rates		OIEC less Proposed Rates	
Account No.	Description	Original Cost	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	GENERAL PLANT											
390.00	Structures & Improvements	73,446,025	2.02%	1,483,610	1.96%	1,436,868	1.96%	1,436,868	-0.06%	-46,742	0.00%	0
391.00	Office Furniture & Equipment	1,567,720	5.70%	89,360	5.86%	91,916	5.86%	91,916	0.16%	2,556	0.00%	0
391.10	Office Equipment - Computers	17,344	31.01%	5,378	23.56%	4,086	23.56%	4,086	-7.45%	-1,292	0.00%	0
392.00	Transportation Equipment	1,874,292	7.18%	134,574	7.46%	139,751	7.46%	139,751	0.28%	5,177	0.00%	0
393.00	Stores Equipment	2,387,007	3.86%	92,138	3.87%	92,450	3.87%	92,450	0.01%	312	0.00%	0
394.00	Tools Shop & Garage Equipment	32,104,652	4.33%	1,390,131	4.39%	1,407,858	4.39%	1,407,858	0.06%	17,727	0.00%	0
395.00	Laboratory Equipment	837,976	6.32%	52,960	6.10%	51,125	6.10%	51,125	-0.22%	-1,835	0.00%	0
396.00	Power Operated Equipment	637,521	7.93%	50,555	9.35%	59,621	9.35%	59,621	1.42%	9,066	0.00%	0
397.00	Communication Equipment	85,154,098	6.97%	5,935,241	7.03%	5,983,371	7.03%	5,983,371	0.06%	48,130	0.00%	0
397.16	AMI - Communication Equipment	17,975,913	7.18%	1,290,671	7.25%	1,303,471	7.25%	1,303,471	0.07%	12,800	0.00%	0
398.00	Miscellaneous Equipment	8,702,922	5.65%	491,715	5.82%	506,421	5.82%	506,421	0.17%	14,706	0.00%	0
	Total General Plant	224,705,470	4.90%	11,016,333	4.93%	11,076,940	4.93%	11,076,940	0.03%	60,607	0.00%	0
	TOTAL PLANT STUDIED	**6,091,268,314**	**3.14%**	**191,476,190**	**3.92%**	**238,899,578**	**3.06%**	**186,144,752**	**-0.09%**	**-5,331,438**	**-0.87%**	**-52,754,826**

[1], [2], [3] PSO Depreciation Study
[4] From Exhibit DJG-1-3
[5] = [4] - [2]
[6] = [4] - [3]

Depreciation Rate Development

Account No.	Description	[1] Original Cost	[2] Iowa Curve Type	[2] Iowa Curve AL	[3] Net Salvage	[4] Depreciable Base	[5] Book Reserve	[6] Future Accruals	[7] Remaining Life	[8] Total Accrual	[9] Total Rate
	STEAM PRODUCTION PLANT										
	Coal Plants										
	NORTHEASTERN UNIT 3										
311.00	Structures & Improvements	20,459,054			-3%	21,094,048	11,074,003	10,020,045	17.21	582,287	**2.85%**
312.00	Boiler Plant Equipment	377,388,950			-3%	389,102,080	167,566,668	221,535,412	17.66	12,546,384	**3.32%**
314.00	Turbogenerator Units	46,210,041			-3%	47,644,275	31,025,955	16,618,320	17.63	942,683	**2.04%**
315.00	Accessory Electrical Equipment	21,241,864			-3%	21,901,154	15,678,215	6,222,939	18.02	345,240	**1.63%**
316.00	Misc. Power Plant Equip.	18,490,776			-3%	19,064,680	10,274,756	8,789,924	17.07	514,988	**2.79%**
	Total	483,790,685			-3%	498,806,236	235,619,597	263,186,639	17.63	14,931,581	**3.09%**
	RAIL SPUR										
310.10	Rail Spur - Land Rights	939,196			0%	939,196	268,912	670,284	4.50	148,952	**15.86%**
312.00	Rail Spur	22,359,915			0%	22,359,915	18,255,596	4,104,319	4.50	912,071	**4.08%**
312.11	Rail Cars	5,255,850			0%	5,255,850	5,206,186	49,664	4.20	11,825	**0.22%**
	Total	28,554,961			0%	28,554,961	23,730,694	4,824,267	4.50	1,072,848	**3.76%**
	Total Coal Plants	512,345,646			-3%	527,361,197	259,350,291	268,010,906	16.75	16,004,429	**3.12%**
	Gas & Combined Cycle Plants										
	COMANCHE										
311.30	Structures & Improvements	6,704,510			-1%	6,770,309	3,738,676	3,031,633	13.33	227,429	**3.39%**
312.30	Boiler Plant Equipment	67,644,421			-1%	68,308,289	25,204,855	43,103,434	12.89	3,343,944	**4.94%**
314.30	Turbogenerator Units	70,935,172			-1%	71,631,336	39,093,530	32,537,806	12.37	2,630,380	**3.71%**
315.30	Accessory Electrical Equipment	8,187,651			-1%	8,268,005	4,793,262	3,474,743	13.27	261,850	**3.20%**
316.30	Misc. Power Plant Equip.	3,341,338			-1%	3,374,130	1,711,926	1,662,204	12.42	133,833	**4.01%**
	Total	156,813,092			-1%	158,352,069	74,542,249	83,809,820	12.70	6,597,436	**4.21%**
	NORTHEASTERN UNITS 1 AND 2										
311.30	Structures & Improvements	12,292,372			-2%	12,597,057	7,504,106	5,092,951	14.34	355,157	**2.89%**
312.30	Boiler Plant Equipment	95,535,595			-2%	97,903,590	60,988,441	36,915,149	14.14	2,610,689	**2.73%**
314.30	Turbogenerator Units	145,165,291			-2%	148,763,433	87,289,497	61,473,936	13.13	4,681,945	**3.23%**
315.30	Accessory Electrical Equipment	16,655,163			-2%	17,067,986	9,584,848	7,483,138	13.85	540,299	**3.24%**
316.30	Misc. Power Plant Equip.	8,714,145			-2%	8,930,138	5,667,958	3,262,180	13.75	237,249	**2.72%**
	Total	278,362,566			-2%	285,262,205	171,034,850	114,227,355	13.56	8,425,340	**3.03%**
	RIVERSIDE UNITS 1 AND 2										
311.30	Structures & Improvements	11,565,514			-7%	12,357,664	5,480,226	6,877,438	18.77	366,406	**3.17%**
312.30	Boiler Plant Equipment	78,252,346			-7%	83,612,036	53,405,129	30,206,907	18.76	1,610,176	**2.06%**
314.30	Turbogenerator Units	72,855,844			-7%	77,845,915	45,430,262	32,415,653	18.58	1,744,653	**2.39%**

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	Total Rate
315.30	Accessory Electrical Equipment	11,374,701			-7%	12,153,781	9,003,866	3,149,915	18.92	166,486	**1.46%**
316.30	Misc. Power Plant Equip.	8,662,195			-7%	9,255,489	2,676,866	6,578,623	17.50	375,921	**4.34%**
	Total	182,710,600			-7%	195,224,885	115,996,349	79,228,536	18.58	4,263,642	**2.33%**
	SOUTHWESTERN UNITS 1-3										
311.30	Structures & Improvements	9,152,384			-3%	9,472,112	4,286,534	5,185,578	10.82	479,259	**5.24%**
312.30	Boiler Plant Equipment	38,097,233			-3%	39,428,117	20,037,172	19,390,945	10.95	1,770,863	**4.65%**
314.30	Turbogenerator Units	38,083,445			-3%	39,413,847	19,118,071	20,295,776	11.04	1,838,386	**4.83%**
315.30	Accessory Electrical Equipment	11,625,747			-3%	12,031,879	5,517,711	6,514,168	11.09	587,391	**5.05%**
316.30	Misc. Power Plant Equip.	2,407,489			-3%	2,491,592	945,783	1,545,809	9.23	167,477	**6.96%**
	Total	99,366,298			-3%	102,837,548	49,905,271	52,932,277	10.93	4,843,374	**4.87%**
	TULSA UNITS 2 AND 4										
311.30	Structures & Improvements	8,337,534			-6%	8,874,182	4,309,468	4,564,714	12.17	375,079	**4.50%**
312.30	Boiler Plant Equipment	27,146,446			-6%	28,893,735	16,930,503	11,963,232	11.75	1,018,147	**3.75%**
314.30	Turbogenerator Units	31,925,874			-6%	33,980,792	21,930,071	12,050,721	12.25	983,732	**3.08%**
315.30	Accessory Electrical Equipment	10,683,227			-6%	11,370,856	4,244,187	7,126,669	12.05	591,425	**5.54%**
316.30	Misc. Power Plant Equip.	3,575,851			-6%	3,806,012	1,760,752	2,045,260	9.94	205,761	**5.75%**
	Total	81,668,932			-6%	86,925,575	49,174,981	37,750,594	11.89	3,174,144	**3.89%**
	Total Gas & Combined Cycle	798,921,488			-4%	828,602,282	460,653,700	367,948,582	13.48	27,303,936	**3.42%**
	Total Steam Production Plant	1,311,267,134			-3%	1,355,963,479	720,003,991	635,959,488	14.68	43,308,365	**3.30%**
	OTHER PRODUCTION PLANT										
	WELEETKA										
341.00	Structures & Improvements	922,151			-7%	982,760	819,309	163,451	3.46	47,240	**5.12%**
342.00	Fuel Holders, Producers & Access.	1,383,128			-7%	1,474,035	1,375,200	98,835	3.49	28,319	**2.05%**
344.00	Generators	16,445,048			-7%	17,525,910	16,085,715	1,440,195	3.46	416,241	**2.53%**
345.00	Accessory Electrical Equip.	567,519			-7%	604,820	368,893	235,927	3.33	70,849	**12.48%**
346.00	Misc. Power Plant Equip.	2,690,372			-7%	2,867,198	2,507,130	360,068	3.48	103,468	**3.85%**
	Total	22,008,218			-7%	23,454,723	21,156,247	2,298,476	3.45	666,118	**3.03%**
	COMANCHE - Diesel										
342.00	Fuel Holders, Producers & Access.	2,994			-1%	3,023	2,135	888	13.50	66	**2.20%**
344.00	Generators	819,929			-1%	827,976	694,428	133,548	13.50	9,892	**1.21%**
346.00	Misc. Power Plant Equip.	62,659			-1%	63,274	15,314	47,960	12.88	3,724	**5.94%**
	Total	885,582			-1%	894,273	711,877	182,396	13.33	13,682	**1.54%**
	NORTHEASTERN U1 AND 2 - Diesel										

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	Total Rate
342.00	Fuel Holders, Producers & Access.	63,289			-2%	64,858	50,829	14,029	14.50	967	**1.53%**
344.00	Generators	761,445			-2%	780,319	187,744	592,575	14.41	41,122	**5.40%**
345.00	Accessory Electrical Equip.	83,558			-2%	85,629	57,920	27,709	13.81	2,006	**2.40%**
346.00	Misc. Power Plant Equip.	3,019			-2%	3,094	2,744	350	14.50	24	**0.80%**
	Total	911,311			-2%	933,899	299,237	634,662	14.38	44,121	**4.84%**
	NORTHEASTERN UNIT 3 - Diesel										
344.00	Generators	437,950			-3%	451,543	401,510	50,033	18.50	2,704	**0.62%**
	Total	437,950			-3%	451,543	401,510	50,033	18.50	2,704	**0.62%**
	RIVERSIDE - Diesel										
342.00	Fuel Holders, Producers & Access.	24,392			-7%	26,063	11,040	15,023	19.50	770	**3.16%**
344.00	Generators	470,175			-7%	502,378	423,462	78,916	19.50	4,047	**0.86%**
345.00	Accessory Electrical Equip.	68,642			-7%	73,343	30,589	42,754	17.11	2,499	**3.64%**
	Total	563,209			-7%	601,785	465,091	136,694	18.68	7,316	**1.30%**
	SOUTHWESTERN - Diesel										
342.00	Fuel Holders, Producers & Access.	58,811			-3%	60,865	41,306	19,559	15.50	1,262	**2.15%**
344.00	Generators	212,484			-3%	219,907	196,046	23,861	15.32	1,557	**0.73%**
	Total	271,295			-3%	280,772	237,352	43,420	15.40	2,819	**1.04%**
	TULSA - Diesel										
342.00	Fuel Holders, Producers & Access.	70,372			-6%	74,902	64,872	10,030	12.50	802	**1.14%**
344.00	Generators	608,404			-6%	647,564	565,087	82,477	12.50	6,598	**1.08%**
	Total	678,776			-6%	722,466	629,959	92,507	12.50	7,401	**1.09%**
	WELEETKA - Diesel										
342.00	Fuel Holders, Producers & Access.	10,291			-7%	10,967	10,347	620	3.50	177	**1.72%**
344.00	Generators	666,380			-7%	710,178	677,457	32,721	3.49	9,376	**1.41%**
345.00	Accessory Electrical Equip.	36,296			-7%	38,682	37,291	1,391	3.45	403	**1.11%**
346.00	Misc. Power Plant Equip.	63,417			-7%	67,585	17,482	50,103	3.50	14,315	**22.57%**
	Total	776,384			-7%	827,412	742,577	84,835	3.50	24,271	**3.13%**
	RIVERSIDE - Units 3&4										
342.00	Fuel Holders, Producers & Access.	9,797,993			-7%	10,469,081	2,990,808	7,478,273	34.50	216,762	**2.21%**
344.00	Generators	47,610,475			-7%	50,871,430	12,482,213	38,389,217	33.07	1,160,847	**2.44%**
345.00	Accessory Electrical Equip.	4,945,633			-7%	5,284,371	589,743	4,694,628	31.62	148,470	**3.00%**
346.00	Misc. Power Plant Equip.	182,932			-7%	195,461	37,066	158,395	34.50	4,591	**2.51%**
	Total	62,537,033			-7%	66,820,344	16,099,830	50,720,514	33.14	1,530,670	**2.45%**

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	Total Rate
	SOUTHWESTERN - Units 4&5										
341.00	Structures & Improvements	4,849,168			-3%	5,018,568	395,256	4,623,312	30.44	151,883	**3.13%**
344.00	Generators	45,397,880			-3%	46,983,804	11,018,254	35,965,550	32.62	1,102,561	**2.43%**
345.00	Accessory Electrical Equip.	9,669,243			-3%	10,007,027	3,090,812	6,916,215	31.62	218,729	**2.26%**
346.00	Misc. Power Plant Equip.	45,733			-3%	47,331	-1,015	48,346	32.51	1,487	**3.25%**
	Total	59,962,024			-3%	62,056,730	14,503,307	47,553,423	32.25	1,474,660	**2.46%**
	NORTH CENTRAL WIND										
344.00	Generators - Sundance	128,742,456			0%	128,742,456	2,712,127	126,030,329	29.50	4,132,633	**3.21%**
344.00	Generators - Maverick	177,285,157			0%	177,285,157	1,416,155	175,869,002	29.50	5,690,854	**3.21%**
344.00	Generators - Traverse	0			0%	0	0	0	30.00	0	**3.21%**
	Total	306,027,613			0%	306,027,613	4,128,282	301,899,331	30.73	9,823,486	**3.21%**
	Total Other Production Plant	455,059,395			-2%	463,071,559	59,375,269	403,696,290	29.69	13,597,249	**2.99%**
	Total Production Plant	1,766,326,529			-3%	1,819,035,038	779,379,260	1,039,655,778	18.27	56,905,614	3.22%
	TRANSMISSION PLANT										
350.10	Land Rights	46,098,428	R4	75	0%	46,098,428	18,719,697	27,378,731	49.99	547,684	**1.19%**
352.00	Structures & Improvements	18,540,896	R3	60	-7%	19,838,759	1,499,314	18,339,445	53.36	343,693	**1.85%**
353.00	Station Equipment	483,286,253	L1	57	-4%	502,617,703	96,912,063	405,705,640	46.24	8,773,911	**1.82%**
354.00	Towers & Fixtures	17,650,043	R3	75	-61%	28,416,569	8,708,670	19,707,899	41.11	479,394	**2.72%**
355.00	Poles & Fixtures	337,092,307	R0.5	41	-60%	539,347,691	54,041,245	485,306,446	34.28	14,157,131	**4.20%**
356.00	OH Conductor & Devices	201,173,759	R2	64	-60%	321,878,014	65,813,046	256,064,968	46.63	5,491,421	**2.73%**
358.00	Underground Conductor	71,915	R4	45	0%	71,915	53,995	17,920	13.29	1,348	**1.87%**
	Total Transmission Plant	1,103,913,601			-32%	1,458,269,080	245,748,030	1,212,521,050	40.70	29,794,582	**2.70%**
	DISTRIBUTION PLANT										
360.10	Land Rights	2,825,149	R4	70	0%	2,825,149	1,195,477	1,629,672	52.66	30,947	**1.10%**
361.00	Structures & Improvements	21,826,570	L0	40	-5%	22,917,899	2,953,105	19,964,794	36.16	552,124	**2.53%**
362.00	Station Equipment	485,615,195	L0	75	-8%	524,464,411	81,412,692	443,051,719	66.99	6,613,699	**1.36%**
364.00	Poles, Towers, & Fixtures	508,465,504	L0.5	55	-100%	1,016,931,008	142,030,440	874,900,568	45.69	19,148,623	**3.77%**
365.00	Overhead Conductor & Devices	518,633,650	R0.5	44	-43%	741,646,120	101,893,370	639,752,750	36.50	17,527,473	**3.38%**
366.00	Underground Conduit	106,786,748	R2	85	-60%	170,858,797	19,903,443	150,955,354	75.55	1,998,085	**1.87%**
367.00	Underground Conductor	410,266,021	R1	80	-29%	529,243,167	83,175,881	446,067,286	69.66	6,403,492	**1.56%**
368.00	Line Transformers	404,536,594	R1	35	-15%	465,217,083	108,217,044	357,000,039	25.72	13,880,250	**3.43%**
369.00	Services	302,499,534	R1.5	60	-65%	499,124,231	109,443,581	389,680,650	47.48	8,207,259	**2.71%**
370.00	Meters	19,889,703	L0	15	-30%	25,856,614	6,707,200	19,149,414	11.37	1,684,205	**8.47%**
370.16	AMI - Meters	95,005,560	R2	15	-30%	123,507,228	34,262,266	89,244,962	9.62	9,277,023	**9.76%**
371.00	Installations on Custs. Prem.	52,562,250	L0	34	-18%	62,023,455	16,213,207	45,810,248	26.73	1,713,814	**3.26%**

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**	**Total Rate**
373.00	Street Lighting & Signal Sys.	67,410,236	O1 - 50	-27%	85,611,000	31,414,783	54,196,217	40.73	1,330,622	**1.97%**
	Total Distribution Plant	2,996,322,714		-43%	4,270,226,160	738,822,489	3,531,403,671	39.96	88,367,616	**2.95%**
	GENERAL PLANT									
390.00	Structures & Improvements	73,446,025	L0 - 58	-10%	80,790,628	10,010,521	70,780,107	49.26	1,436,868	**1.96%**
391.00	Office Furniture & Equipment	1,567,720	SQ - 20	0%	1,567,720	634,769	932,951	10.15	91,916	**5.86%**
391.10	Office Equipment - Computers	17,344	SQ - 5	0%	17,344	7,128	10,216	2.50	4,086	**23.56%**
392.00	Transportation Equipment	1,874,292	SQ - 15	0%	1,874,292	616,530	1,257,762	9.00	139,751	**7.46%**
393.00	Stores Equipment	2,387,007	SQ - 30	0%	2,387,007	935,538	1,451,469	15.70	92,450	**3.87%**
394.00	Tools Shop & Garage Equipment	32,104,652	SQ - 25	0%	32,104,652	9,269,195	22,835,457	16.22	1,407,858	**4.39%**
395.00	Laboratory Equipment	837,976	SQ - 20	0%	837,976	380,922	457,054	8.94	51,125	**6.10%**
396.00	Power Operated Equipment	637,521	SQ - 18	0%	637,521	415,730	221,791	3.72	59,621	**9.35%**
397.00	Communication Equipment	85,154,098	SQ - 15	0%	85,154,098	16,285,494	68,868,604	11.51	5,983,371	**7.03%**
397.16	AMI - Communication Equipment	17,975,913	SQ - 15	0%	17,975,913	4,876,027	13,099,886	10.05	1,303,471	**7.25%**
398.00	Miscellaneous Equipment	8,702,922	SQ - 20	-3%	8,964,010	3,114,844	5,849,166	11.55	506,421	**5.82%**
	Total General Plant	224,705,470		-3%	232,311,160	46,546,698	185,764,462	16.77	11,076,940	**4.93%**
	TOTAL PLANT STUDIED	**6,091,268,314**		-28%	**7,779,841,438**	**1,810,496,477**	**5,969,344,961**	**32.07**	**186,144,752**	**3.06%**

[1] Company depreciation study
[2] Average life and Iowa curve shape developed through actuarial analysis and professional judgment
[3] Net salvage for mass property 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]

Terminal Net Salvage Rate Adjustments

[1] Production Units	[2] Plant Balance 12/31/2021	[3] S&L Net Salvage Estimate	[4] Contingency Costs	[5] Adjusted Net Salvage	[6] Adjusted Net Salvage Ratio
Northeastern Units 3 & 4	$ 484,228,635	$ 21,853,344	$ 6,824,200	$ 15,029,144	-3.1%
Comanche	157,698,674	2,436,968	889,300	1,547,668	-1.0%
Northeastern Units 1 & 2	279,273,877	10,603,727	3,681,500	6,922,227	-2.5%
Riverside Units 1-4	245,810,842	22,292,071	5,455,900	16,836,171	-6.8%
Southwestern Units 1-5	159,599,617	8,403,033	2,827,600	5,575,433	-3.5%
Tulsa	82,347,708	7,803,833	2,503,500	5,300,333	-6.4%
Weleetka	22,784,602	1,901,333	403,800	1,497,533	-6.6%
Total	$ 1,431,743,955	$ 75,294,309	$ 22,585,800	$ 52,708,509	

[1], [2] Company production units and plant balances - see depreciation study

[3], [4] Sargent & Lundy net salvage estimates and contingency cost estimates - see Exhibit JAC-3

[5] = [3] - [4] (also does not include annual inflation rate)

[6] = [5] / [2] * -1

Northeast Unit 3 Account 311 - Remaining Life Calculation

[1]	[2]	[3]	[4]
Year	**Amount Retired**	**Remaining Life**	**Dollar Years**
2022	$ 154,568	0.5	$ 77,284
2023	154,568	1.5	231,852
2024	154,568	2.5	386,420
2025	154,568	3.5	540,989
2026	154,568	4.5	695,557
2027	154,568	5.5	850,125
2028	154,568	6.5	1,004,693
2029	154,568	7.5	1,159,261
2030	154,568	8.5	1,313,829
2031	154,568	9.5	1,468,397
2032	154,568	10.5	1,622,966
2033	154,568	11.5	1,777,534
2034	154,568	12.5	1,932,102
2035	154,568	13.5	2,086,670
2036	154,568	14.5	2,241,238
2037	154,568	15.5	2,395,806
2038	154,568	16.5	2,550,375
2039	154,568	17.5	2,704,943
2040	17,676,827	18.5	327,021,304
Total	$ 20,459,054		$ 352,061,345

Interim Retirement Amount	$ 2,782,227	[5]
Interim Retirement Rate	0.76%	[6]
Average Remaining Life	**17.21**	[7]

[1] Year
[2] Interim amounts retired = total amount to be retired * [6]
[3] Remaining life
[4] = [2] * [3]
[5] = sum of [2] less terminal retirements
[6] Company's estimated interim retirement rate
[7] = sum of [4] / sum of [2]

Northeast Unit 3 Account 312 - Remaining Life Calculation

Exhibit DJG-2-6

[1]	[2]	[3]	[4]
Year	**Amount Retired**	**Remaining Life**	**Dollar Years**
2022	$ 1,859,773	0.5	$ 929,886
2023	1,859,773	1.5	2,789,659
2024	1,859,773	2.5	4,649,432
2025	1,859,773	3.5	6,509,205
2026	1,859,773	4.5	8,368,977
2027	1,859,773	5.5	10,228,750
2028	1,859,773	6.5	12,088,523
2029	1,859,773	7.5	13,948,296
2030	1,859,773	8.5	15,808,068
2031	1,859,773	9.5	17,667,841
2032	1,859,773	10.5	19,527,614
2033	1,859,773	11.5	21,387,387
2034	1,859,773	12.5	23,247,159
2035	1,859,773	13.5	25,106,932
2036	1,859,773	14.5	26,966,705
2037	1,859,773	15.5	28,826,478
2038	1,859,773	16.5	30,686,250
2039	1,859,773	17.5	32,546,023
2040	343,913,041	18.5	6,362,391,251
Total	$ 377,388,950		$ 6,663,674,436

Interim Retirement Amount	$ 33,475,909	[5]
Interim Retirement Rate	0.49%	[6]
Average Remaining Life	**17.66**	[7]

[1] Year
[2] Interim amounts retired = total amount to be retired * [6]
[3] Remaining life
[4] = [2] * [3]
[5] = sum of [2] less terminal retirements
[6] Company's estimated interim retirement rate
[7] = sum of [4] / sum of [2]

Northeast Unit 3 Account 314 - Remaining Life Calculation

[1]	[2]	[3]	[4]
Year	**Amount Retired**	**Remaining Life**	**Dollar Years**
2022	$ 235,440	0.5	$ 117,720
2023	235,440	1.5	353,160
2024	235,440	2.5	588,600
2025	235,440	3.5	824,041
2026	235,440	4.5	1,059,481
2027	235,440	5.5	1,294,921
2028	235,440	6.5	1,530,361
2029	235,440	7.5	1,765,801
2030	235,440	8.5	2,001,241
2031	235,440	9.5	2,236,682
2032	235,440	10.5	2,472,122
2033	235,440	11.5	2,707,562
2034	235,440	12.5	2,943,002
2035	235,440	13.5	3,178,442
2036	235,440	14.5	3,413,882
2037	235,440	15.5	3,649,322
2038	235,440	16.5	3,884,763
2039	235,440	17.5	4,120,203
2040	41,972,118	18.5	776,484,186
Total	$ 46,210,041		$ 814,625,491

Interim Retirement Amount	$ 4,237,923	[5]
Interim Retirement Rate	0.51%	[6]
Average Remaining Life	**17.63**	[7]

[1] Year
[2] Interim amounts retired = total amount to be retired * [6]
[3] Remaining life
[4] = [2] * [3]
[5] = sum of [2] less terminal retirements
[6] Company's estimated interim retirement rate
[7] = sum of [4] / sum of [2]

Northeast Unit 3 Account 315 - Remaining Life Calculation

[1]	[2]	[3]	[4]
Year	**Amount Retired**	**Remaining Life**	**Dollar Years**
2022	$ 59,010	0.5	$ 29,505
2023	59,010	1.5	88,515
2024	59,010	2.5	147,525
2025	59,010	3.5	206,535
2026	59,010	4.5	265,545
2027	59,010	5.5	324,554
2028	59,010	6.5	383,564
2029	59,010	7.5	442,574
2030	59,010	8.5	501,584
2031	59,010	9.5	560,594
2032	59,010	10.5	619,604
2033	59,010	11.5	678,614
2034	59,010	12.5	737,624
2035	59,010	13.5	796,634
2036	59,010	14.5	855,644
2037	59,010	15.5	914,653
2038	59,010	16.5	973,663
2039	59,010	17.5	1,032,673
2040	20,179,686	18.5	373,324,188
Total	$ 21,241,864		$ 382,883,791

Interim Retirement Amount	$ 1,062,178	[5]
Interim Retirement Rate	0.28%	[6]
Average Remaining Life	**18.02**	[7]

[1] Year
[2] Interim amounts retired = total amount to be retired * [6]
[3] Remaining life
[4] = [2] * [3]
[5] = sum of [2] less terminal retirements
[6] Company's estimated interim retirement rate
[7] = sum of [4] / sum of [2]

Northeast Unit 3 Account 316 - Remaining Life Calculation

[1]	[2]	[3]	[4]
Year	**Amount Retired**	**Remaining Life**	**Dollar Years**
2022	$ 154,823	0.5	$ 77,412
2023	154,823	1.5	232,235
2024	154,823	2.5	387,058
2025	154,823	3.5	541,882
2026	154,823	4.5	696,705
2027	154,823	5.5	851,528
2028	154,823	6.5	1,006,351
2029	154,823	7.5	1,161,175
2030	154,823	8.5	1,315,998
2031	154,823	9.5	1,470,821
2032	154,823	10.5	1,625,645
2033	154,823	11.5	1,780,468
2034	154,823	12.5	1,935,291
2035	154,823	13.5	2,090,114
2036	154,823	14.5	2,244,938
2037	154,823	15.5	2,399,761
2038	154,823	16.5	2,554,584
2039	154,823	17.5	2,709,408
2040	15,703,960	18.5	290,523,255
Total	$ 18,490,779		$ 315,604,628

Interim Retirement Amount	$ 2,786,819	[5]
Interim Retirement Rate	0.84%	[6]
Average Remaining Life	**17.07**	[7]

[1] Year
[2] Interim amounts retired = total amount to be retired * [6]
[3] Remaining life
[4] = [2] * [3]
[5] = sum of [2] less terminal retirements
[6] Company's estimated interim retirement rate
[7] = sum of [4] / sum of [2]

Northeast Unit 3 Diesel - Remaining Life Calculation

[1]	[2]	[3]	[4]
Year	**Amount Retired**	**Remaining Life**	**Dollar Years**
2022	$ -	0.5	$ -
2023	-	1.5	-
2024	-	2.5	-
2025	-	3.5	-
2026	-	4.5	-
2027	-	5.5	-
2028	-	6.5	-
2029	-	7.5	-
2030	-	8.5	-
2031	-	9.5	-
2032	-	10.5	-
2033	-	11.5	-
2034	-	12.5	-
2035	-	13.5	-
2036	-	14.5	-
2037	-	15.5	-
2038	-	16.5	-
2039	-	17.5	-
2040	437,950	18.5	8,102,075
Total	$ 437,950		$ 8,102,075

Interim Retirement Amount	$ -	[5]
Interim Retirement Rate	0.00%	[6]
Average Remaining Life	**18.50**	[7]

[1] Year
[2] Interim amounts retired = total amount to be retired * [6]
[3] Remaining life
[4] = [2] * [3]
[5] = sum of [2] less terminal retirements
[6] Company's estimated interim retirement rate
[7] = sum of [4] / sum of [2]

Account 366 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] PSO R2.5-80	[5] OIEC R2-85	[6] PSO SSD	[7] OIEC SSD
0.0	108,000,000	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	104,000,000	100.00%	99.97%	99.94%	0.0000	0.0000
1.5	97,239,256	99.96%	99.89%	99.83%	0.0000	0.0000
2.5	90,920,517	99.93%	99.82%	99.71%	0.0000	0.0000
3.5	83,484,790	99.89%	99.74%	99.59%	0.0000	0.0000
4.5	77,090,983	99.84%	99.66%	99.46%	0.0000	0.0000
5.5	70,499,170	99.81%	99.57%	99.33%	0.0000	0.0000
6.5	65,483,645	99.77%	99.48%	99.19%	0.0000	0.0000
7.5	55,775,909	99.73%	99.38%	99.04%	0.0000	0.0000
8.5	52,789,527	99.67%	99.28%	98.89%	0.0000	0.0001
9.5	48,879,305	99.61%	99.17%	98.74%	0.0000	0.0001
10.5	46,259,800	99.53%	99.06%	98.58%	0.0000	0.0001
11.5	43,163,064	99.47%	98.94%	98.41%	0.0000	0.0001
12.5	33,967,950	99.38%	98.82%	98.24%	0.0000	0.0001
13.5	27,368,326	99.26%	98.69%	98.06%	0.0000	0.0001
14.5	23,714,122	98.99%	98.55%	97.87%	0.0000	0.0001
15.5	21,423,496	98.88%	98.41%	97.68%	0.0000	0.0001
16.5	19,797,639	98.67%	98.26%	97.48%	0.0000	0.0001
17.5	18,356,478	98.51%	98.10%	97.27%	0.0000	0.0002
18.5	14,192,864	98.26%	97.94%	97.05%	0.0000	0.0001
19.5	9,278,540	98.13%	97.76%	96.83%	0.0000	0.0002
20.5	8,136,864	97.22%	97.58%	96.60%	0.0000	0.0000
21.5	8,107,069	96.90%	97.39%	96.36%	0.0000	0.0000
22.5	7,506,101	96.69%	97.19%	96.12%	0.0000	0.0000
23.5	6,357,945	95.61%	96.98%	95.86%	0.0002	0.0000
24.5	5,542,133	95.51%	96.76%	95.60%	0.0002	0.0000
25.5	4,476,256	95.37%	96.53%	95.33%	0.0001	0.0000
26.5	4,324,214	94.06%	96.29%	95.05%	0.0005	0.0001
27.5	4,285,703	93.89%	96.04%	94.76%	0.0005	0.0001
28.5	4,280,857	93.79%	95.78%	94.46%	0.0004	0.0000
29.5	4,213,944	92.44%	95.50%	94.15%	0.0009	0.0003
30.5	4,162,512	92.30%	95.22%	93.83%	0.0009	0.0002
31.5	3,772,394	92.12%	94.92%	93.50%	0.0008	0.0002
32.5	3,761,872	91.94%	94.60%	93.16%	0.0007	0.0001
33.5	3,745,697	91.56%	94.28%	92.81%	0.0007	0.0002
34.5	3,370,811	91.08%	93.94%	92.45%	0.0008	0.0002
35.5	3,249,391	90.33%	93.58%	92.07%	0.0011	0.0003
36.5	3,236,300	90.11%	93.21%	91.69%	0.0010	0.0002
37.5	3,068,709	90.00%	92.83%	91.29%	0.0008	0.0002
38.5	2,902,530	89.84%	92.43%	90.89%	0.0007	0.0001
39.5	2,875,653	89.54%	92.01%	90.46%	0.0006	0.0001
40.5	2,866,569	89.37%	91.58%	90.03%	0.0005	0.0000
41.5	2,783,278	88.88%	91.12%	89.59%	0.0005	0.0001
42.5	2,478,485	88.66%	90.65%	89.13%	0.0004	0.0000
43.5	2,353,825	88.18%	90.17%	88.65%	0.0004	0.0000
44.5	2,194,267	87.68%	89.66%	88.17%	0.0004	0.0000
45.5	2,152,345	87.42%	89.13%	87.67%	0.0003	0.0000
46.5	1,985,502	86.70%	88.58%	87.15%	0.0004	0.0000
47.5	1,957,133	86.32%	88.01%	86.62%	0.0003	0.0000
48.5	1,686,494	85.96%	87.42%	86.08%	0.0002	0.0000
49.5	1,561,147	85.37%	86.81%	85.52%	0.0002	0.0000
50.5	1,538,679	85.05%	86.18%	84.94%	0.0001	0.0000
51.5	1,528,122	84.47%	85.52%	84.35%	0.0001	0.0000
52.5	1,509,884	84.11%	84.84%	83.74%	0.0001	0.0000
53.5	1,475,660	83.82%	84.13%	83.12%	0.0000	0.0000

Account 366 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] PSO R2.5-80	[5] OIEC R2-85	[6] PSO SSD	[7] OIEC SSD
54.5	1,426,069	83.07%	83.40%	82.48%	0.0000	0.0000
55.5	1,397,098	82.50%	82.64%	81.82%	0.0000	0.0000
56.5	1,367,636	81.82%	81.85%	81.14%	0.0000	0.0000
57.5	1,305,135	81.40%	81.04%	80.45%	0.0000	0.0001
58.5	1,277,996	81.02%	80.20%	79.74%	0.0001	0.0002
59.5	1,259,571	80.56%	79.33%	79.01%	0.0002	0.0002
60.5	1,196,629	80.26%	78.43%	78.26%	0.0003	0.0004
61.5	1,105,971	79.92%	77.50%	77.50%	0.0006	0.0006
62.5	1,033,859	79.57%	76.54%	76.71%	0.0009	0.0008
63.5	986,051	79.24%	75.55%	75.91%	0.0014	0.0011
64.5	855,604	78.92%	74.52%	75.09%	0.0019	0.0015
65.5	726,927	78.42%	73.47%	74.25%	0.0025	0.0017
66.5	709,940	76.59%	72.38%	73.38%	0.0018	0.0010
67.5	430,576	75.40%	71.25%	72.50%	0.0017	0.0008
68.5	414,944	73.44%	70.09%	71.60%	0.0011	0.0003
69.5	410,668	72.68%	68.90%	70.68%	0.0014	0.0004
70.5	391,367	69.52%	67.68%	69.74%	0.0003	0.0000
71.5	263,646	66.94%	66.41%	68.79%	0.0000	0.0003
72.5	150,216	66.43%	65.12%	67.81%	0.0002	0.0002
73.5	148,006	65.46%	63.79%	66.81%	0.0003	0.0002
74.5	145,483	64.34%	62.43%	65.79%	0.0004	0.0002
75.5	141,451	63.73%	61.03%	64.75%	0.0007	0.0001
76.5	140,085	63.11%	59.60%	63.70%	0.0012	0.0000
77.5	138,115	62.22%	58.15%	62.63%	0.0017	0.0000
78.5	134,854	60.75%	56.66%	61.53%	0.0017	0.0001
79.5	132,302	59.61%	55.15%	60.42%	0.0020	0.0001
80.5	130,291	58.72%	53.61%	59.30%	0.0026	0.0000
81.5	126,884	57.55%	52.05%	58.15%	0.0030	0.0000
82.5	121,645	56.11%	50.46%	56.99%	0.0032	0.0001
83.5	108,476	54.13%	48.86%	55.82%	0.0028	0.0003
84.5			47.24%	54.62%		
Sum of Squared Differences				[8]	0.0489	0.0153
Up to 1% of Beginning Exposures				[9]	0.0170	0.0068

[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.

Account 367 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] PSO R1.5-70	[5] OIEC R1-80	[6] PSO SSD	[7] OIEC SSD
0.0	449,607,477	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	433,173,215	99.76%	99.87%	99.84%	0.0000	0.0000
1.5	414,985,502	99.05%	99.62%	99.51%	0.0000	0.0000
2.5	397,461,695	98.24%	99.35%	99.18%	0.0001	0.0001
3.5	371,277,918	97.54%	99.08%	98.84%	0.0002	0.0002
4.5	348,626,089	96.82%	98.80%	98.50%	0.0004	0.0003
5.5	321,789,603	96.16%	98.52%	98.15%	0.0006	0.0004
6.5	299,689,121	95.50%	98.22%	97.80%	0.0007	0.0005
7.5	281,810,921	94.83%	97.92%	97.44%	0.0010	0.0007
8.5	267,326,391	94.01%	97.61%	97.07%	0.0013	0.0009
9.5	251,738,942	93.34%	97.30%	96.70%	0.0016	0.0011
10.5	238,996,756	92.80%	96.97%	96.32%	0.0017	0.0012
11.5	224,770,533	92.38%	96.63%	95.94%	0.0018	0.0013
12.5	207,073,880	92.03%	96.29%	95.55%	0.0018	0.0012
13.5	172,853,854	91.79%	95.94%	95.16%	0.0017	0.0011
14.5	154,669,008	91.52%	95.58%	94.76%	0.0017	0.0011
15.5	142,818,374	91.30%	95.21%	94.35%	0.0015	0.0009
16.5	134,085,376	91.07%	94.83%	93.94%	0.0014	0.0008
17.5	125,698,474	90.86%	94.44%	93.53%	0.0013	0.0007
18.5	122,159,767	90.63%	94.05%	93.11%	0.0012	0.0006
19.5	117,577,262	90.34%	93.64%	92.68%	0.0011	0.0005
20.5	111,620,101	90.03%	93.22%	92.25%	0.0010	0.0005
21.5	101,618,828	89.76%	92.80%	91.81%	0.0009	0.0004
22.5	92,766,321	89.49%	92.36%	91.37%	0.0008	0.0004
23.5	82,689,425	89.27%	91.91%	90.92%	0.0007	0.0003
24.5	72,622,729	89.02%	91.45%	90.47%	0.0006	0.0002
25.5	58,224,708	88.79%	90.98%	90.01%	0.0005	0.0001
26.5	57,653,066	88.58%	90.50%	89.54%	0.0004	0.0001
27.5	50,496,774	88.35%	90.01%	89.07%	0.0003	0.0001
28.5	46,593,835	88.16%	89.50%	88.60%	0.0002	0.0000
29.5	43,781,911	87.91%	88.99%	88.12%	0.0001	0.0000
30.5	39,667,389	87.70%	88.45%	87.63%	0.0001	0.0000
31.5	36,458,796	87.49%	87.91%	87.13%	0.0000	0.0000
32.5	34,026,552	87.29%	87.35%	86.63%	0.0000	0.0000
33.5	32,155,318	87.06%	86.78%	86.13%	0.0000	0.0001
34.5	30,364,111	86.83%	86.19%	85.62%	0.0000	0.0001
35.5	28,760,920	86.63%	85.59%	85.10%	0.0001	0.0002
36.5	25,797,178	86.39%	84.98%	84.57%	0.0002	0.0003
37.5	22,984,638	86.13%	84.34%	84.03%	0.0003	0.0004
38.5	20,775,428	85.88%	83.70%	83.49%	0.0005	0.0006
39.5	18,896,754	85.62%	83.03%	82.94%	0.0007	0.0007
40.5	16,946,027	85.32%	82.35%	82.39%	0.0009	0.0009
41.5	14,917,241	84.97%	81.65%	81.82%	0.0011	0.0010
42.5	12,796,243	84.64%	80.93%	81.25%	0.0014	0.0011
43.5	10,890,297	84.30%	80.20%	80.67%	0.0017	0.0013
44.5	9,423,305	83.91%	79.44%	80.07%	0.0020	0.0015
45.5	8,386,890	83.47%	78.67%	79.48%	0.0023	0.0016
46.5	7,030,744	82.97%	77.88%	78.87%	0.0026	0.0017
47.5	6,044,675	82.52%	77.07%	78.25%	0.0030	0.0018
48.5	4,426,566	82.09%	76.24%	77.62%	0.0034	0.0020
49.5	3,716,868	81.66%	75.39%	76.99%	0.0039	0.0022
50.5	3,135,975	81.18%	74.51%	76.34%	0.0044	0.0023
51.5	2,786,552	80.67%	73.62%	75.69%	0.0050	0.0025
52.5	2,466,042	80.30%	72.71%	75.02%	0.0058	0.0028

Account 367 Curve Fitting

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**PSO R1.5-70**	**OIEC R1-80**	**PSO SSD**	**OIEC SSD**
53.5	2,202,497	79.91%	71.78%	74.35%	0.0066	0.0031
54.5	1,806,507	79.51%	70.82%	73.66%	0.0075	0.0034
55.5	1,630,346	79.13%	69.85%	72.97%	0.0086	0.0038
56.5	1,488,258	78.86%	68.85%	72.26%	0.0100	0.0044
57.5	1,367,137	78.60%	67.84%	71.55%	0.0116	0.0050
58.5	1,309,986	78.33%	66.80%	70.82%	0.0133	0.0056
59.5	1,250,815	78.00%	65.74%	70.09%	0.0150	0.0063
60.5	1,204,101	77.58%	64.66%	69.34%	0.0167	0.0068
61.5	1,112,278	76.72%	63.56%	68.59%	0.0173	0.0066
62.5	990,107	76.04%	62.44%	67.82%	0.0185	0.0068
63.5	887,924	75.03%	61.31%	67.04%	0.0188	0.0064
64.5	735,414	73.95%	60.15%	66.26%	0.0191	0.0059
65.5	540,176	73.01%	58.97%	65.46%	0.0197	0.0057
66.5	529,381	72.06%	57.78%	64.66%	0.0204	0.0055
67.5	201,772	70.93%	56.56%	63.84%	0.0206	0.0050
68.5	190,036	69.39%	55.33%	63.02%	0.0198	0.0041
69.5	184,229	67.27%	54.09%	62.18%	0.0174	0.0026
70.5	179,247	66.65%	52.83%	61.34%	0.0191	0.0028
71.5	90,236	65.98%	51.55%	60.49%	0.0208	0.0030
72.5	49,826	67.21%	50.27%	59.62%	0.0287	0.0057
73.5	49,784	67.15%	48.97%	58.75%	0.0330	0.0070
74.5	48,780	67.10%	47.66%	57.87%	0.0378	0.0085
75.5	47,809	67.08%	46.34%	56.99%	0.0430	0.0102
76.5	47,772	67.02%	45.02%	56.09%	0.0484	0.0120
77.5	47,603	66.79%	43.69%	55.19%	0.0534	0.0135
78.5	47,173	66.18%	42.35%	54.28%	0.0568	0.0142
79.5	45,729	64.16%	41.01%	53.36%	0.0536	0.0117
80.5	43,224	62.19%	39.67%	52.43%	0.0507	0.0095
81.5	37,986	60.47%	38.34%	51.50%	0.0490	0.0080
82.5	29,580	59.04%	37.00%	50.56%	0.0486	0.0072
83.5			35.67%	49.62%		
Sum of Squared Differences				[8]	0.8697	0.2413
Up to 1% of Beginning Exposures				[9]	0.0434	0.0294

[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.

Account 373 Curve Fitting

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**PSO L0-45**	**OIEC O1-50**	**PSO SSD**	**OIEC SSD**
0.0	67,283,737	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	63,387,367	99.45%	99.85%	99.50%	0.0000	0.0000
1.5	59,874,718	98.62%	99.36%	98.50%	0.0001	0.0000
2.5	57,355,341	97.64%	98.71%	97.50%	0.0001	0.0000
3.5	54,875,408	96.39%	97.95%	96.50%	0.0002	0.0000
4.5	52,604,629	95.31%	97.10%	95.50%	0.0003	0.0000
5.5	49,933,537	94.54%	96.17%	94.50%	0.0003	0.0000
6.5	46,206,627	90.82%	95.17%	93.50%	0.0019	0.0007
7.5	43,980,776	89.93%	94.12%	92.50%	0.0018	0.0007
8.5	41,522,930	89.14%	93.02%	91.50%	0.0015	0.0006
9.5	39,358,364	88.28%	91.87%	90.50%	0.0013	0.0005
10.5	37,649,459	87.47%	90.69%	89.50%	0.0010	0.0004
11.5	35,941,513	86.60%	89.47%	88.50%	0.0008	0.0004
12.5	33,948,414	85.79%	88.22%	87.50%	0.0006	0.0003
13.5	28,082,794	84.94%	86.94%	86.50%	0.0004	0.0002
14.5	25,777,464	84.13%	85.64%	85.50%	0.0002	0.0002
15.5	24,163,897	83.12%	84.32%	84.50%	0.0001	0.0002
16.5	22,832,100	82.02%	82.98%	83.50%	0.0001	0.0002
17.5	20,783,051	81.04%	81.63%	82.50%	0.0000	0.0002
18.5	19,064,965	80.08%	80.27%	81.50%	0.0000	0.0002
19.5	18,378,287	79.10%	78.89%	80.50%	0.0000	0.0002
20.5	16,625,494	78.25%	77.51%	79.50%	0.0001	0.0002
21.5	15,565,524	77.34%	76.12%	78.50%	0.0001	0.0001
22.5	12,899,634	76.39%	74.74%	77.50%	0.0003	0.0001
23.5	10,716,831	75.50%	73.35%	76.50%	0.0005	0.0001
24.5	8,989,592	74.59%	71.96%	75.50%	0.0007	0.0001
25.5	5,385,717	73.63%	70.58%	74.50%	0.0009	0.0001
26.5	5,058,973	72.70%	69.20%	73.50%	0.0012	0.0001
27.5	3,626,273	71.81%	67.82%	72.50%	0.0016	0.0000
28.5	2,020,372	70.78%	66.44%	71.50%	0.0019	0.0001
29.5	968,121	69.68%	65.07%	70.50%	0.0021	0.0001
30.5			63.70%	69.50%		
Sum of Squared Differences				[8]	0.0202	0.0059
Up to 1% of Beginning Exposures				[9]	0.0202	0.0059

[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.

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Electric Division

366.00 Underground Conduit

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2021

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 85 **Survivor Curve:** R2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1937	103,304.80	85.00	1,215.35	23.75	28,868.66
1938	8,881.89	85.00	104.49	24.24	2,532.47
1939	2,049.03	85.00	24.11	24.73	596.03
1940	824.87	85.00	9.70	25.22	244.76
1941	39.95	85.00	0.47	25.72	12.09
1946	2,638.27	85.00	31.04	28.35	879.89
1947	7.76	85.00	0.09	28.89	2.64
1949	111,435.89	85.00	1,311.01	30.01	39,339.09
1950	113,163.78	85.00	1,331.34	30.57	40,702.11
1951	1,460.44	85.00	17.18	31.14	535.11
1953	4,422.63	85.00	52.03	32.31	1,681.03
1954	268,351.63	85.00	3,157.07	32.90	103,879.09
1956	123,326.65	85.00	1,450.90	34.11	49,486.91
1957	126,417.32	85.00	1,487.26	34.72	51,636.48
1958	43,569.09	85.00	512.58	35.34	18,112.84
1959	67,249.52	85.00	791.17	35.96	28,450.92
1960	85,608.79	85.00	1,007.16	36.59	36,856.56
1961	58,209.71	85.00	684.82	37.23	25,496.75
1962	11,195.23	85.00	131.71	37.87	4,988.34
1963	20,972.41	85.00	246.73	38.52	9,504.88
1964	55,548.78	85.00	653.51	39.18	25,602.90
1965	17,903.36	85.00	210.63	39.84	8,391.56
1966	19,164.83	85.00	225.47	40.51	9,133.20
1967	36,491.17	85.00	429.31	41.18	17,678.99
1968	28,953.50	85.00	340.63	41.86	14,258.17
1969	11,722.08	85.00	137.91	42.54	5,866.82
1971	16,687.13	85.00	196.32	43.93	8,624.09

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Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2021
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 85 *Survivor Curve:* R2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1972	113,695.13	85.00	1,337.59	44.63	59,696.13
1973	262,546.76	85.00	3,088.78	45.34	140,031.98
1974	19,622.79	85.00	230.86	46.05	10,630.19
1975	149,115.00	85.00	1,754.29	46.76	82,036.24
1976	35,602.55	85.00	418.85	47.48	19,889.06
1977	146,179.07	85.00	1,719.75	48.21	82,917.18
1978	111,079.56	85.00	1,306.82	48.95	63,964.69
1979	298,122.76	85.00	3,507.32	49.68	174,258.40
1980	67,425.24	85.00	793.24	50.43	39,999.97
1981	3,702.95	85.00	43.56	51.17	2,229.31
1982	17,000.00	85.00	200.00	51.93	10,385.50
1983	160,837.31	85.00	1,892.20	52.68	99,690.17
1984	163,438.83	85.00	1,922.81	53.45	102,767.50
1985	5,420.00	85.00	63.76	54.21	3,456.87
1986	93,577.00	85.00	1,100.90	54.98	60,532.10
1987	355,328.15	85.00	4,180.32	55.76	233,092.58
1988	383.00	85.00	4.51	56.54	254.77
1989	3,359.76	85.00	39.53	57.33	2,265.95
1990	381,939.04	85.00	4,493.39	58.12	261,141.26
1991	44,970.58	85.00	529.06	58.91	31,167.43
1992	5,344.54	85.00	62.88	59.71	3,754.27
1993	325.73	85.00	3.83	60.51	231.88
1994	30,469.46	85.00	358.46	61.32	21,980.90
1995	90,659.91	85.00	1,066.59	62.13	66,267.89
1996	1,057,598.20	85.00	12,442.31	62.95	783,194.51
1997	809,705.38	85.00	9,525.93	63.77	607,423.33
1998	1,063,996.24	85.00	12,517.58	64.59	808,490.61

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Electric Division
366.00 Underground Conduit

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2021
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 85 *Survivor Curve:* R2

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1999	583,095.65	85.00	6,859.94	65.42	448,761.08
2000	3,248.91	85.00	38.22	66.25	2,532.21
2001	1,056,081.03	85.00	12,424.46	67.08	833,491.37
2002	4,895,209.45	85.00	57,590.61	67.92	3,911,778.05
2003	4,117,588.06	85.00	48,442.14	68.77	3,331,210.80
2004	1,409,074.99	85.00	16,577.33	69.61	1,154,004.38
2005	1,579,919.42	85.00	18,587.26	70.47	1,309,767.05
2006	2,262,837.58	85.00	26,621.58	71.32	1,898,658.77
2007	3,579,704.00	85.00	42,114.10	72.18	3,039,722.41
2008	6,561,697.47	85.00	77,196.32	73.04	5,638,396.69
2009	9,154,478.35	85.00	107,699.58	73.90	7,959,495.93
2010	3,070,926.69	85.00	36,128.49	74.77	2,701,432.73
2011	2,578,524.38	85.00	30,335.53	75.65	2,294,784.85
2012	3,877,960.19	85.00	45,622.99	76.52	3,491,174.52
2013	2,953,809.82	85.00	34,750.65	77.40	2,689,735.18
2014	9,680,389.62	85.00	113,886.76	78.28	8,915,392.39
2015	4,990,454.36	85.00	58,711.14	79.17	4,648,046.01
2016	6,567,144.36	85.00	77,260.40	80.06	6,185,305.14
2017	6,351,411.76	85.00	74,722.38	80.95	6,048,751.43
2018	7,402,110.19	85.00	87,083.52	81.84	7,127,301.75
2019	6,287,661.12	85.00	73,972.37	82.74	6,120,634.18
2020	6,817,236.21	85.00	80,202.66	83.64	6,708,375.26
2021	4,175,138.75	85.00	49,119.20	84.55	4,152,846.85
Total	106,786,747.81	85.00	1,256,312.75	75.55	94,916,712.10

Composite Average Remaining Life ... 75.55 Years

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Electric Division

367.00 Underground Conductor

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2021

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: **80** *Survivor Curve:* **R1**

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1938	28,875.87	80.00	360.94	27.70	9,999.62
1939	7,507.48	80.00	93.84	28.18	2,644.24
1940	4,037.72	80.00	50.47	28.66	1,446.24
1941	1,106.10	80.00	13.83	29.14	402.84
1946	953.44	80.00	11.92	31.61	376.73
1947	967.20	80.00	12.09	32.12	388.30
1949	42,090.64	80.00	526.12	33.14	17,438.24
1950	87,213.31	80.00	1,090.15	33.67	36,701.37
1951	3,262.61	80.00	40.78	34.19	1,394.38
1953	7,373.75	80.00	92.17	35.25	3,249.27
1954	319,269.96	80.00	3,990.81	35.79	142,839.56
1955	3,811.68	80.00	47.65	36.33	1,731.15
1956	185,817.40	80.00	2,322.68	36.88	85,661.70
1957	139,744.52	80.00	1,746.78	37.43	65,383.60
1958	89,085.87	80.00	1,113.55	37.99	42,301.49
1959	112,224.15	80.00	1,402.78	38.55	54,073.37
1960	78,596.05	80.00	982.43	39.11	38,423.97
1961	39,871.40	80.00	498.38	39.68	19,775.24
1962	53,725.13	80.00	671.55	40.25	27,031.89
1963	52,367.37	80.00	654.58	40.83	26,726.24
1964	116,208.22	80.00	1,452.58	41.41	60,151.62
1965	136,576.26	80.00	1,707.17	41.99	71,692.66
1966	167,472.42	80.00	2,093.37	42.59	89,147.98
1967	385,028.86	80.00	4,812.78	43.18	207,812.30
1968	251,622.94	80.00	3,145.23	43.78	137,687.41
1969	307,591.02	80.00	3,844.82	44.38	170,623.95
1970	329,687.28	80.00	4,121.02	44.98	185,382.95

PSO
Electric Division
367.00 Underground Conductor

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2021
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 80 *Survivor Curve:* R1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1971	559,426.36	80.00	6,992.71	45.59	318,826.39
1972	686,504.64	80.00	8,581.16	46.21	396,510.97
1973	1,586,057.94	80.00	19,825.38	46.82	928,299.31
1974	948,425.56	80.00	11,855.11	47.45	562,479.60
1975	1,305,516.49	80.00	16,318.67	48.07	784,448.42
1976	987,568.13	80.00	12,344.39	48.70	601,152.11
1977	1,416,616.24	80.00	17,707.39	49.33	873,497.61
1978	1,854,809.93	80.00	23,184.72	49.97	1,158,448.75
1979	2,062,189.96	80.00	25,776.93	50.60	1,304,424.81
1980	1,958,803.54	80.00	24,484.62	51.25	1,254,732.22
1981	1,885,444.91	80.00	23,567.65	51.89	1,222,927.71
1982	1,814,621.66	80.00	22,682.38	52.54	1,191,717.55
1983	2,141,920.44	80.00	26,773.54	53.19	1,424,089.37
1984	2,736,333.64	80.00	34,203.58	53.84	1,841,647.44
1985	2,884,400.52	80.00	36,054.38	54.50	1,964,959.63
1986	1,532,589.11	80.00	19,157.03	55.16	1,056,710.10
1987	1,707,213.76	80.00	21,339.80	55.82	1,191,236.19
1988	1,779,163.02	80.00	22,239.15	56.49	1,256,210.83
1989	2,348,677.81	80.00	29,357.96	57.15	1,677,893.42
1990	3,114,359.41	80.00	38,928.81	57.82	2,250,990.65
1991	4,013,952.93	80.00	50,173.54	58.49	2,934,882.46
1992	2,678,718.60	80.00	33,483.40	59.17	1,981,145.93
1993	3,794,824.41	80.00	47,434.48	59.84	2,838,637.58
1994	7,005,185.90	80.00	87,563.30	60.52	5,299,514.75
1995	435,335.48	80.00	5,441.60	61.20	333,035.17
1996	14,207,643.47	80.00	177,592.45	61.88	10,989,969.15
1997	9,838,446.94	80.00	122,978.45	62.57	7,694,293.52

PSO

Electric Division

367.00 Underground Conductor

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2021

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 80 *Survivor Curve:* R1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1998	9,843,115.87	80.00	123,036.81	63.25	7,782,384.96
1999	3,282,278.61	80.00	41,027.77	63.94	2,623,298.75
2000	9,667,121.51	80.00	120,836.92	64.63	7,809,499.67
2001	5,560,312.45	80.00	69,502.70	65.32	4,539,848.08
2002	4,182,461.31	80.00	52,279.86	66.01	3,451,149.34
2003	3,220,599.12	80.00	40,256.79	66.71	2,685,446.67
2004	8,088,489.37	80.00	101,104.36	67.40	6,814,919.53
2005	8,373,104.56	80.00	104,661.99	68.10	7,127,867.38
2006	11,477,556.34	80.00	143,466.96	68.81	9,871,418.96
2007	17,673,124.13	80.00	220,910.21	69.51	15,355,446.64
2008	33,678,972.75	80.00	420,979.83	70.22	29,559,412.14
2009	16,831,420.97	80.00	210,389.10	70.92	14,921,591.39
2010	13,162,959.78	80.00	164,534.13	71.64	11,786,526.82
2011	11,278,313.36	80.00	140,976.46	72.35	10,199,509.34
2012	13,679,724.64	80.00	170,993.58	73.06	12,493,587.19
2013	12,062,307.86	80.00	150,776.22	73.78	11,124,674.30
2014	15,754,697.67	80.00	196,930.29	74.50	14,672,267.92
2015	19,912,119.78	80.00	248,897.16	75.23	18,724,167.93
2016	24,455,015.20	80.00	305,682.37	75.95	23,218,019.45
2017	19,904,287.38	80.00	248,799.26	76.68	19,078,800.16
2018	23,349,688.84	80.00	291,866.03	77.42	22,595,297.70
2019	14,148,250.15	80.00	176,850.05	78.15	13,821,086.81
2020	15,078,753.31	80.00	188,481.14	78.89	14,869,073.70
2021	15,364,506.61	80.00	192,052.99	79.63	15,293,016.23

PSO

Electric Division

367.00 Underground Conductor

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2021

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: **80** *Survivor Curve:* **R1**

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
Total	410,266,021.02	80.00	5,128,235.99	69.66	357,251,480.97

Composite Average Remaining Life ... **69.66 Years**

PSO
Electric Division
373.00 Street Lighting and Signal Systems

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2021
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 50   *Survivor Curve:* O1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1934	59,504.28	50.00	1,190.06	6.26	7,449.75
1935	31,257.56	50.00	625.14	6.76	4,225.45
1938	1,757.83	50.00	35.16	8.26	290.30
1939	94.24	50.00	1.88	8.76	16.51
1940	576.32	50.00	11.53	9.26	106.69
1941	691.72	50.00	13.83	9.76	134.97
1942	1,261.74	50.00	25.23	10.26	258.80
1945	3,339.59	50.00	66.79	11.76	785.14
1946	545.82	50.00	10.92	12.26	133.78
1947	5,051.26	50.00	101.02	12.75	1,288.53
1948	12,162.80	50.00	243.25	13.25	3,224.21
1949	14,138.09	50.00	282.75	13.75	3,889.16
1950	39,006.40	50.00	780.11	14.25	11,119.97
1951	32,831.87	50.00	656.62	14.75	9,687.94
1952	25,816.66	50.00	516.32	15.25	7,876.00
1953	78,540.26	50.00	1,570.77	15.75	24,745.80
1954	42,828.56	50.00	856.55	16.25	13,922.23
1955	22,960.87	50.00	459.21	16.75	7,693.41
1956	48,597.21	50.00	971.92	17.25	16,769.14
1957	84,481.26	50.00	1,689.58	17.75	29,996.05
1958	60,995.82	50.00	1,219.89	18.25	22,267.10
1959	24,886.28	50.00	497.71	18.75	9,333.78
1960	152,955.99	50.00	3,059.04	19.25	58,896.52
1961	88,242.99	50.00	1,764.82	19.75	34,860.69
1962	87,946.13	50.00	1,758.88	20.25	35,622.72
1963	54,729.79	50.00	1,094.57	20.75	22,715.59
1964	65,168.51	50.00	1,303.34	21.25	27,699.76

PSO
Electric Division
373.00 Street Lighting and Signal Systems

Original Cost Of Utility Plant In Service
And Development Of Composite Remaining Life as of December 31, 2021
Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 50 *Survivor Curve:* O1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1965	106,961.66	50.00	2,139.18	21.75	46,533.32
1966	198,468.26	50.00	3,969.27	22.25	88,327.32
1967	220,314.47	50.00	4,406.18	22.75	100,252.68
1968	265,427.12	50.00	5,308.41	23.25	123,434.80
1969	201,079.64	50.00	4,021.49	23.75	95,521.03
1970	146,391.27	50.00	2,927.75	24.25	71,005.54
1971	190,808.96	50.00	3,816.08	24.75	94,457.74
1972	204,227.11	50.00	4,084.44	25.25	103,142.23
1973	311,619.81	50.00	6,232.24	25.75	160,495.33
1974	268,752.85	50.00	5,374.92	26.25	141,104.53
1975	324,443.57	50.00	6,488.71	26.75	173,588.13
1976	165,096.17	50.00	3,301.84	27.25	89,982.74
1977	376,390.79	50.00	7,527.63	27.75	208,908.67
1978	331,921.97	50.00	6,638.27	28.25	187,545.96
1979	352,192.25	50.00	7,043.67	28.75	202,520.82
1980	414,704.57	50.00	8,293.88	29.25	242,613.87
1981	534,621.85	50.00	10,692.17	29.75	318,114.56
1982	266,567.85	50.00	5,331.22	30.25	161,280.56
1983	354,579.34	50.00	7,091.41	30.75	218,075.30
1984	435,630.38	50.00	8,712.39	31.25	272,279.61
1985	525,704.77	50.00	10,513.83	31.75	333,834.89
1986	474,264.40	50.00	9,485.05	32.25	305,911.28
1987	437,904.02	50.00	8,757.86	32.75	286,836.69
1988	929,867.78	50.00	18,596.89	33.25	618,381.56
1989	920,100.66	50.00	18,401.55	33.75	621,086.49
1990	865,563.54	50.00	17,310.84	34.25	592,927.90
1991	952,501.01	50.00	19,049.55	34.75	662,006.04

PSO

Electric Division

373.00 Street Lighting and Signal Systems

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2021

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: 50 *Survivor Curve:* O1

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
1992	1,020,890.08	50.00	20,417.29	35.25	719,745.80
1993	1,554,057.80	50.00	31,080.38	35.75	1,111,178.03
1994	1,370,608.14	50.00	27,411.48	36.25	993,713.46
1995	258,476.50	50.00	5,169.40	36.75	189,984.30
1996	3,488,981.28	50.00	69,777.89	37.25	2,599,343.55
1997	1,597,926.07	50.00	31,957.72	37.75	1,206,456.94
1998	2,031,977.59	50.00	40,638.54	38.25	1,554,490.43
1999	2,474,072.49	50.00	49,480.22	38.75	1,917,438.12
2000	868,429.07	50.00	17,368.15	39.25	681,727.41
2001	1,553,377.93	50.00	31,066.78	39.75	1,234,953.41
2002	453,093.72	50.00	9,061.65	40.25	364,745.45
2003	1,473,416.23	50.00	29,467.59	40.75	1,200,849.59
2004	1,776,990.55	50.00	35,538.92	41.25	1,466,034.53
2005	1,011,456.97	50.00	20,228.64	41.75	844,575.82
2006	1,302,062.80	50.00	26,040.61	42.25	1,100,254.20
2007	2,040,340.66	50.00	40,805.80	42.75	1,744,507.51
2008	5,528,051.24	50.00	110,558.27	43.25	4,781,805.15
2009	1,655,114.43	50.00	33,101.46	43.75	1,448,236.21
2010	1,336,608.53	50.00	26,731.50	44.25	1,182,906.75
2011	1,344,432.65	50.00	26,887.98	44.75	1,203,274.72
2012	1,766,796.11	50.00	35,335.04	45.25	1,598,959.37
2013	2,070,156.62	50.00	41,402.10	45.75	1,894,202.48
2014	1,772,530.94	50.00	35,449.73	46.25	1,639,598.02
2015	1,762,387.18	50.00	35,246.86	46.75	1,647,838.15
2016	2,245,715.39	50.00	44,913.19	47.25	2,122,207.69
2017	1,655,017.71	50.00	33,099.53	47.75	1,580,545.85
2018	1,745,385.83	50.00	34,906.85	48.25	1,684,300.59

PSO

Electric Division

373.00 Street Lighting and Signal Systems

Original Cost Of Utility Plant In Service

And Development Of Composite Remaining Life as of December 31, 2021

Based Upon Broad Group/Remaining Life Procedure and Technique

Average Service Life: **50** *Survivor Curve:* **O1**

Year (1)	Original Cost (2)	Avg. Service Life (3)	Avg. Annual Accrual (4)	Avg. Remaining Life (5)	Future Annual Accruals (6)
2019	1,927,985.18	50.00	38,558.74	48.75	1,879,788.18
2020	2,982,252.58	50.00	59,643.56	49.25	2,937,521.36
2021	3,525,168.16	50.00	70,501.61	49.75	3,507,543.61
Total	67,410,236.35	50.00	1,348,171.11	40.73	54,913,906.25

Composite Average Remaining Life ... 40.73 Years

PUBLIC SERVICE COMPANY OF OKLAHOMA'S RESPONSE TO PUD Set 6

Question No. 6-4:

Please refer to Cash Direct Testimony, page 14, lines 9-10, which states:

"Similar to other depreciable assets, intangible capitalized software assets should be amortized over the expected useful life of the assets."

(a): Please provide a copy of the study showing the "useful life" of PSO's capitalized software.

(b): Please explain how the duration of the "useful life" was determined in this study.

Response No. 6-4:

a.) No study was prepared as part of this depreciation study showing the useful life of the Company's software. Please refer the Direct Testimony of Company Witness Cash, page 15, lines 11-14 which states, "AEP concluded the average useful life of most of its capitalized software assets is 5 years and has a long-standing policy of amortizing those assets over a 5-year period. Recently, AEP has used longer lives for certain significant, enterprise-wide software assets. These conclusions were based upon several distinguishing factors, including, the costs of the projects and other qualitative facts and circumstances regarding the nature and expected use of the software assets." Software with a useful life of 1 year or less is not eligible for capitalization.
b.) ASC 350-40-35-5 requires the estimation of a useful life, and provides factors that should be considered in the assessment. Please refer to page 14, lines 12-26, in the Direct Testimony of Company witness Cash which recites the factors that should be considered in the assessment as explained in ASC 350-40-35-5.
AEP has historically estimated that the average useful life of most of its software products to be 5 years. Excluding the exceptions mentioned in the response to part a, AEP has been applying this long-standing practice to most of its software products since 1998.

Witness: Jason A. Cash Title: Dir Regulatory Acctg Svcs

Date Response Provided: 1/24/2023

BEFORE THE CORPORATION COMMISSION OF THE STATE OF OKLAHOMA

APPLICATION OF PUBLIC SERVICE COMPANY OF OKLAHOMA, AN OKLAHOMA CORPORATION, FOR AN ADJUSTMENT IN ITS RATES AND CHARGES AND THE ELECTRIC SERVICE RULES, REGULATIONS AND CONDITIONS OF SERVICE FOR ELECTRIC SERVICE IN THE STATE OF OKLAHOMA AND TO APPROVE A FORMULA BASE RATE PROPOSAL	))))))))))	CASE NO. PUD 2022-000093

PUBLIC SERVICE COMPANY OF OKLAHOMA'S RESPONSE TO OIEC Set 7

Question No. 7-20:

Please identify each software system reflected in Account 303. Please provide a detailed description of the software, the year it was installed, and its corresponding cost. Finally, identify if it is still in physical service (not retired on an amortization basis, but rather still physically being utilized). The information should be provided on electronic medium in Excel readable format.

Response No. 7-20:

The Company maintains its investment in intangible plant by project. Please refer to OIEC 7-20 Attachment 1.xlsx for a list of the projects with a cost to the Company of more than $100,000, a description of each project, and the first in service year of the software components installed under each project. The Company maintains a list of installed software products but not their costs, installation dates or utilization period. As described on page 16, lines 1-8, in the direct testimony of Company witness Cash, the investment in account 303 is retired using a vintage year accounting method. Using this method, the property is amortized over its predetermined average service life and retired from the books when it meets its average service life, regardless if the asset is still in use or not.

Witness: Jason A. Cash

Title: Dir Regulatory Acctg Svcs

Date Response Provided: 1/31/2023