Filing Receipt

Received - 2021-10-22 01:14:39 PM
Control Number - 52195
ItemNumber - 274

SOAH DOCKET NO. 473-21-2606
PUC DOCKET NO. 52195

APPLICATION OF EL PASO ELECTRIC COMPANY TO CHANGE RATES	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS

OF

DAVID J. GARRETT

ON BEHALF OF

THE CITY OF EL PASO

David J. Garrett
Resolve Utility Consulting PLLC
101 Park Avenue, Suite 1125
Oklahoma City, OK 73102

OCTOBER 22, 2021

TABLE OF CONTENTS

I. INTRODUCTION 4

II. EXECUTIVE SUMMARY 5

III. LEGAL STANDARDS 8

IV. ANALYTIC METHODS 10

V. LIFE SPAN PROPERTY ANALYSIS 12

A. Introduction 12

B. Interim Retirements and Salvage 12

VI. MASS PROPERTY ANALYSIS 19

A. Service Life Analysis 21

1. Account 353 – Station Equipment 22

2. Account 356 – Overhead Conductors and Devices 24

3. Account 362 – Distribution Station Equipment 26

4. Account 366 – Underground Conduit 28

B. Net Salvage 29

1. Account 355 – Wood and Steel Poles 31

2. Account 356 – Overhead Conductors and Devices 31

3. Account 362 – Station Equipment 32

4. Account 364 – Poles, Towers and Fixtures 33

5. Account 366 – Underground Conduit 33

6. Account 368 – Line Transformers 34

7. Account 369 – Services 35

VII. RATE CASE EXPENSES 35

APPENDICES

Appendix A: The Depreciation System

Appendix B: Iowa Curves

Appendix C: Actuarial Analysis

LIST OF EXHIBITS

Exhibit DJG-1 Curriculum Vitae of David J. Garrett

Exhibit DJG-2 Summary Accrual Adjustment

Exhibit DJG-3 Depreciation Parameter Comparison

Exhibit DJG-4 Detailed Rate Comparison

Exhibit DJG-5 Depreciation Rate Development

Exhibit DJG-6 Account 353 Iowa Curve Fitting

Exhibit DJG-7 Account 356 Iowa Curve Fitting

Exhibit DJG-8 Account 362 Iowa Curve Fitting

Exhibit DJG-9 Account 366 Iowa Curve Fitting

Exhibit DJG-10 Observed Life Tables and Iowa Curve Charts

Exhibit DJG-11 Remaining Life Development

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, where 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. In 2016 I formed Resolve Utility Consulting, PLLC, where I have represented various consumer groups and state agencies in utility regulatory proceedings, primarily in the areas of cost of capital and depreciation. I am a Certified Depreciation Professional with the Society of Depreciation Professionals. I am also a Certified Rate of Return Analyst with the Society of Utility and Regulatory Financial Analysts. A more complete description of my qualifications and regulatory experience is included in my curriculum vitae.[1]

[1] Exhibit DJG-1.

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

A. I am testifying on behalf of the City of El Paso (the "City").

Q. Describe the scope and organization of your testimony.

A. My direct testimony addresses depreciation issues in response to the direct testimony of Company witness John J. Spanos, who sponsors the depreciation study conducted for El Paso Electric Company ("EPE" or the "Company").

Q. To the extent you do not address a specific issue, should that be construed to mean you agree with EPE's proposal on such issue?

A. No. Excluding any specific adjustments or amounts EPE proposes does not indicate my approval of those adjustments or amounts. Rather, the scope of my testimony is limited to the specific items addressed herein.

II. <u>EXECUTIVE SUMMARY</u>

Q. Summarize the key points of your testimony.

A. In the context of utility ratemaking, "depreciation" refers to a cost allocation system designed to measure the rate by which a utility may recover its capital investments in a systematic and rational manner over the average service life of the capital investment. I employed a depreciation system using actuarial analysis to statistically analyze the Company's depreciable assets and develop reasonable depreciation rates and annual accruals. The table below compares the proposed annual depreciation accruals in this case.[2]

---

[2] *See also* Exhibit DJG-2.

Figure 1:
Depreciation Accrual Comparison by Plant Function

Plant Function	Plant Balance 12/31/2019	Company Proposed Accrual	City Proposed Accrual	**City Accrual Adjustment**
Steam Production	$ 565,455,715	$ 18,397,949	$ 14,784,009	$ (3,613,940)
Gas Turbine	518,021,063	15,143,974	11,561,033	(3,582,941)
Transmission	532,343,334	9,023,893	8,275,788	(748,105)
Distribution	1,347,787,849	29,846,554	28,149,622	(1,696,932)
General	171,715,519	6,601,194	6,616,766	15,572
Total Depreciable Plant	$ 3,135,323,480	$ 79,013,564	$ 69,387,217	**$ (9,626,347)**

The original cost and accrual amounts shown in this table correspond to plant balances at December 31, 2019. As shown in this table, the City's proposed depreciation accrual results in an adjustment reducing the Company's proposed annual depreciation accrual by $9.6 million per year, applicable to plant balances as of the study date.

Q. Summarize the primary factors driving the City's adjustment.

A. The City's total proposed depreciation adjustment is driven by three primary issues, which include: (1) removing interim retirements and net salvage components for the Company's production plant accounts; (2) adjusting the service lives for several of EPE's mass property accounts based on Iowa curve analysis; and (3) increasing the proposed net salvage rates for several of the Company's mass property accounts. The estimated impact of these issues on the City's proposed adjustment to the depreciation accrual are summarized in the table below.

Figure 2:
Broad Issue Impacts

Issue	Impact	
1. Remove interim retirement and salvage components	$7.2	million
2. Adjust mass property service lives	$0.9	million
3. Adjust mass property net salvage	$1.5	million
Total	**$9.6**	**million**

Each of these issues will be discussed in more detail in my testimony.

Q. Please summarize and compare the different service life and net salvage parameters proposed for EPE's mass property accounts.

A. The following table compares the different service life and net salvage parameters proposed for the Company's mass property accounts to which I recommend adjustments.[3]

Figure 3:
Mass Property Parameter Comparison

		Company Proposal				City Proposal			
		Iowa Curve		NS	Annual	Iowa Curve		NS	Annual
Account No.	Description	Type	AL	Rate	Accrual	Type	AL	Rate	Accrual
	TRANSMISSION PLANT								
353.00	STATION EQUIPMENT	R4	- 50	-5%	2,948,962	R3	- 58	-5%	2,647,195
355.00	WOOD AND STEEL POLES	S3	- 55	-20%	3,115,165	S3	- 55	-15%	2,918,845
356.00	OH CONDUCTORS AND DEVICES	R5	- 60	-15%	1,579,563	R4	- 65	-10%	1,329,527
	DISTRIBUTION PLANT								
362.00	STATION EQUIPMENT	R2	- 65	-5%	4,102,971	R1.5	- 71	0%	3,568,711
364.00	POLES, TOWERS AND FIXTURES	R3	- 45	-30%	5,697,660	R3	- 45	-25%	5,396,941
366.00	UNDERGROUND CONDUIT	R4	- 65	-5%	2,124,461	R4	- 71	0%	1,804,272
368.00	LINE TRANSFORMERS	R3	- 52	-15%	6,629,377	R3	- 52	-10%	6,260,694
369.00	SERVICES	S3	- 65	-15%	779,571	S3	- 65	0%	607,181

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

The reasoning behind my proposed adjustments to EPE's mass property accounts is discussed in more detail in my testimony.

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

A. Under the rate-base rate of return model, the utility is allowed to recover the original cost of its prudent investments required to provide service. Depreciation systems are designed to allocate those costs in a systematic and rational manner – specifically, over the service lives of the utility's assets. If depreciation rates are overestimated (i.e., service lives are underestimated), it may unintentionally incent economic inefficiency. When an asset is fully depreciated and no longer in rate base, but still used by a utility, a utility may be incented to retire and replace the asset to increase rate base, even though the retired asset may not have reached the end of its economic useful life. If, on the other hand, an asset must be retired before it is fully depreciated, there are regulatory mechanisms that can ensure the utility fully recovers its prudent investment in the retired asset. Thus, in my opinion, it is preferable for regulators to ensure that assets are not depreciated before the end of their economic useful lives.

III. <u>LEGAL STANDARDS</u>

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

A. In *Lindheimer v. Illinois Bell Telephone Co.*, the U.S. Supreme Court stated that "depreciation is the loss, not restored by current maintenance, which is due to all the factors causing the ultimate retirement of the property. These factors embrace wear and tear, decay, inadequacy, and obsolescence."[4] The *Lindheimer* Court also recognized that the original cost of plant assets, rather than present value or some other measure, is the proper basis for calculating depreciation expense.[5] 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.[6]

Thus, the Commission must ultimately determine if EPE 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.[7] Adoption of this "value concept" requires 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

---

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

[5] *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."

[6] *Id.* at 169.

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

also receive a "return of" its invested capital in the form of recovered depreciation expense. The cost allocation concept also satisfies several fundamental accounting principles, including verifiability, neutrality, and the matching principle.[8] 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.[9]

Thus, the concept of depreciation as "the allocation of cost has proven to be the most useful and most widely used concept."[10]

IV. ANALYTIC METHODS

Q. Discuss the definition and general purpose of a depreciation system, as well as the specific 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

---

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

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

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

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 the depreciation rate; and 4) a model for analyzing the characteristics of vintage property groups.[11] 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. Are you and Mr. Spanos essentially using the same depreciation system to conduct your analyses?

A. Yes. Mr. Spanos and I are essentially using the same depreciation system. Thus, the difference in our positions stems from our different opinions regarding net salvage rates, interim retirements, and mass property service life estimates.

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). I will discuss my analysis of the accounts in both types of property below.

---

[11] *See* Wolf *supra* n. 7, at 70, 140.

V. LIFE SPAN PROPERTY ANALYSIS

A. Introduction

Q. Describe life span property.

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

B. Interim Retirements and Salvage

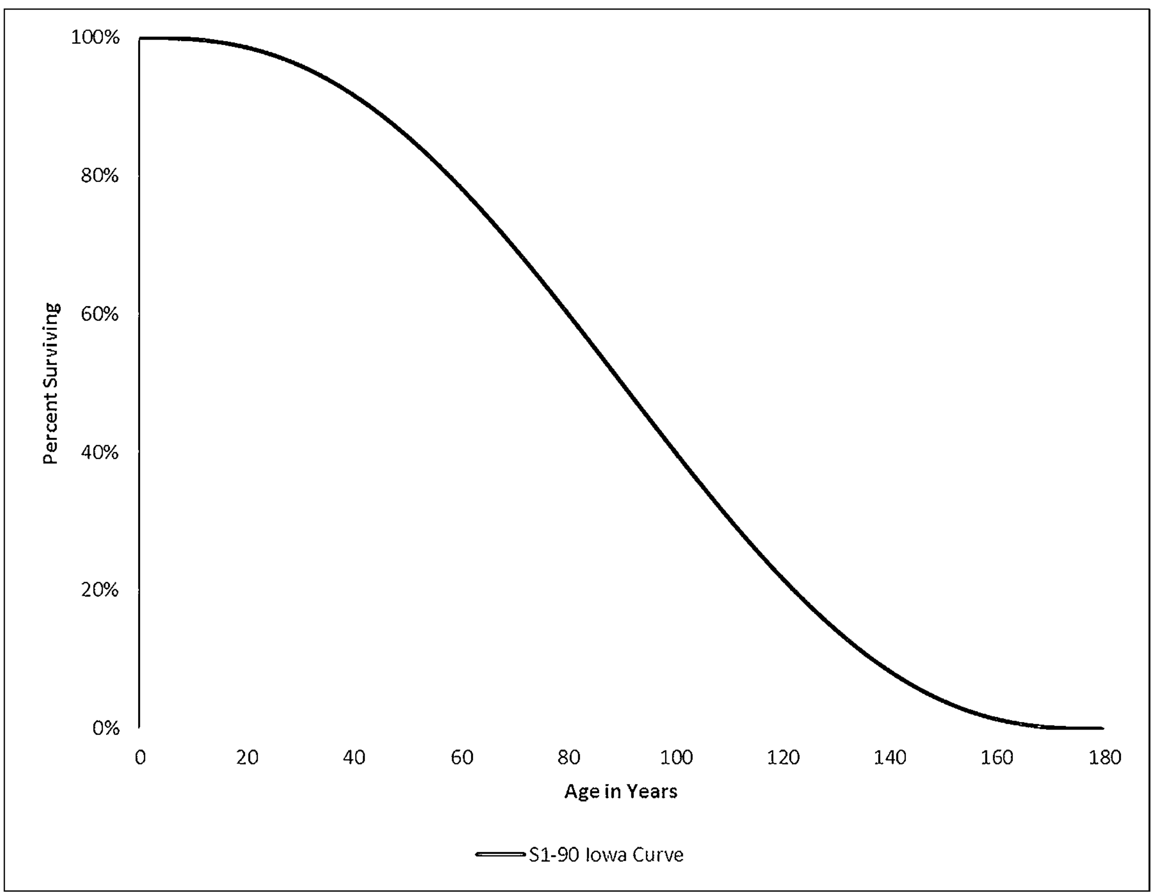
Q. By requesting the inclusion of interim retirements and salvage, how much is the Company proposing to increase its annual depreciation accrual?

A. The inclusion of interim retirements and salvage would add $7.2 million to the depreciation accrual. Thus, this is a significant issue.

Q. Please discuss and illustrate the concept of interim retirements.

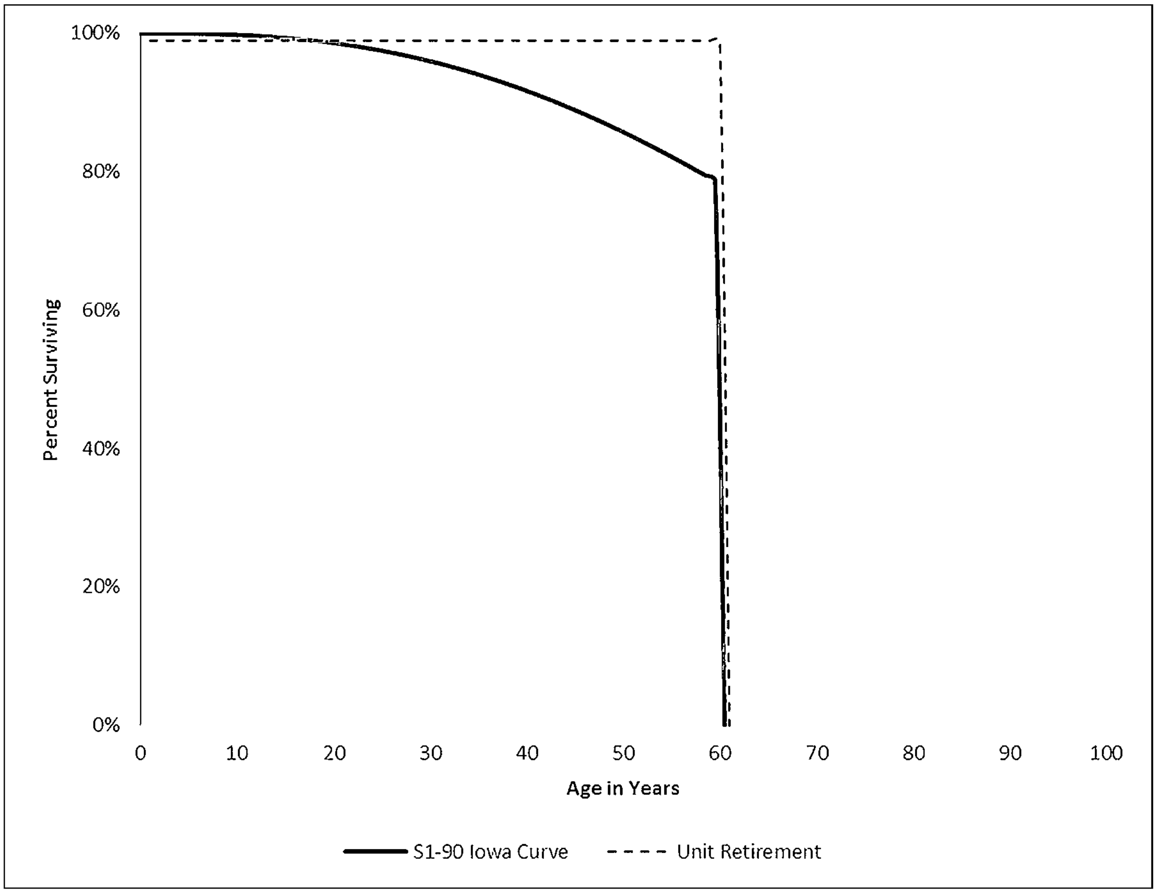
A. As discussed further below, the concept of interim retirements is an issue in this case. While some jurisdictions allow for interim retirements to be included in the determination of depreciation rates for production units, the Texas Public Utility Commission does not. Interim retirements relate to the individual accounts comprising a production plant location. The mortality characteristics of the individual components of life span property, such as generators and electrical equipment, could be described by interim survivor curves. The figures below illustrate this concept.

Figure 4:
S1-90 Iowa Curve



The S1-90 curve shown in this figure might be used to represent mortality characteristics of a structures and improvements account. If that account were in transmission or distribution (i.e., mass property accounts), the entirety of the S1-90 curve would be used to calculate the average life of the grouped assets. Average life is determined by calculating the area under the Iowa curve. However, if the same curve were applied to the structures and improvements of a life span account (such as Account 311), the curve would be truncated at the projected retirement date of the generating unit. This means that even if the structures and improvements comprised in the generating unit could potentially last much longer than the plant itself, we assume that those assets will nonetheless be retired concurrently with the entire generating plant. This concept is illustrated in the figure below:

Figure 5:
S1-90 Curve for Interim Retirements



The solid line represents the same S1-90 Iowa curve shown in the previous graph. However, the curve is "truncated" at 60 years, and we do not see the tail end of the curve. The black dotted line in this graph represents the survivor curve of the generating unit if there were no interim retirements. Because of its shape, this is called a "square" survivor curve. In that case, the generating unit would have a 60-year life (i.e., the area under the square curve equals 60). When interim retirements are considered, however, the average life of the unit is less than 60 years (in this case, 56 years). When average life is decreased through the application of interim retirements, it increases the current depreciation rate and expense for every asset account comprising the generating unit, all else held constant.

Q. Is the Company recommending that interim retirements and net salvage be included in its proposed depreciation rates in this case?

A. Yes. Mr. Spanos argues that interim retirements must be included in depreciation rates.[12]

Q. Do you agree with Mr. Spanos's positions regarding interim retirements?

A. No. In Southwestern Electric Power Company's (SWEPCO) 2012 rate case, the Commission directly upheld its long-standing precedent of excluding interim retirements and found:

> The rate at which interim retirements will be made is not known and measurable. Incorporation of interim retirements would best be done when those retirements are actually made. It is not reasonable to incorporate interim retirements, resulting in a reduction in the depreciation expense of $1 million on a Texas retail basis.[13]

The ALJ in that case found that the "Commission has consistently rejected interim retirements for any production plant account under any methodology."[14]

---

[12] *See* Direct Testimony of John J. Spanos, pp. 9-20.

[13] *Application of Southwestern Electric Power Company for Authority to Change Rates & Reconcile Fuel Costs*, Docket No. 40443, Final Order 33 (Finding of Fact No. 195) (October 10, 2013).

[14] *Application of Southwestern Electric Power Company for Authority to Change Rates & Reconcile Fuel Costs*, Docket No. 40443, Proposal for Decision at 191 (May 20, 2013).

Q. In response to this ruling, has SWEPCO requested the inclusion of interim retirements in its past two rate case?

A. No. In SWEPCO's 2017 rate case before the Commission, SWEPCO did not request the inclusion of interim retirements in its production plant depreciation rates. According to SWEPCO witness David Davis:

> The Commission order in PUC Docket No. 40443 (Finding of Fact, No. 195) 15 indicated that it was not reasonable to include interim retirements in the calculation of production plant depreciation rates since the rate at which interim retirements will be made is not known and measurable. Therefore, interim retirements of production plant were not used in the current study's calculation of production plant depreciation rates.[15]

No party to the case, including Staff, took issue with SWEPCO's decision to exclude interim retirements from its proposed depreciation rates. Likewise, in SWEPCO's pending rate case before the Commission, SWEPCO specifically excluded interim retirements from its proposed depreciation rates under the same reasoning.[16]

Q. Likewise, did Southwestern Public Service Company ("SPS") request the inclusion of interim retirements in its pending case before the Commission?

A. No. According to the depreciation study filed in SPS's pending rate case before the Commission, the depreciation study specifically excludes interim retirements and interim net salvage "per Commission precedent."[17]

---

[15] Direct Testimony of David Davis at 11, Docket No. 46449, *Application of Southwestern Electric Power Company for Authority to Change Rates* (December 16, 2016).

[16] Direct Testimony of Jason Cash, p. 10, lines 1-11, Docket No. 51415, *Application of Southwestern Electric Power Company for Authority to Change Rates* (October 2020).

[17] Direct Testimony of Dane A. Watson, Attachment DAW-RR-2, p. 65, Docket No. 51802, *Application of Southwestern Public Service Company for Authority to Change Rates* (February 2021).

Q. In his direct testimony, Mr. Spanos cites several treatises and rules in support of his position on interim retirements. What is your general response to this testimony?

A. As discussed in further detail below, Mr. Spanos cites several treatises and rules in support of his position on the inclusion of interim retirements in this case. I do not agree with the narrative and implications suggested by Mr. Spanos in his description of these various treatises and rules. Specifically, Mr. Spanos describes one treatise "mandatory" as "authoritative" that interim retirements "must" be included, and he describes an instruction in the Uniform System of Accounts as a "requirement" to include interim retirements, and that by disallowing interim retirements, the Commission has "violates" the Uniform System of Accounts.[18] While it might be fair to describe a treatise as "authoritative" among practitioners in a particular practice area, it is certainly not binding or "mandatory" on this Commission. Likewise, the Uniform System of Accounts does not prescribe or "require" the Commission to make any particular ratemaking decision. Moreover, the Commission has not been "violating" the Uniform System of Accounts for over 25 years by disallowing interim retirements. As discussed in more detail below, none of the sources cited by Mr. Spanos should not be considered "mandatory" authority from a legal standpoint or binding on depreciation analysis and are not binding on this Commission. Likewise, the other utilities, such as SWEPCO and SPS, who have not asked for the inclusion of interim retirements, apparently agree that the inclusion of interim retirements is not required by any particular rule or standard. Moreover, EPE's current depreciation rates adopted by the Commission do not include interim retirements. Therefore, I disagree with the narrative

---

[18] *See generally* Direct Testimony of John J. Spanos pp. 9-20.

and implications suggested by Mr. Spanos in his description of these various sources with regard to interim retirements.

Q. Would including interim retirements in this case result in a substantial and harmful rate impact to customers?

A. Yes. EPE is asking for a substantial increase in its annual depreciation accrual in the amount of $20.7 million, or 36%.[19] Of this amount, approximately $7.2 million is due to the inclusion of interim retirements and salvage.[20]

Q. Do the depreciation rates you propose in this case exclude interim retirements and net salvage?

A. Yes. The depreciation rates I propose in this case exclude interim retirements and net salvage components.[21]

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

---

[19] *See* response to CEP 7-16, Attach. 1.

[20] *See* response to CEP 7-37, Attach 1.

[21] *See* Exhibit DJG-5; *see also* see response to CEP 7-37, Attach 1 for mass property salvage rates used assuming no interim retirements or net salvage.

single rate for an entire group of assets, however, actuarial analysis is required to calculate the average remaining life of the group. Net salvage is estimated through a combination of historical analysis and professional judgment.

Q. Describe the methodology used to estimate the service lives of grouped depreciable assets.

A. The study of retirement patterns of industrial property is derived from the same actuarial process used to study human mortality. Just as actuarial analysts study historical human mortality data to predict how long a group of people will live, depreciation analysts study historical plant data to estimate the average lives of property groups. The most common actuarial method used by depreciation analysts is called the "retirement rate method." In the retirement rate method, original property data, including additions, retirements, transfers, and other transactions, are organized by vintage and transaction year.[22] 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.[23] The most widely used survivor curves for this curve fitting process were developed at Iowa State University in the early

---

[22] 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).

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

1900s and are commonly known as the "Iowa curves."[24] A more detailed explanation of how the Iowa curves are used in the actuarial analysis of depreciable property is set forth in Appendices B and C.

A. Service Life Analysis

Q. Please describe the actuarial analysis process.

A. I used the Company's historical property data and created an observed life table ("OLT") for each applicable 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). To calculate average life (the area under a curve), a complete survivor curve is required. 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 visually inspecting the OLT curve, I use a

---

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

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 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. Are you recommending adjustments to any of the Company's accounts based on your actuarial analysis?

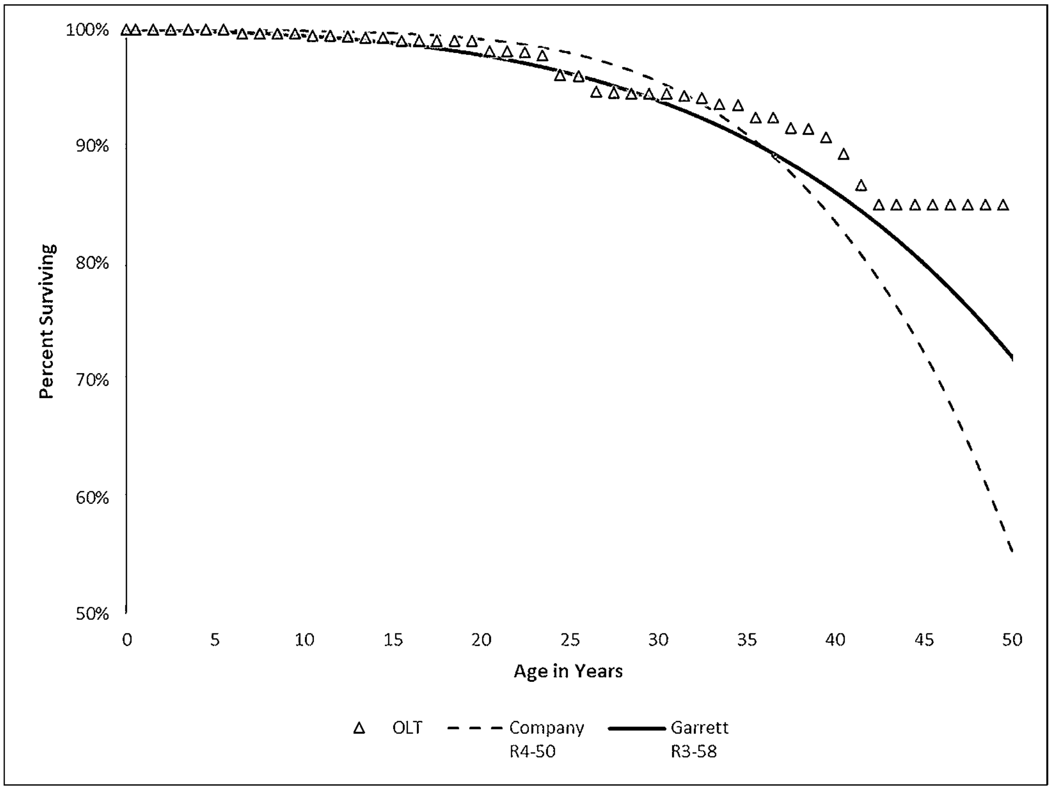
A. Yes. I recommend adjusting EPE's proposed service lives for four accounts based on actuarial analysis. Those accounts are discussed below.

1. <u>Account 353 – Station Equipment</u>

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

A. The OLT curve for this account is shown in the graph below. The graph also shows the Iowa curves that Mr. Spanos and I selected to estimate the average life for this account. The average life is determined by calculating the area under the Iowa curves. Thus, a longer curve will produce a longer average life, and it will also result in a lower depreciation rate. For this account, Mr. Spanos selected the R4-50 Iowa curve, and I selected the R3-58 Iowa curve. The average lives resulting from each curve are indicated by the numbers after the dashes (50 and 58 in this case). Both Iowa curves are shown with the OLT curve in the graph below.

Figure 6:
Account 353 – Station Equipment



For this account, nearly all of the data points on the OLT curve are statistically relevant based on the 1% cutoff described above. Thus, it appears that the R4-50 curve selected by Mr. Spanos does not give enough statistical credit to data points occurring after the 35-year age interval.

Q. Does that Iowa curve you selected provide a better mathematical fit to the OLT curve for this account?

A. Yes. While visual curve-fitting techniques helped us to identify the most statistically relevant portions of the OLT curve for this account, mathematical curve-fitting techniques can help us determine which of the two Iowa curves provides the better fit. Mathematical curve fitting essentially involves measuring the distance between the OLT curve and the selected Iowa curve. 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. For this account, the SSD, or "distance" between the OLT curve and the Company's curve is 0.2684, while the total SSD between the OLT curve and the R3-58 curve I selected is only 0.0537.[25] Thus, the R3-58 curve results in a closer mathematical fit.

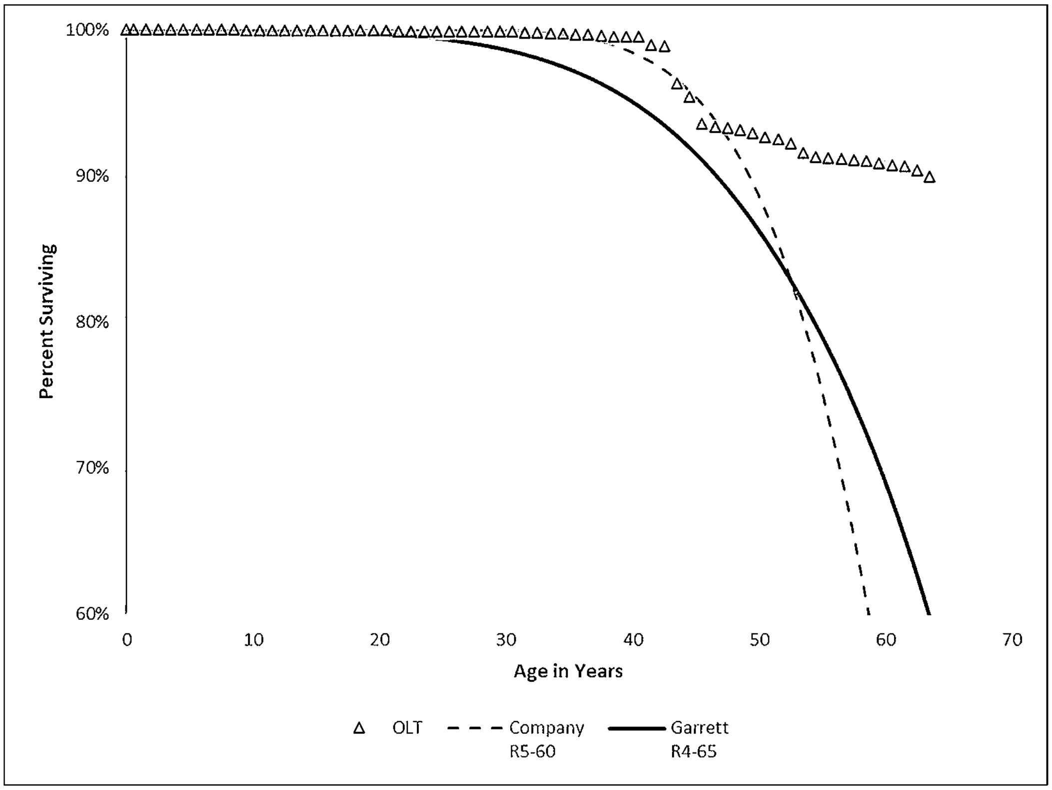
2. Account 356 – Overhead Conductors and Devices

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

A. For this account, Mr. Spanos selected the R5-60 curve, and I selected the R4-65 curve. Both Iowa curves are shown with the OLT curve in the graph below.

[25] Exhibit DJG-6.

Figure 7:
Account 356 – Overhead Conductors and Devices



As with the account discussed above, nearly all of the data points on the OLT curve are statistically relevant. The R5-60 curve selected by Mr. Spanos has a relatively high mode, and therefore “drops” sharply as it approaches the average life (60 years for his curve). However, an average life of only 60 years combined with the R5 curve shape does not give much significance to the historical data occurring after the 50-year age interval. In my experience it is unusual to see the sharp decline described by an R% Iowa curve in Account 356. The R4-65 curve I selected is reasonable in that it does not attempt to match this OLT curve shape exactly (which could result in an unreasonably long Iowa curve), but also it does not assume as sharp of a decline as the R5 curve shape selected by Mr. Spanos.

Q. Does the Iowa curve you selected provide a better mathematical fit to the OLT curve for this account?

A. Yes. The total SSD for the Company's curve is 1.3043, while the SSD for the R4-65 curve I selected is 0.4972, which means it provides the closer fit.[26]

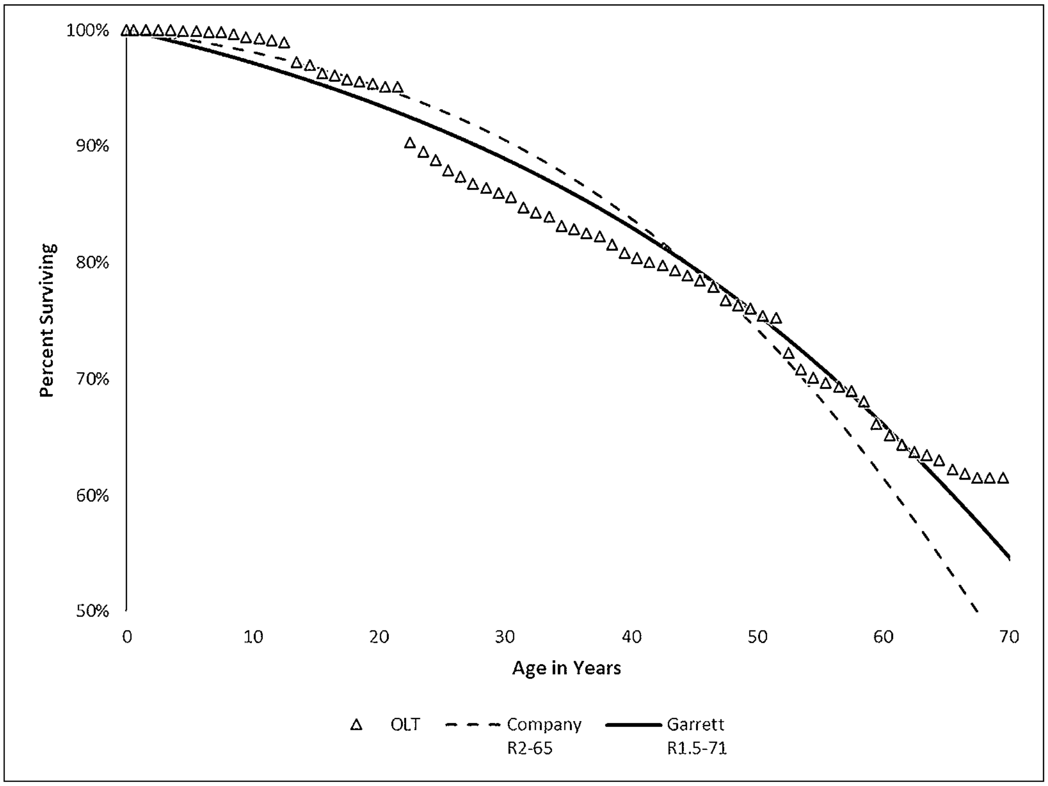
3. Account 362 – Distribution Station Equipment

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

A. For this account, Mr. Spanos selected the R2-65 curve, and I selected the R1.5-71 curve. Both Iowa curves are shown with the OLT curve in the graph below.

[26] Exhibit DJG-7.

Figure 8:
Account 362 – Distribution Station Equipment



As with the accounts discussed above, the Iowa curve selected by Mr. Spanos has a higher mode, sharper decline, and shorter average life than what is otherwise indicated by EPE's own historical retirement data for this account.

Q. Does the Iowa curve you selected provide a better mathematical fit to the OLT curve for this account?

A. Yes. The total SSD for the Company's curve is 0.1372, while the SSD for the R1.5-71 curve I selected is only 0.0338, which means it provides the closer fit to the observed data.[27]

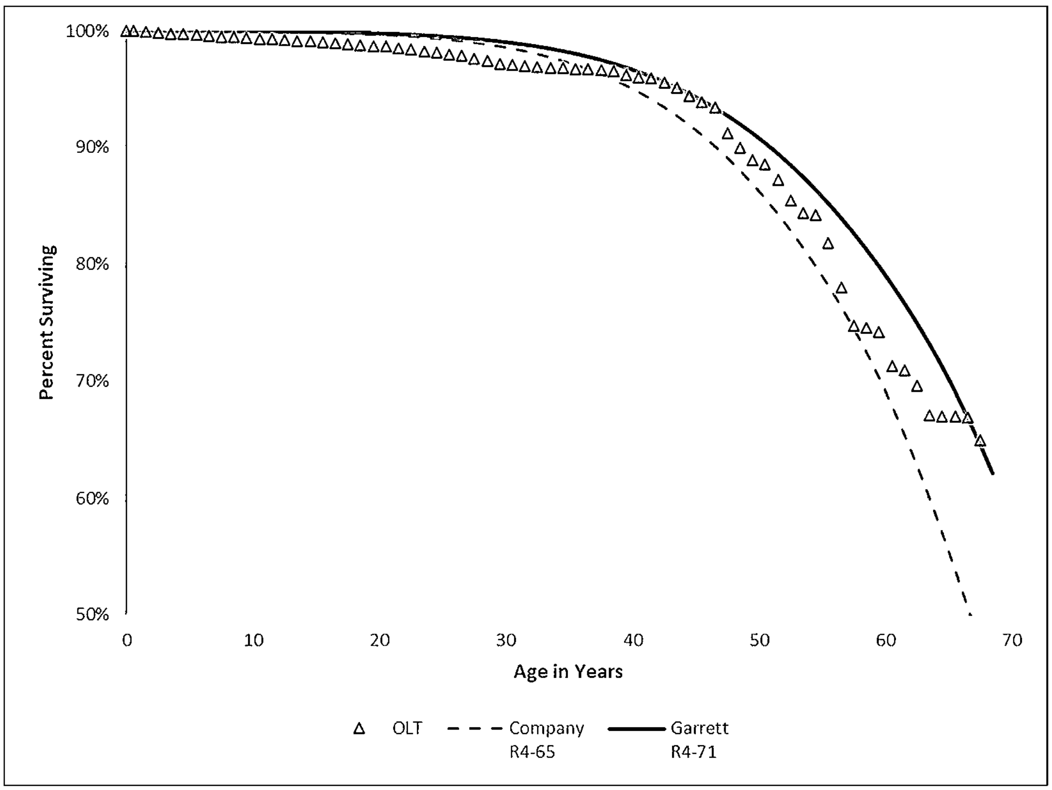
[27] Exhibit DJG-8.

4. Account 366 – Underground Conduit

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

A. For this account, Mr. Spanos selected the R4-65 curve, and I selected the R4-71 curve. Both Iowa curves are shown with the OLT curve in the graph below.

Figure 9:
Account 366 – Underground Conduit



From a visual perspective, both Iowa curves appear to provide a relatively close fit to the observed data. We can use mathematical curve fitting techniques to determine which Iowa curve provides the closer fit.

Q. Does the Iowa curve you selected provide a better mathematical fit to the OLT curve for this account?

A. Yes. The total SSD for the Company's curve is 0.1168, while the SSD for the R4-71 curve I selected is only 0.0454, which means it provides the closer mathematical fit to the observed data.[28]

B. Net Salvage

Q. Describe the concept of net salvage.

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

---

[28] Exhibit DJG-9.

Q. Are you recommending any adjustments to the Company's proposed net salvage rates?

A. Yes. I am proposing adjustments to the net salvage rates of seven transmission and distribution accounts, as summarized in the figure below.

Figure 1:
Net Salvage Adjustments

Account No.	Description	EPE NS	City NS
	TRANSMISSION PLANT		
355.00	WOOD AND STEEL POLES	-20%	-15%
356.00	OVERHEAD CONDUCTORS AND DEVICES	-15%	-10%
	DISTRIBUTION PLANT		
362.00	STATION EQUIPMENT	-5%	0%
364.00	POLES, TOWERS AND FIXTURES	-30%	-25%
366.00	UNDERGROUND CONDUIT	-5%	0%
368.00	LINE TRANSFORMERS	-15%	-10%
369.00	SERVICES	-15%	0%

As shown in the table, my proposed net salvage rates are slightly higher(less negative) for each of these accounts than the net salvage rates proposed by Mr. Spanos. Thus, my proposed net salvage rates have a decreasing effect on depreciation rates and expense.

Q. Please describe the basis for your net salvage adjustments.

A. As part of my net salvage analysis, I analyzed the historical net salvage rates for each account that were provided in the depreciation study. Each of my proposed net salvage adjustments is based on a balancing of the overall historical net salvage experienced observed in each account with the more recent net salvage experience. I discuss my analysis and recommendations for each account below.

1. Account 355 – Wood and Steel Poles

Q. What is the Company's proposed net salvage rate for this account?

A. The Company proposes a net salvage rate of -20% for this account.[29]

Q. Please explain your proposed net salvage rate for this account.

A. The overall historical net salvage rate for Account 355 is -18%.[30] This is reflective of Mr. Spanos's proposed net salvage rate of -20%. However, according to the most recent five-year average, the historical net salvage rate experienced in this account is only -3%.[31] This could indicate a trend toward a higher (i.e., less negative) net salvage rate. In my opinion, a more reasonable net salvage estimate for this account would be -15%. A net salvage rate of -15% balances the overall net salvage rate experience with the more recent experience in this account.

2. Account 356 – Overhead Conductors and Devices

Q. What is the Company's proposed net salvage rate for this account?

A. The Company proposes a net salvage rate of -15% for this account.[32]

---

[29] Exhibit JJS-2, p. 56.

[30] *Id.* at p. 187.

[31] *Id.* at p. 188.

[32] *Id.* at p. 56.

Q. Please explain your proposed net salvage rate for this account.

A. The overall historical net salvage rate for this account is a positive 11%.[33] However, more recent trends indicate a negative net salvage rate.[34] In my opinion, a more reasonable net salvage estimate for this account would be -10%. A net salvage rate of -10% represents a balance between the overall net salvage rate experience in this account (which is positive) with the more recent experience in this account indicating a negative net salvage rate.

3. Account 362 – Station Equipment

Q. What is the Company's proposed net salvage rate for this account?

A. The Company proposes a net salvage rate of -5% for this account.[35]

Q. Please explain your proposed net salvage rate for this account.

A. The overall historical net salvage rate for this account is a positive 3%.[36] Likewise, the most recent five-year average shows a positive 2% net salvage rate. While the most recent five-year average shows a lower net salvage rate than the overall net salvage rate for the account, the Company's proposed salvage rate of -5% is inadequately supported based on the evidence. In my opinion, a more reasonable net salvage rate to use for this account based on the evidence would be 0%.

---

[33] *Id.* at p. 189.

[34] *Id.*

[35] *Id.* at p. 56.

[36] *Id.* at p. 194.

4. **<u>Account 364 – Poles, Towers and Fixtures</u>**

Q. What is the Company's proposed net salvage rate for this account?

A. The Company proposes a net salvage rate of -30% for this account.[37]

Q. Please explain your proposed net salvage rate for this account.

A. The overall historical net salvage rate for this account is only -1%.,[38] which is significantly greater (less negative) than the Company's proposed rate of -30%. Although the reported net salvage rates in recent years has been negative, the rolling three-year averages from 2004-2014 were all positive, and ranged as high as 198%.[39] In my opinion, a more reasonable net salvage rate to use for this account at this time would be -25%, which represents a balance between the overall retirement rate in this account and the recent experience.

5. **<u>Account 366 – Underground Conduit</u>**

Q. What is the Company's proposed net salvage rate for this account?

A. The Company proposes a net salvage rate of -5% for this account.[40]

---

[37] *Id.* at p. 56.

[38] *Id.* at p. 196.

[39] *Id.* at p. 199.

[40] *Id.* at p. 56.

Q. Please explain your proposed net salvage rate for this account.

A. The overall historical net salvage rate for this account is a positive 15%.[41] More recent rolling three-year averages also indicate a positive net salvage rate, although these net salvage rates are based on fewer retirements.[42] Based on the historical data, the Company's proposal of a -5% net salvage rate is unsupported. A more reasonable net salvage rate to use for this account at this time would be 0%.

6. Account 368 – Line Transformers

Q. What is the Company's proposed net salvage rate for this account?

A. The Company proposes a net salvage rate of -15% for this account.[43]

Q. Please explain your proposed net salvage rate for this account.

A. The overall historical net salvage rate for this account is -13%.[44] The rolling three-year averages from 2004-2013 showed consecutive, positive net salvage rates.[45] Based on the historical data, a more reasonable net salvage rate to use for this account would be -10%. If the next depreciation study shows a continuing trend towards lower net salvage rates, the net salvage rate for this account can be adjusted accordingly.

---

[41] *Id.* at p. 200.

[42] *Id.* at pp. 200-201.

[43] *Id.* at p. 56.

[44] *Id.* at p. 205.

[45] *Id.*

7. <u>Account 369 – Services</u>

Q. What is the Company's proposed net salvage rate for this account?

A. The Company proposes a net salvage rate of -15% for this account.[46]

Q. Please explain your proposed net salvage rate for this account.

A. The overall historical net salvage rate for this account is a <u>positive</u> 63%.[47] Even the most recent trends indicate positive net salvage rates.[48] The Company's proposed net salvage rate of -15% is not supported by the evidence. A more reasonable net salvage rate to use for this account at this time would be 0%, which essentially assumes that the net salvage rate in this account will decline from the rates otherwise demonstrated by the historical data.

VII. <u>RATE CASE EXPENSES</u>

Q. Please state the amount of rate case expense for Resolve Utility Consulting in this proceeding.

A. The professional fees of Resolve Utility Consulting ("Resolve") through September 30, 2021, were $15,500. These fees were for time spent reviewing the application, testimony, discovery, schedules and workpapers, and for developing issues and conferring with counsel and other experts. These fees were charged by me, Resolve's managing member.

---

[46] *Id.* at p. 56.

[47] *Id.* at p. 206.

[48] *Id.* at p. 207.

My billing rate is $200 per hour. I anticipate that Resolve will incur additional fees in the amount of $20,000 to complete this case.

Q. Is your hourly rate and the amount of time you spent of tasks in this case reasonable?

A. Yes. My billing rate is reasonable and is within the range of rates charged by other consultants with similar experience and providing regulatory services in Texas. A more complete description of my qualifications and regulatory experience is included in my curriculum vitae.[49]

Q. Do your expenses include any of the type of charges that may be excludable?

A. No. Our charges are entirely for professional fees only.

Q. Do the issues raised in your testimony have a reasonable basis in law, policy, and fact?

A. Yes.

Q. What is your conclusion regarding your firm's actual and estimated charges?

A. In my opinion, our actual fees of $15,500 incurred through September are reasonable and necessary, and they are not disproportionate, excessive, or unwarranted in relation to the nature and scope of the filing. Likewise, I believe my estimated fees of $20,000 to complete this case are reasonable and necessary, and they are not disproportionate, excessive, or unwarranted in relation to the nature and scope of the filing. These fees will likely include the following tasks, if necessary: attending depositions, reviewing deposition transcripts, preparing and filing direct testimony, responding to discovery,

[49] Exhibit DJG-8.

reviewing rebuttal testimonies, developing and reviewing discovery related rebuttal testimony, participating in settlement discussions, providing settlement impact analysis, preparing for and testifying at trial, and providing assistance with any post-hearing briefs.

Q. Does this conclude your testimony?

A. Yes.

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.[50] 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.[51] The figure below illustrates the basic concept of a depreciation system and includes some of the available parameters.[52]

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.

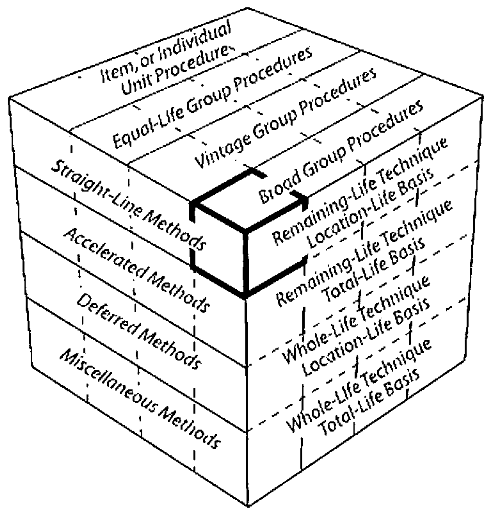
---

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

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

[52] 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 some of the available parameters of a depreciation system.

Figure 10:
The Depreciation System Cube



1. Allocation Methods

The "method" refers to the pattern of depreciation in relation to the accounting periods. The method most commonly used in the regulatory context is the "straight-line method" – a type of age-life method in which the depreciable cost of plant is charged in equal amounts to each accounting period over the service life of plant.[53] 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.[54] The basic formula for the straight-line method is as follows:[55]

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

[54] *Id.*

[55] *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 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.[56] In practice, the annual accrual is expressed as a rate which is applied to the original cost of plant to determine the annual accrual in dollars. The formula for determining the straight-line rate is as follows:[57]

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.[58] 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

---

[56] *Id.* at 57.

[57] *Id.* at 56.

[58] Wolf *supra* n. 9, at 74-75.

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.[59] 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.[60]

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.[61] 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.[62] Under the equal life procedure the property is divided into subgroups that each has a common life.[63]

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

[59] *Id.* at 74.

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

[61] *See* Wolf *supra* n. 9, at 74-75.

[62] *Id.* at 75.

[63] *Id.*

technique applies the depreciation rate on the estimated average service life of a group, while the remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.[64]

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.[65] Analysts can calculate the level of imbalance in the accumulated depreciation account by determining the "calculated accumulated depreciation," (a.k.a. "theoretical reserve" and referred to in these appendices as "CAD"). The CAD is the calculated balance that would be in the accumulated depreciation account at a point in time using current depreciation parameters.[66] 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

[64] NARUC *supra* n. 10, at 63-64.

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

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

in the annual accrual.[67] 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:[68]

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.[69]

4. Analysis Model

The fourth parameter of a depreciation system, the "model," relates to the way of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group for depreciation purposes.[70] 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

---

[67] 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.").

[68] *Id.* at 64.

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

[70] *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 form a continuous property group.

The broad group model views the continuous property group as a collection of vintage groups that each have 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.[71] 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.[72] 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

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

[72] *Id.* at 23.

representing the life characteristics of each group of property.[73] They generalized the 65 curves 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.[74] 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."[75] 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.[76] 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

---

[73] *Id.* at 34.

[74] *Id.*

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

[76] 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).

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 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:[77]

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.[78]

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

---

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

[78] *Id.*

used to depict retirements which are all planned to occur at a given age. Finally, analysts 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

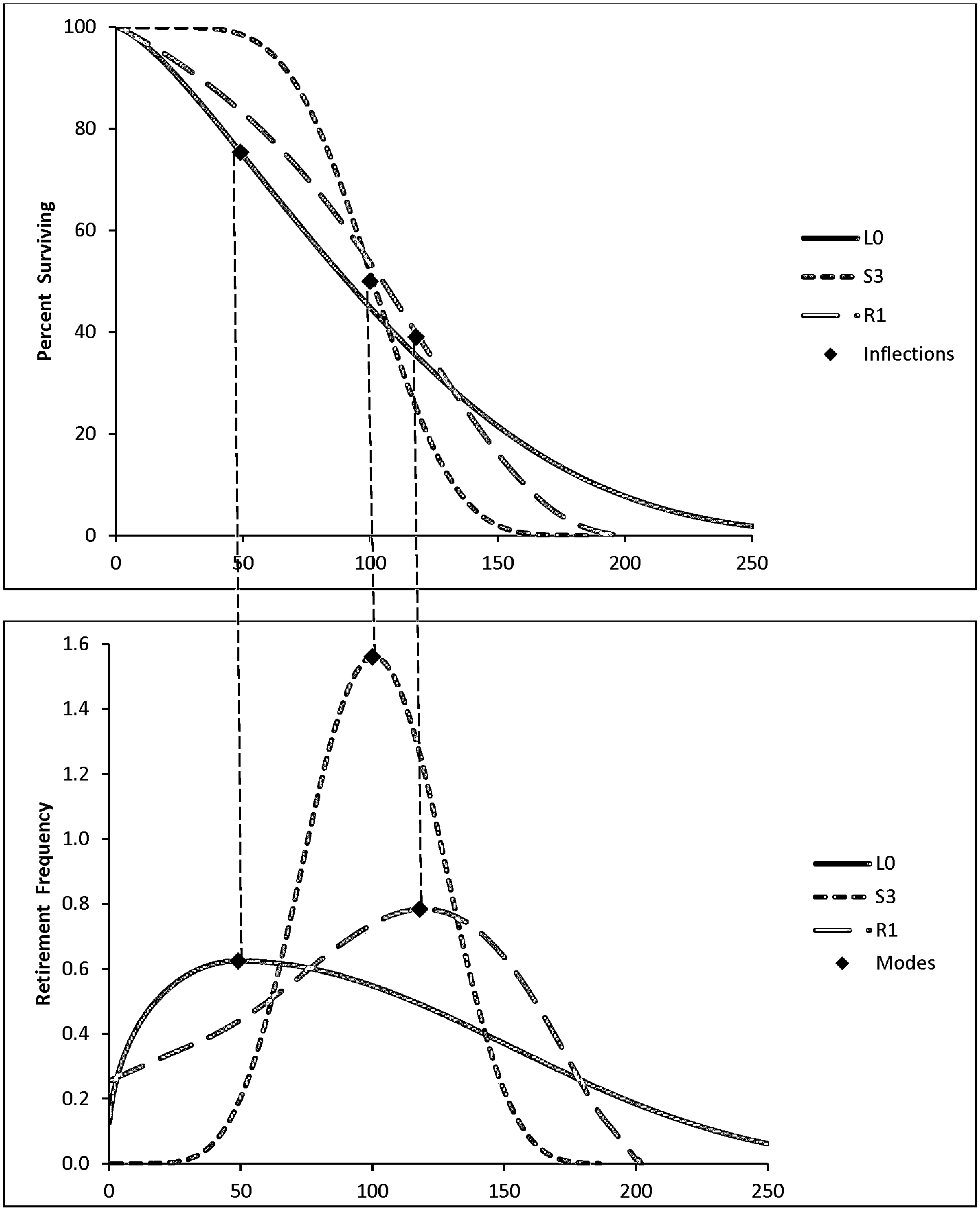
The Iowa curves are classified by three variables: modal location, average life, and variation of life. First, the mode is the percent life that results in the highest point of the frequency curve and the "inflection point" on the survivor curve. The modal age is the age at which the greatest rate of 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).[79] 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.

---

[79] 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 11:
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 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."[80]

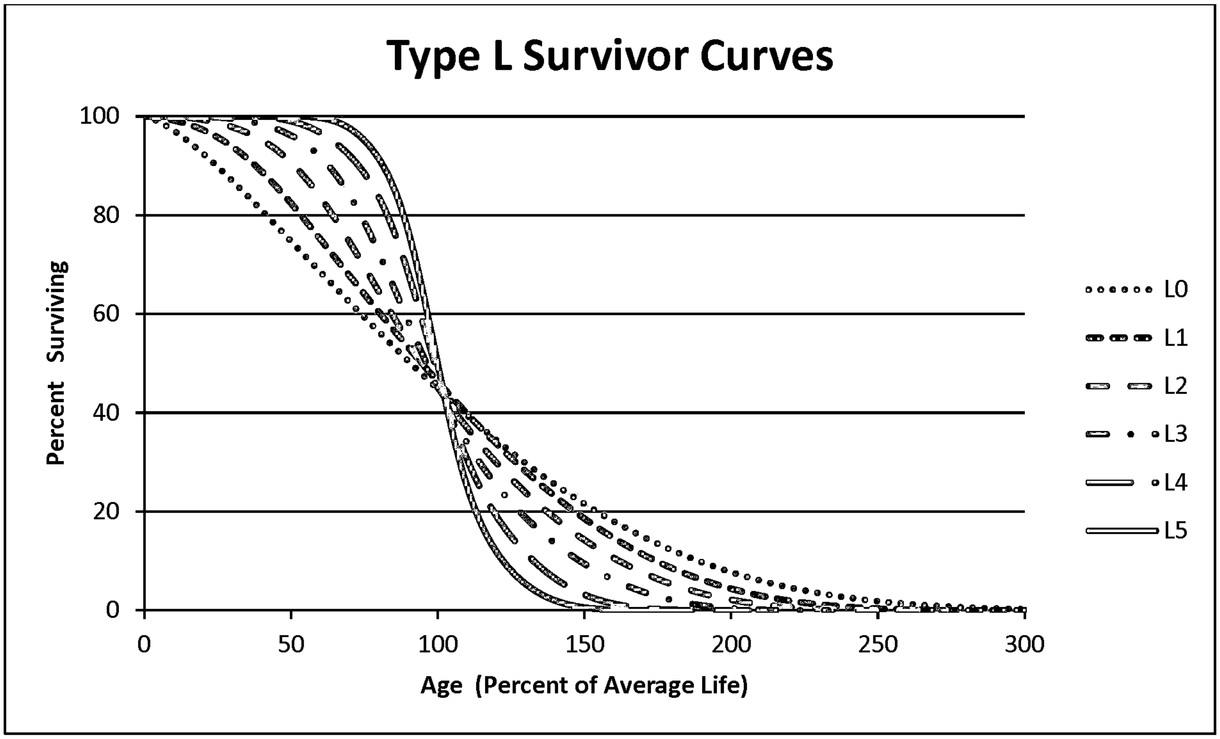
Because age is expressed in terms of percent of average life, any particular Iowa curve type can be modified to forecast property groups with various average lives.

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.

---

[80] Winfrey *supra* n. 75, at 60.

Figure 12:
Type L Survivor and Frequency Curves



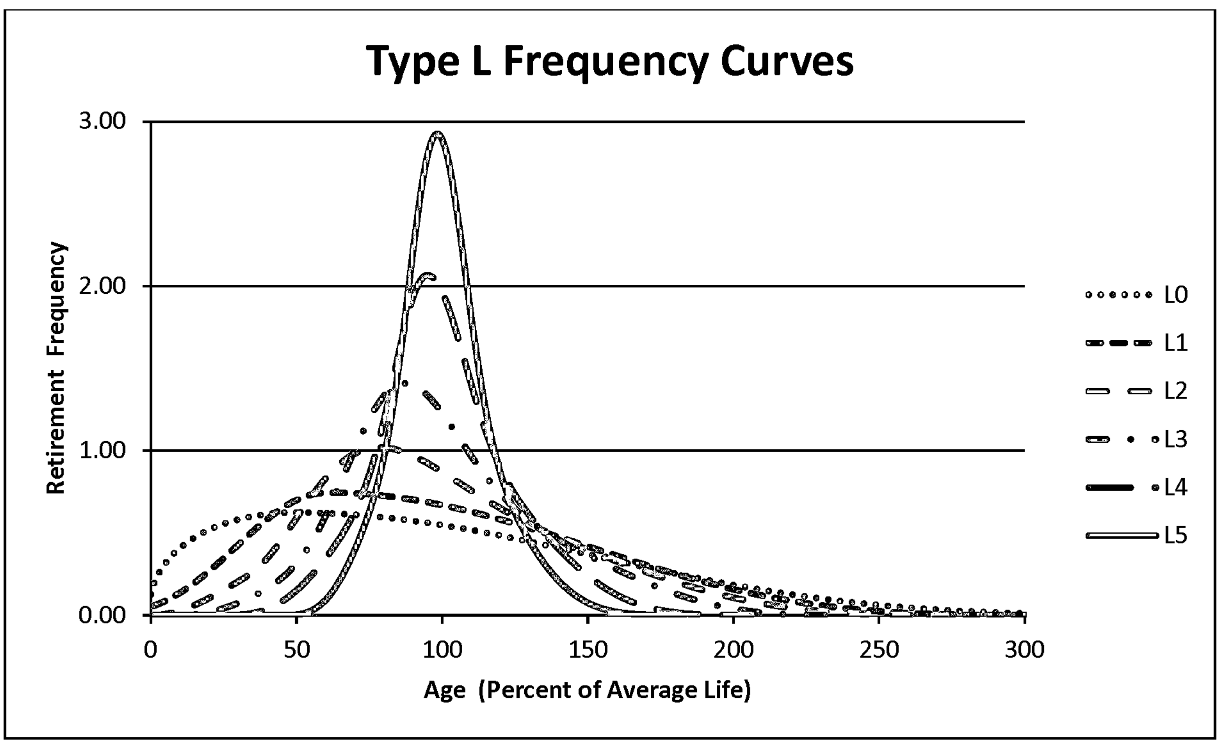
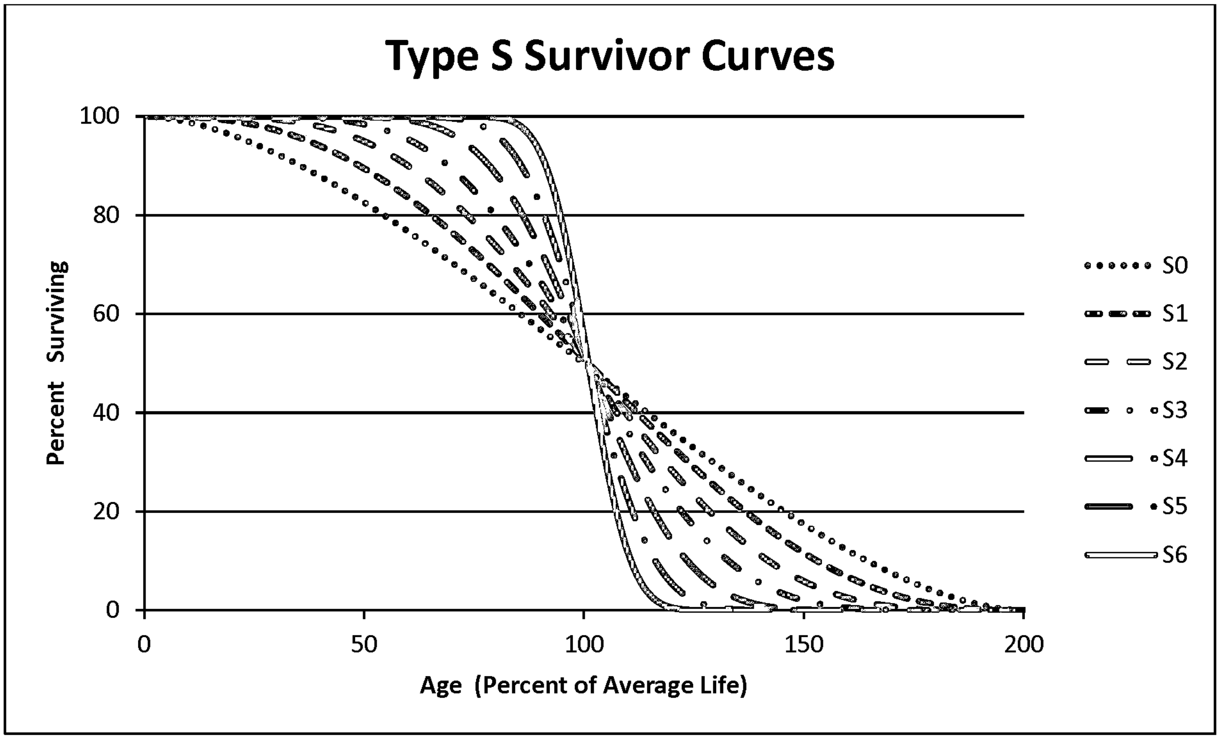


Figure 13:
Type S Survivor and Frequency Curves



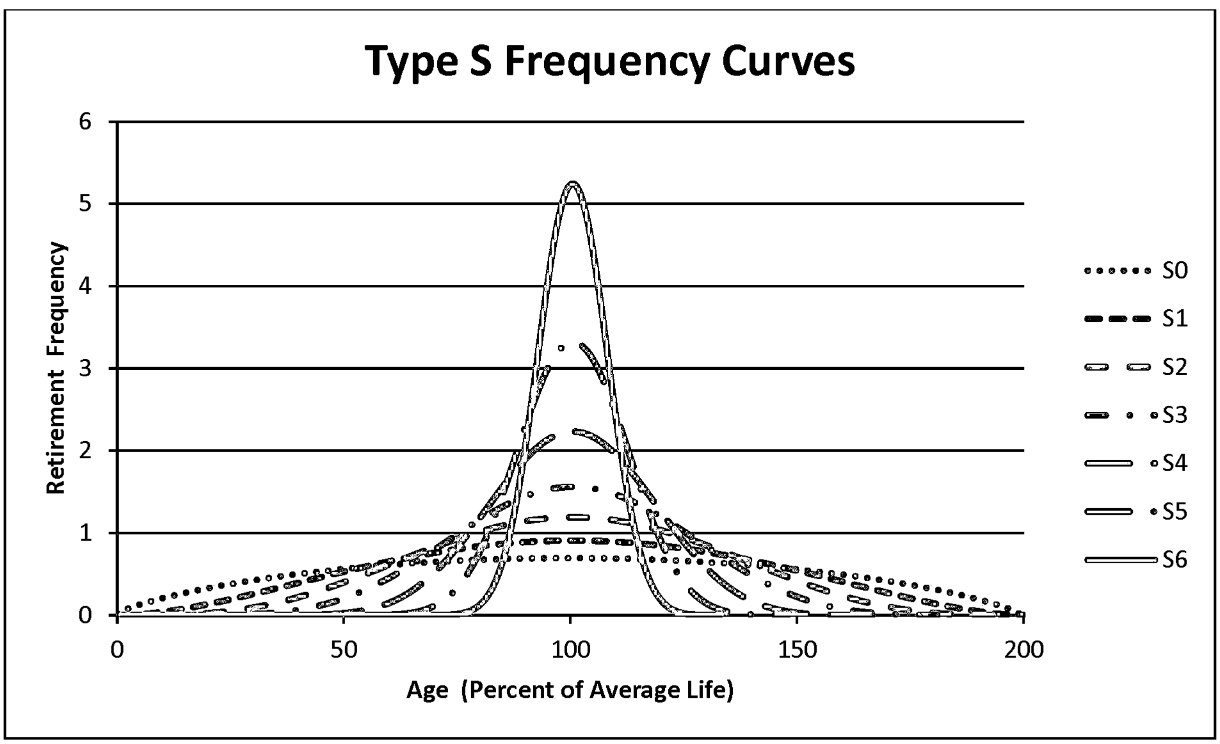
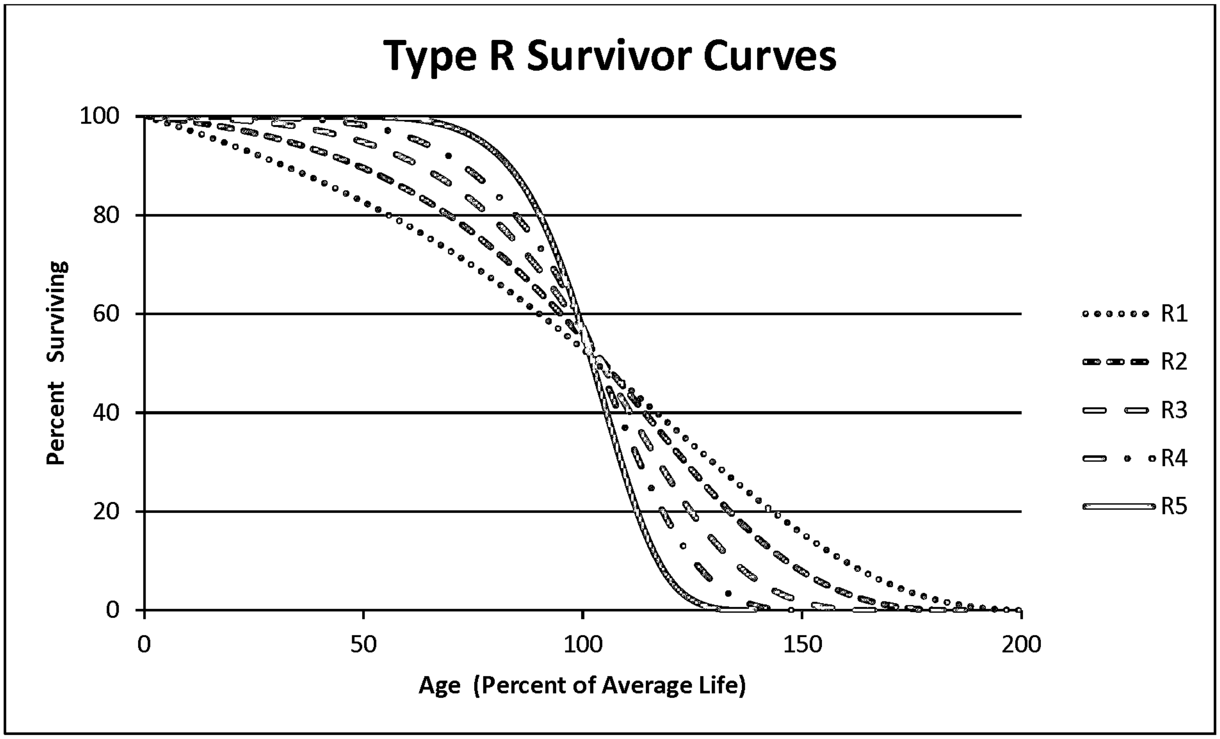
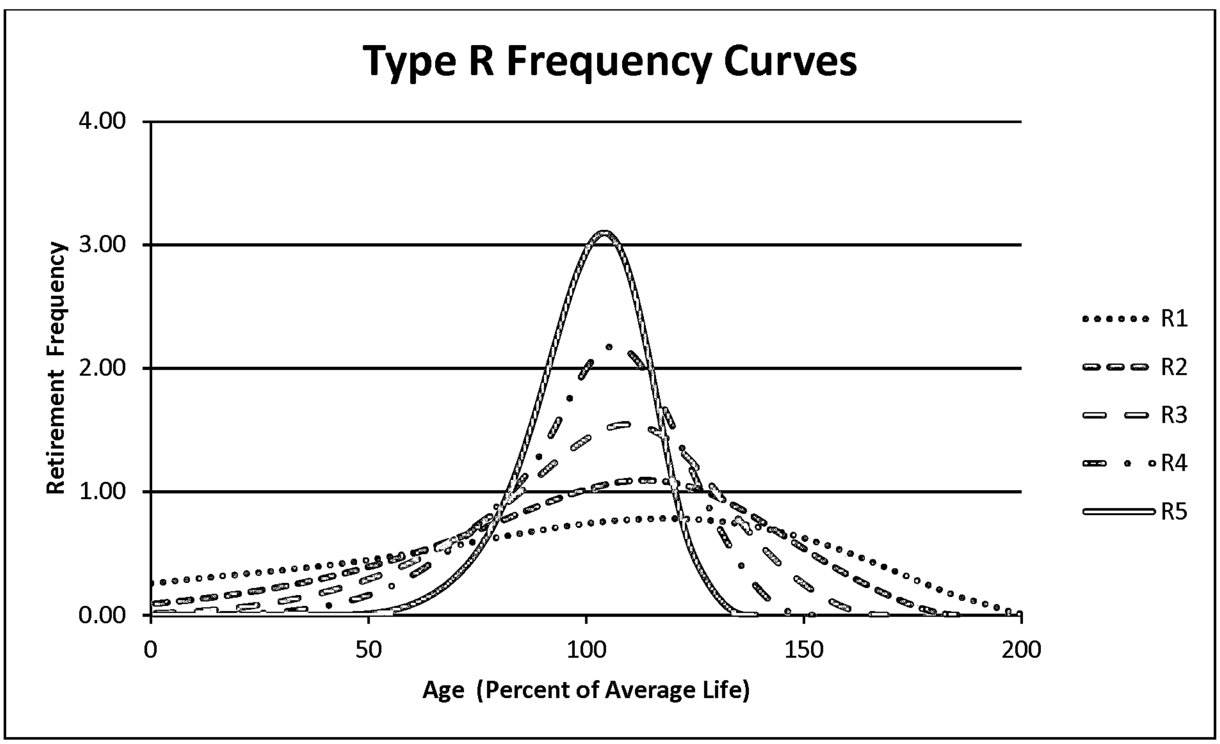


Figure 14:
Type R Survivor and Frequency Curves





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.[81]

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:[82]

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

[81] 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.

[82] *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.[83] 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.[84] Remaining life is sometimes referred to as "average remaining life" and "life expectancy." To calculate average remaining life at age x, the area under the estimated future portion of the survivor curve is divided by the percent surviving at age x (denoted S_X). Thus, the average remaining life formula is:

Equation 5:
Average Remaining Life

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

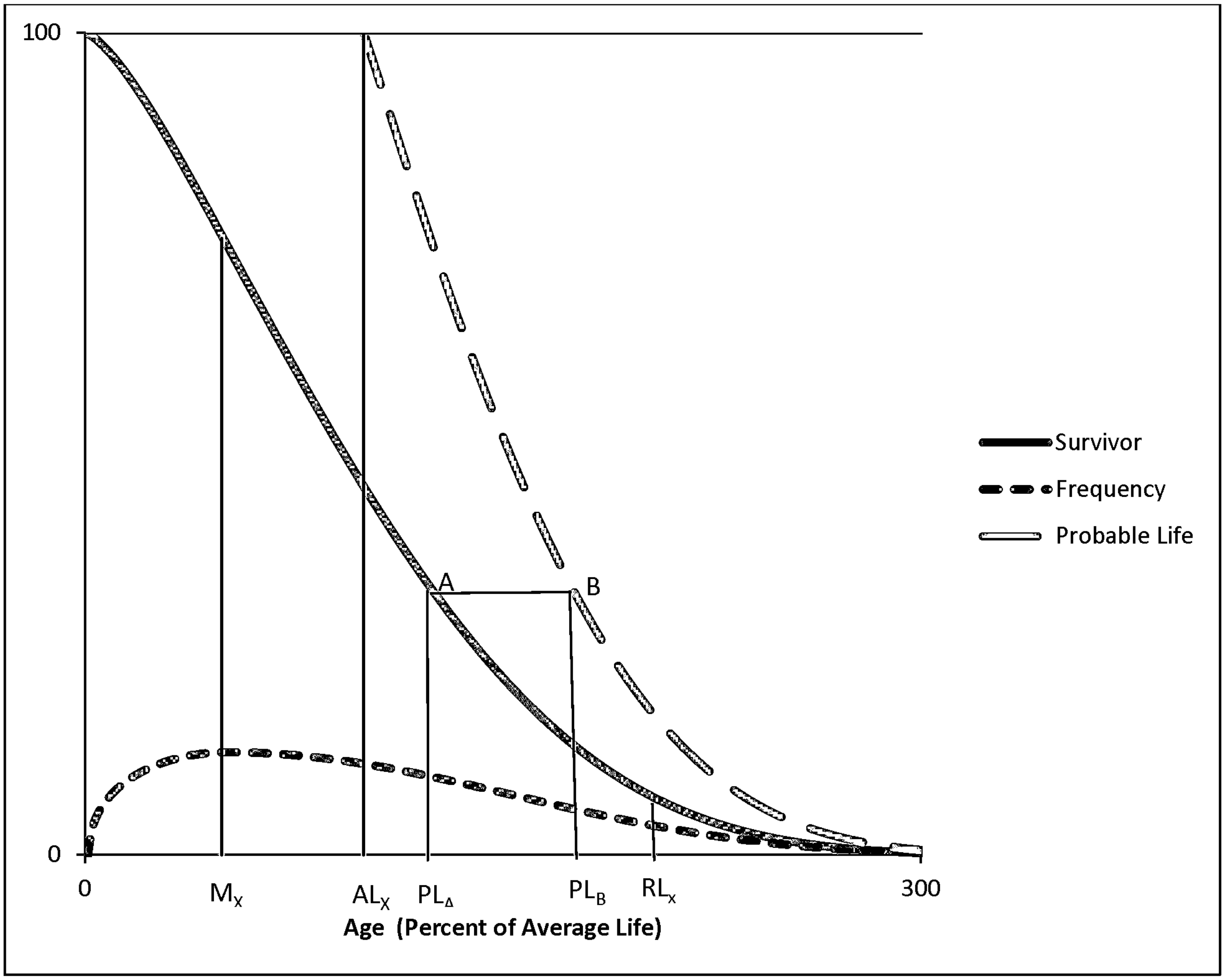
It is necessary to determine average remaining life to calculate the annual accrual under the remaining life technique.

---

[83] *Id.* at 73.

[84] *Id.* at 74.

Figure 15:
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.[85] 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

[85] 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 today will live. Insurance companies rely on actuarial analysis in determining premiums for life insurance policies.

The study of human mortality is analogous to estimating service lives of industrial property groups. While some humans die solely from chance, most deaths are related to age; that is, death rates generally increase as age increases. Similarly, physical plant is also subject to forces of retirement. These forces include physical, functional, and contingent factors, as shown in the table below.[86]

Figure 16:
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

[86] 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.[87] 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 to calculate observed survivor curves for property groups. Of these methods, the retirement rate method is superior, and is widely employed by depreciation analysts.[88] 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 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 into service 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

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

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

method may not be employed. The first matrix is the exposure matrix, which shows the exposures at the beginning of each year.[89] 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 2012 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 were retired during 2012.

Figure 17:
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	

[89] 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 accounting period is called an "exposure" rather than an addition.

Figure 18:
Retirement Matrix

Placement Years	2008	2009	2010	2011	2012	2013	2014	2015	Total During Age Interval	Age Interval
	Experience Years Retirments During the Year (Dollars in 000's)									
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.[90] 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).

---

[90] 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 at the beginning of 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 19:
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			

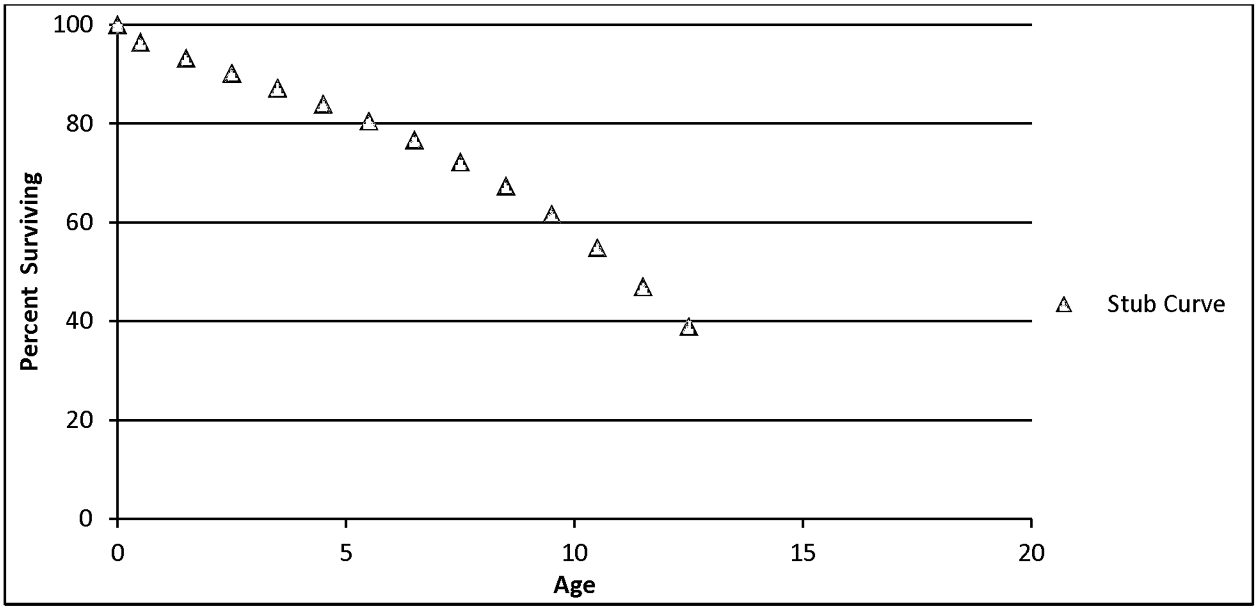
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. 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)[91].

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

[91] 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 above.

Figure 20:
Original "Stub" Survivor Curve



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

<u>Banding</u>

The forces of retirement and characteristics of industrial property are constantly changing. A depreciation analyst may examine the magnitude of these changes. Analysts often use a technique called "banding" to assist with this process. Banding refers to the merging of several years of data into a single data set for further analysis, and it is a common technique associated with the retirement rate method.[92] 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.[93]

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.

---

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

[93] *Id.*

Figure 21:
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.[94] 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 into service with a special chemical treatment that extended the service lives of those poles, an analyst could use placement bands to isolate and analyze the effect of that change in the property group's physical characteristics. While

---

[94] Wolf *supra* n. 9, at 182.

placement 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.[95]

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.

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

Figure 22:
Experience Bands

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

The shaded cells within the experience band equal the total exposures at the beginning of age interval 4.5–5.5 ($1,237). The same experience band would be used for the retirement matrix covering the same experience years of 2011 – 2013. This of course would result in a different OLT and original stub survivor than if the band had not been used. Analysts often use experience bands to isolate and analyze the effects of an operating environment over time.[96] 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

[96] *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 to get complete survivor curves, but such analysis would ignore some of the property currently in service and would arguably not provide an accurate description of life characteristics for current plant in service. Because a complete curve is necessary to calculate the average life of the property group, however, curve fitting techniques using Iowa curves or other standardized curves may be employed in order to complete the stub curve.

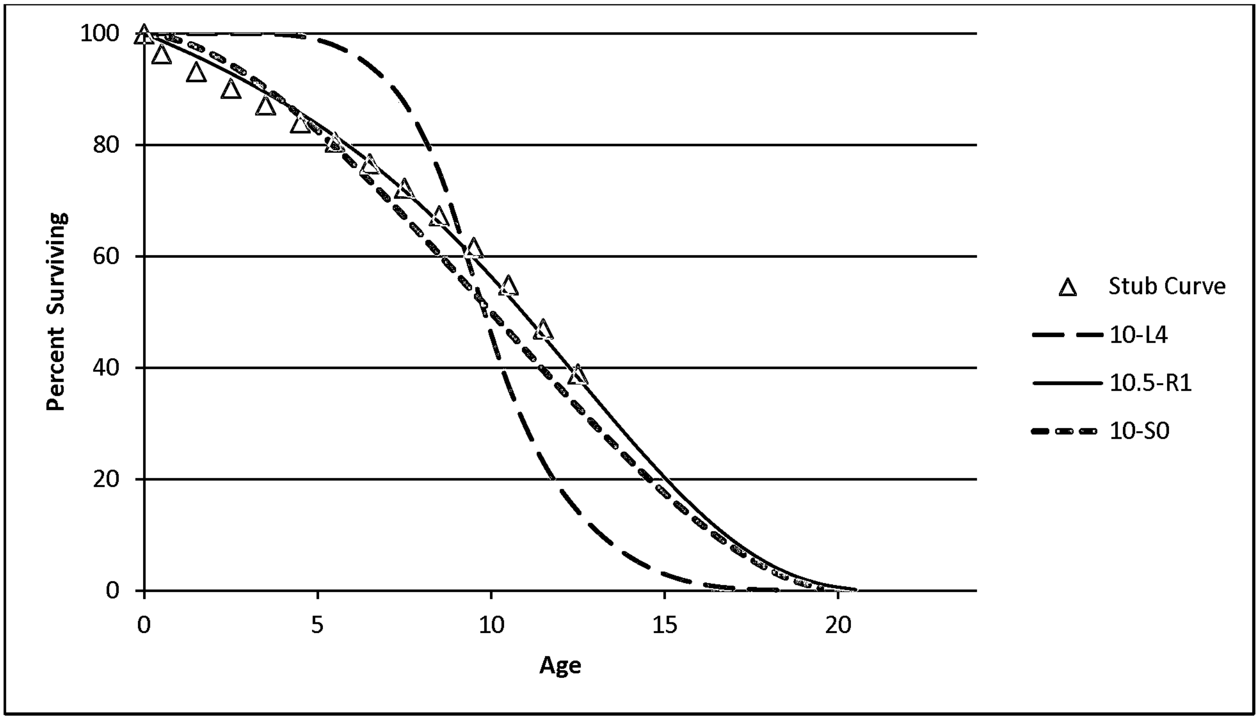
Curve Fitting

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 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."[97]

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.

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

Figure 23:
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.[98]

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."[99]

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 for the other two curves. Curve 10-L4 is the worst fit, which was also confirmed visually.

---

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

[99] *Id.* at 48.

Figure 24:
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**

101 Park Avenue, Suite 1125
Oklahoma City, OK 73102

DAVID J. GARRETT

405.249.1050
dgarrett@resolveuc.com

EDUCATION

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

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

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

PROFESSIONAL DESIGNATIONS

Society of Depreciation Professionals
Certified Depreciation Professional (CDP)

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

The Mediation Institute
Certified Civil / Commercial & Employment Mediator

WORK EXPERIENCE

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

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

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

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

TEACHING EXPERIENCE

University of Oklahoma — Norman, OK
Adjunct Instructor – "Conflict Resolution" — 2014 – 2020
Adjunct Instructor – "Ethics in Leadership"

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

PUBLICATIONS

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

PROFESSIONAL ASSOCIATIONS

Oklahoma Bar Association — 2007 – Present

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

Society of Utility Regulatory Financial Analysts — 2014 – Present

Utility Regulatory Proceedings

Regulatory Agency	Utility Applicant	Docket Number	Issues Addressed	Parties Represented
Pennsylvania Public Utility Commission	PECO Energy Company	R-2021-3024601	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
New Mexico Public Regulation Commission	Southwestern Public Service Company	20-00238-UT	Cost of capital and authorized rate of return	The New Mexico Large Customer Group; Occidental Permian
Pennsylvania Public Utility Commission	Duquesne Light Company	R-2021-3024750	Cost of capital, awarded rate of return, capital structure	Pennsylvania Office of Consumer Advocate
Maryland Public Service Commission	Columbia Gas of Maryland	9664	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Indiana Utility Regulatory Commission	Southern Indiana Gas Company, d/b/a Vectren Energy Delivery of Indiana, Inc.	45447	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utility Commission of Texas	Southwestern Public Service Company	PUC 51415	Depreciation rates, service lives, net salvage	Cities Advocating Reasonable Deregulation
New Mexico Public Regulatory Commission	Avangrid, Inc., Avangrid Networks, Inc., NM Green Holdings, Inc., PNM, and PNM Resources	20-00222-UT	Ring fencing and capital structure	The Albuquerque Bernalillo County Water Utility Authority
Indiana Utility Regulatory Commission	Indiana Gas Company, d/b/a Vectren Energy Delivery of Indiana, Inc.	45468	Depreciation rates, service lives, net salvage	Indiana Office of Utility Consumer Counselor
Public Utilities Commission of Nevada	Nevada Power Company and Sierra Pacific Power Company, d/b/a NV Energy	20-07023	Construction work in progress	MGM Resorts International, Caesars Enterprise Services, LLC, and the Southern Nevada Water Authority
Massachusetts Department of Public Utilities	Boston Gas Company, d/b/a National Grid	D.P.U. 20-120	Depreciation rates, service lives, net salvage	Massachusetts Office of the Attorney General, Office of Ratepayer Advocacy
Public Service Commission of the State of Montana	ABACO Energy Services, LLC	D2020.07.082	Cost of capital and authorized rate of return	Montana Consumer Counsel
Maryland Public Service Commission	Washington Gas Light Company	9651	Cost of capital and authorized rate of return	Maryland Office of People's Counsel
Florida Public Service Commission	Utilities, Inc. of Florida	20200139-WS	Cost of capital and authorized rate of return	Florida Office of Public Counsel
New Mexico Public Regulatory Commission	El Paso Electric Company	20-00104-UT	Cost of capital, depreciation rates, net salvage	City of Las Cruces and Doña Ana County

Utility Regulatory Proceedings

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

Utility Regulatory Proceedings

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

Utility Regulatory Proceedings

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

Utility Regulatory Proceedings

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

Utility Regulatory Proceedings

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

Summary Accrual Adjustment

Plant Function		Plant Balance 12/31/2019		Company Proposed Accrual		City Proposed Accrual		**City Accrual Adjustment**
Steam Production	$	565,455,715	$	18,397,949	$	14,784,009	$	(3,613,940)
Gas Turbine		518,021,063		15,143,974		11,561,033		(3,582,941)
Transmission		532,343,334		9,023,893		8,275,788		(748,105)
Distribution		1,347,787,849		29,846,554		28,149,622		(1,696,932)
General		171,715,519		6,601,194		6,616,766		15,572
Total Depreciable Plant	$	3,135,323,480	$	79,013,564	$	69,387,217	**$**	**(9,626,347)**

Mass Property Parameter Comparison

Account No.	Description	Company Proposal Iowa Curve Type	AL	NS Rate	Depr Rate	Annual Accrual	City Proposal Iowa Curve Type	AL	NS Rate	Depr Rate	Annual Accrual
	TRANSMISSION PLANT										
353.00	STATION EQUIPMENT	R4	50	-5%	1.56%	2,948,962	R3	58	-5%	1.40%	2,647,195
355.00	WOOD AND STEEL POLES	S3	55	-20%	1.91%	3,115,165	S3	55	-15%	1.79%	2,918,845
356.00	OVERHEAD CONDUCTORS AND DEVICES	R5	60	-15%	1.61%	1,579,563	R4	65	-10%	1.35%	1,329,527
	DISTRIBUTION PLANT										
362.00	STATION EQUIPMENT	R2	65	-5%	1.43%	4,102,971	R1.5	71	0%	1.24%	3,568,711
364.00	POLES, TOWERS AND FIXTURES	R3	45	-30%	3.11%	5,697,660	R3	45	-25%	2.94%	5,396,941
366.00	UNDERGROUND CONDUIT	R4	65	-5%	1.50%	2,124,461	R4	71	0%	1.27%	1,804,272
368.00	LINE TRANSFORMERS	R3	52	-15%	2.34%	6,629,377	R3	52	-10%	2.21%	6,260,694
369.00	SERVICES	S3	65	-15%	1.38%	779,571	S3	65	0%	1.08%	607,181

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			Company Proposal		City Proposal		Difference	
Account No.	Description	Plant 12/31/2019	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	STEAM PRODUCTION PLANT							
311.00	STRUCTURES AND IMPROVEMENTS							
	RIO GRANDE UNIT 6	1,290,817	4.87%	62,880	0.37%	4,744	-4.50%	-58,136
	RIO GRANDE UNIT 7	1,269,983	3.00%	38,120	0.00%	0	-3.00%	-38,120
	RIO GRANDE UNIT 8	2,311,211	2.15%	49,684	1.49%	34,492	-0.66%	-15,192
	RIO GRANDE COMMON	4,433,409	6.36%	281,794	5.70%	252,765	-0.66%	-29,029
	NEWMAN UNIT 1	1,269,946	1.65%	20,984	0.00%	0	-1.65%	-20,984
	NEWMAN UNIT 2	1,035,405	11.26%	116,618	9.24%	95,722	-2.02%	-20,896
	NEWMAN UNIT 3	1,097,187	4.29%	47,086	3.42%	37,573	-0.87%	-9,513
	NEWMAN UNIT 4	15,848,533	6.25%	989,904	5.33%	845,069	-0.92%	-144,835
	NEWMAN UNIT 5	25,932,328	2.00%	519,409	1.82%	472,089	-0.18%	-47,320
	NEWMAN COMMON	18,900,582	2.42%	458,120	2.25%	425,597	-0.17%	-32,523
	Total Account 311.00	73,389,401	3.52%	2,584,599	2.95%	2,168,052	-0.57%	-416,547
312.00	BOILER PLANT EQUIPMENT							
	RIO GRANDE UNIT 6	2,973,008	2.03%	60,345	0.00%	0	-2.03%	-60,345
	RIO GRANDE UNIT 7	4,604,495	3.02%	139,002	0.00%	0	-3.02%	-139,002
	RIO GRANDE UNIT 8	15,577,498	2.92%	454,804	2.25%	350,852	-0.67%	-103,952
	RIO GRANDE COMMON	939,445	5.75%	54,061	5.11%	47,985	-0.64%	-6,076
	NEWMAN UNIT 1	8,696,638	5.03%	437,616	3.03%	263,683	-2.00%	-173,933
	NEWMAN UNIT 2	8,916,414	13.54%	1,206,859	11.48%	1,023,316	-2.06%	-183,543
	NEWMAN UNIT 3	6,743,234	4.69%	316,152	3.80%	256,399	-0.89%	-59,753
	NEWMAN UNIT 4	3,303,062	7.77%	256,498	6.91%	228,120	-0.86%	-28,378
	NEWMAN UNIT 5	112,841,612	1.97%	2,221,976	1.78%	2,013,325	-0.19%	-208,651
	NEWMAN COMMON	6,752,670	2.31%	155,686	2.13%	143,736	-0.18%	-11,950
	Total Account 312.00	171,348,075	3.09%	5,302,999	2.53%	4,327,418	-0.57%	-975,581
313.00	ENGINES AND ENGINE-DRIVEN GENERATORS							
	NEWMAN UNIT 1	327,497	0.00%	0	0.00%	0	0.00%	0
	NEWMAN UNIT 4	24,780,032	7.19%	1,780,675	7.08%	1,754,283	-0.11%	-26,392
	NEWMAN UNIT 5	48,432,717	2.39%	1,158,343	2.12%	1,026,283	-0.27%	-132,060
	Total Account 313.00	73,540,247	4.00%	2,939,018	3.78%	2,780,566	-0.22%	-158,452
314.00	TURBOGENERATOR UNITS							
	RIO GRANDE UNIT 6	3,559,998	2.07%	73,825	0.00%	0	-2.07%	-73,825
	RIO GRANDE UNIT 7	4,204,367	3.73%	156,647	0.69%	28,951	-3.04%	-127,696

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			Company Proposal		City Proposal		Difference	
Account No.	Description	Plant 12/31/2019	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	RIO GRANDE UNIT 8	11,776,648	2.10%	247,615	1.41%	166,522	-0.69%	-81,093
	NEWMAN UNIT 1	13,716,383	7.36%	1,010,167	5.35%	733,281	-2.01%	-276,886
	NEWMAN UNIT 2	11,439,310	7.69%	879,152	5.67%	648,513	-2.02%	-230,639
	NEWMAN UNIT 3	12,089,865	7.09%	857,278	6.18%	747,750	-0.91%	-109,528
	NEWMAN UNIT 4	33,968,975	2.28%	774,735	1.41%	479,887	-0.87%	-294,848
	NEWMAN UNIT 5	61,650,972	2.27%	1,400,181	2.02%	1,243,728	-0.25%	-156,453
	NEWMAN COMMON	58,097	0.00%	0	0.00%	0	0.00%	0
	Total Account 314.00	152,464,615	3.54%	5,399,600	2.66%	4,048,632	-0.89%	-1,350,968
315.00	ACCESSORY ELECTRIC EQUIPMENT							
	RIO GRANDE UNIT 6	784,259	7.63%	59,851	2.88%	22,614	-4.75%	-37,237
	RIO GRANDE UNIT 7	856,688	11.39%	97,562	8.16%	69,925	-3.23%	-27,637
	RIO GRANDE UNIT 8	6,535,523	5.62%	367,315	4.95%	323,791	-0.67%	-43,524
	NEWMAN UNIT 1	1,148,175	2.11%	24,241	0.02%	209	-2.09%	-24,032
	NEWMAN UNIT 2	1,052,955	2.09%	22,021	0.00%	0	-2.09%	-22,021
	NEWMAN UNIT 3	1,150,892	5.52%	63,543	4.54%	52,217	-0.98%	-11,326
	NEWMAN UNIT 4	6,332,763	0.89%	56,266	0.00%	3	-0.89%	-56,263
	NEWMAN UNIT 5	24,098,577	1.98%	477,670	1.82%	437,660	-0.16%	-40,010
	NEWMAN COMMON	157,237	2.53%	3,976	2.38%	3,744	-0.15%	-232
	Total Account 315.00	42,117,069	2.78%	1,172,445	2.16%	910,164	-0.62%	-262,281
316.00	MISCELLANEOUS POWER PLANT EQUIPMENT							
	RIO GRANDE UNIT 6	1,489,364	4.51%	67,097	0.00%	0	-4.51%	-67,097
	RIO GRANDE UNIT 7	1,851,433	2.18%	40,407	0.00%	0	-2.18%	-40,407
	RIO GRANDE UNIT 8	5,951,707	2.12%	125,977	1.45%	86,121	-0.67%	-39,856
	RIO GRANDE COMMON	1,938,696	4.84%	93,906	4.20%	81,357	-0.64%	-12,549
	NEWMAN UNIT 1	2,177,691	2.02%	44,023	0.02%	400	-2.00%	-43,623
	NEWMAN UNIT 2	2,829,108	2.01%	56,724	0.00%	1	-2.01%	-56,723
	NEWMAN UNIT 3	5,645,296	1.50%	84,453	0.63%	35,732	-0.87%	-48,721
	NEWMAN UNIT 4	11,495,252	0.86%	98,730	0.00%	0	-0.86%	-98,730
	NEWMAN UNIT 5	1,771,257	1.55%	27,489	1.34%	23,754	-0.21%	-3,735
	NEWMAN ZERO LIQUID DISCHARGE	14,375,574	2.06%	296,134	1.84%	264,343	-0.22%	-31,791
	NEWMAN COMMON	3,070,930	2.10%	64,348	1.87%	57,469	-0.23%	-6,879
	Total Account 316.00	52,596,308	1.90%	999,288	1.04%	549,177	-0.86%	-450,111
	Total Steam Production Plant	565,455,715	3.25%	18,397,949	2.61%	14,784,009	-0.64%	-3,613,940

Detailed Rate Comparison

Account No.	Description	[1] Plant 12/31/2019	[2] Company Proposal Rate	Company Proposal Annual Accrual	[3] City Proposal Rate	City Proposal Annual Accrual	[4] Difference Rate	Difference Annual Accrual
	GAS TURBINE PLANT							
341.00	STRUCTURES AND IMPROVEMENTS							
	COPPER POWER STATION	791,864	2.10%	16,598	1.32%	10,489	-0.78%	-6,109
	RIO GRANDE UNIT 9	22,158,133	2.55%	565,958	2.33%	517,007	-0.22%	-48,951
	MONTANA POWER STATION UNIT 1	315,347	2.40%	7,553	2.21%	6,965	-0.19%	-588
	MONTANA POWER STATION UNIT 2	257,181	2.39%	6,155	2.21%	5,680	-0.18%	-475
	MONTANA POWER STATION UNIT 3	206,815	2.35%	4,855	2.16%	4,473	-0.19%	-382
	MONTANA POWER STATION UNIT 4	237,486	2.37%	5,630	2.19%	5,189	-0.18%	-441
	MONTANA POWER STATION COMMON	18,007,977	2.43%	436,896	2.20%	395,873	-0.23%	-41,023
	SOLAR FACILITIES	91,868	4.84%	4,449	4.61%	4,233	-0.23%	-216
	Total Account 341.00	42,066,673	2.49%	1,048,094	2.26%	949,910	-0.23%	-98,184
342.00	FUEL HOLDERS							
	COPPER POWER STATION	511,691	1.42%	7,248	0.55%	2,798	-0.87%	-4,450
	RIO GRANDE UNIT 9	3,768,778	2.54%	95,879	2.25%	84,940	-0.29%	-10,939
	MONTANA POWER STATION COMMON	20,877,428	2.53%	528,536	2.23%	465,060	-0.30%	-63,476
	Total Account 342.00	25,157,897	2.51%	631,663	2.20%	552,797	-0.31%	-78,866
343.00	PRIME MOVERS							
	RIO GRANDE UNIT 9	59,555,058	3.09%	1,838,029	2.24%	1,331,516	-0.85%	-506,513
	MONTANA POWER STATION UNIT 1	78,609,841	2.92%	2,174,179	2.18%	1,711,597	-0.74%	-462,582
	MONTANA POWER STATION UNIT 2	73,503,725	2.93%	2,038,250	2.18%	1,600,484	-0.75%	-437,766
	MONTANA POWER STATION UNIT 3	63,009,557	2.99%	2,028,005	2.18%	1,372,607	-0.81%	-655,398
	MONTANA POWER STATION UNIT 4	62,425,439	3.01%	2,024,234	2.20%	1,373,306	-0.81%	-650,928
	MONTANA POWER STATION COMMON	34,687,535	2.96%	983,374	2.12%	733,894	-0.84%	-249,480
	Total Account 343.00	371,791,155	2.98%	11,086,071	2.18%	8,123,404	-0.80%	-2,962,667
344.00	GENERATORS							
	COPPER POWER STATION	10,369,392	4.27%	442,451	3.45%	357,417	-0.82%	-85,034
	RIO GRANDE UNIT 9	8,420,577	2.75%	231,923	2.33%	195,862	-0.42%	-36,061
	MONTANA POWER STATION UNIT 1	6,122,691	2.70%	165,547	2.28%	139,610	-0.42%	-25,937
	MONTANA POWER STATION UNIT 2	6,122,691	2.70%	165,464	2.28%	139,454	-0.42%	-26,010
	MONTANA POWER STATION UNIT 3	6,241,096	2.62%	163,335	2.21%	137,665	-0.41%	-25,670
	MONTANA POWER STATION UNIT 4	6,126,228	2.63%	161,282	2.22%	135,957	-0.41%	-25,325
	MONTANA POWER STATION COMMON	63	3.17%	2	1.59%	1	-1.58%	-1

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			Company Proposal		City Proposal		Difference	
Account No.	Description	Plant 12/31/2019	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	SOLAR FACILITIES	1,187,262	5.23%	62,103	4.60%	54,636	-0.63%	-7,467
	Total Account 344.00	44,590,001	3.12%	1,392,107	2.60%	1,160,603	-0.52%	-231,504
345.00	ACCESSORY ELECTRIC EQUIPMENT							
	COPPER POWER STATION	2,306,861	7.43%	171,293	6.53%	150,677	-0.90%	-20,616
	RIO GRANDE UNIT 9	5,186,611	2.81%	145,846	2.21%	114,540	-0.60%	-31,306
	MONTANA POWER STATION UNIT 1	3,115,518	2.80%	87,129	2.23%	69,357	-0.57%	-17,772
	MONTANA POWER STATION UNIT 2	3,029,962	2.79%	84,673	2.22%	67,330	-0.57%	-17,343
	MONTANA POWER STATION UNIT 3	2,686,650	2.78%	74,780	2.21%	59,378	-0.57%	-15,402
	MONTANA POWER STATION UNIT 4	2,250,774	2.81%	63,194	2.23%	50,294	-0.58%	-12,900
	MONTANA POWER STATION COMMON	9,316,081	2.73%	254,615	2.11%	196,589	-0.62%	-58,026
	SOLAR FACILITIES	167,360	5.30%	8,862	4.54%	7,604	-0.76%	-1,258
	Total Account 345.00	28,059,816	3.17%	890,392	2.55%	715,767	-0.62%	-174,625
346.00	MISCELLANEOUS POWER PLANT EQUIPMENT							
	COPPER POWER STATION	4,170,624	1.04%	43,243	0.30%	12,387	-0.74%	-30,856
	RIO GRANDE UNIT 9	410,060	2.53%	10,363	2.23%	9,155	-0.30%	-1,208
	MONTANA POWER STATION UNIT 1	297,569	2.43%	7,240	2.17%	6,453	-0.26%	-787
	MONTANA POWER STATION UNIT 2	275,751	2.42%	6,679	2.16%	5,947	-0.26%	-732
	MONTANA POWER STATION UNIT 3	229,358	2.42%	5,557	2.15%	4,941	-0.27%	-616
	MONTANA POWER STATION UNIT 4	231,228	2.45%	5,662	2.18%	5,040	-0.27%	-622
	MONTANA POWER STATION COMMON	740,931	2.28%	16,903	1.97%	14,629	-0.31%	-2,274
	Total Account 346.00	6,355,521	1.50%	95,647	0.92%	58,552	-0.58%	-37,095
	Total Gas Turbine Plant	518,021,063	2.92%	15,143,974	2.23%	11,561,033	-0.69%	-3,582,941
	TRANSMISSION PLANT							
350.10	LAND RIGHTS	18,917,746	1.02%	192,753	1.02%	192,848	0.00%	95
350.10	LAND RIGHTS - ISLETA	16,824,156	3.79%	636,818	3.79%	636,818	0.00%	0
352.00	STRUCTURES AND IMPROVEMENTS	12,463,443	1.16%	144,867	1.16%	144,810	0.00%	-57
353.00	STATION EQUIPMENT	188,643,566	1.56%	2,948,962	1.40%	2,647,195	-0.16%	-301,767
354.00	STEEL TOWERS AND FIXTURES	30,170,782	1.19%	359,891	1.19%	359,839	0.00%	-52
355.00	WOOD AND STEEL POLES	163,484,540	1.91%	3,115,165	1.79%	2,918,845	-0.12%	-196,320
356.00	OVERHEAD CONDUCTORS AND DEVICES	98,265,749	1.61%	1,579,563	1.35%	1,329,527	-0.26%	-250,036
359.00	ROADS AND TRAILS	3,573,353	1.28%	45,874	1.28%	45,905	0.00%	31

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			Company Proposal		City Proposal		Difference	
Account No.	Description	Plant 12/31/2019	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	Total Transmission Plant	532,343,334	1.70%	9,023,893	1.55%	8,275,788	-0.14%	-748,105
	DISTRIBUTION PLANT							
360.10	LAND RIGHTS	2,578,795	1.32%	33,963	1.32%	33,955	0.00%	-8
361.00	STRUCTURES AND IMPROVEMENTS	21,788,555	1.46%	317,742	1.46%	317,870	0.00%	128
362.00	STATION EQUIPMENT	287,622,780	1.43%	4,102,971	1.24%	3,568,711	-0.19%	-534,260
364.00	POLES, TOWERS AND FIXTURES	183,367,772	3.11%	5,697,660	2.94%	5,396,941	-0.17%	-300,719
365.00	OVERHEAD CONDUCTORS AND DEVICES	117,036,296	2.35%	2,747,955	2.35%	2,749,335	0.00%	1,380
366.00	UNDERGROUND CONDUIT	141,830,292	1.50%	2,124,461	1.27%	1,804,272	-0.23%	-320,189
367.00	UNDERGROUND CONDUCTORS AND DEVICES	166,797,046	3.07%	5,117,534	3.07%	5,117,987	0.00%	453
368.00	LINE TRANSFORMERS	283,609,012	2.34%	6,629,377	2.21%	6,260,694	-0.13%	-368,683
369.00	SERVICES	56,297,452	1.38%	779,571	1.08%	607,181	-0.30%	-172,390
370.00	METERS	61,010,255	2.62%	1,598,992	2.62%	1,596,396	0.00%	-2,596
371.00	INSTALLATIONS ON CUSTOMERS' PREMISES	14,098,584	3.22%	454,004	3.22%	453,868	0.00%	-136
373.00	STREET LIGHTING AND SIGNAL SYSTEMS	11,751,010	2.06%	242,324	2.06%	242,411	0.00%	87
	Total Distribution Plant	1,347,787,849	2.21%	29,846,554	2.09%	28,149,622	-0.13%	-1,696,932
	GENERAL PLANT							
390.00	STRUCTURES AND IMPROVEMENTS							
	SYSTEMS OPERATIONS BUILDING	15,318,735	3.66%	560,769	3.66%	561,272	0.00%	503
	STANTON TOWER	38,933,123	2.30%	896,927	2.30%	896,115	0.00%	-812
	EASTSIDE OPERATIONS CENTER	42,631,420	2.11%	898,410	2.11%	897,875	0.00%	-535
	OTHER STRUCTURES	17,628,831	2.97%	524,165	2.97%	524,014	0.00%	-151
	Total Account 390.00	114,512,108	2.52%	2,880,271	2.51%	2,879,276	0.00%	-995
391.00	OFFICE FURNITURE AND EQUIPMENT	6,751,956	0.49%	32,752	0.49%	32,779	0.00%	27
393.00	STORES EQUIPMENT	53,348	0.37%	195	0.37%	196	0.00%	1
394.00	TOOLS, SHOP AND GARAGE EQUIPMENT	5,680,076	3.44%	195,583	3.44%	195,258	0.00%	-325
395.00	LABORATORY EQUIPMENT	5,226,132	6.65%	347,704	6.68%	349,056	0.03%	1,352
396.00	POWER OPERATED EQUIPMENT	4,300,329	3.86%	165,782	3.85%	165,754	-0.01%	-28
397.00	COMMUNICATION EQUIPMENT	30,616,208	8.43%	2,580,060	8.48%	2,595,737	0.05%	15,677
398.00	MISCELLANEOUS EQUIPMENT	4,575,362	8.72%	398,847	8.71%	398,711	-0.01%	-136

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			Company Proposal		City Proposal		Difference	
Account No.	Description	Plant 12/31/2019	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	Total General Plant	171,715,519	3.84%	6,601,194	3.85%	6,616,766	0.01%	15,572
	TOTAL DEPRECIABLE PLANT	**$ 3,135,323,480**	**2.52%**	**$ 79,013,564**	**2.21%**	**$ 69,387,217**	**-0.31%**	**$ (9,626,347)**

[1], [2] From depreciation study
[3] From Depreciation Rate Development exhibit
[4] = [3] - [2]

Depreciation Rate Development

Account No.	Description	[1] Plant 12/31/2019	[2] Iowa Curve Type	[2] Iowa Curve AL	[3] Net Salvage	[4] Depreciable Base	[5] Book Reserve	[6] Future Accruals	[7] Remaining Life	[8] Service Life Accrual	[9] Service Life Rate	[10] Net Salvage Accrual	[11] Net Salvage Rate	[12] Total Accrual	[13] Total Rate
	STEAM PRODUCTION PLANT														
311.00	STRUCTURES AND IMPROVEMENTS														
	RIO GRANDE UNIT 6	1,290,817			0.0%	1,290,817	1,281,328	9,489	2.00	4,744	0.37%	0	0.00%	4,744	**0.37%**
	RIO GRANDE UNIT 7	1,269,983			0.0%	1,269,983	1,269,984	-1							
	RIO GRANDE UNIT 8	2,311,211			0.0%	2,311,211	1,828,321	482,891	14.00	34,492	1.49%	0	0.00%	34,492	**1.49%**
	RIO GRANDE COMMON	4,433,409			0.0%	4,433,409	894,702	3,538,707	14.00	252,765	5.70%	0	0.00%	252,765	**5.70%**
	NEWMAN UNIT 1	1,269,946			0.0%	1,269,946	1,283,433	-13,486							
	NEWMAN UNIT 2	1,035,405			0.0%	1,035,405	748,238	287,167	3.00	95,722	9.24%	0	0.00%	95,722	**9.24%**
	NEWMAN UNIT 3	1,097,187			0.0%	1,097,187	834,174	263,013	7.00	37,573	3.42%	0	0.00%	37,573	**3.42%**
	NEWMAN UNIT 4	15,848,533			0.0%	15,848,533	9,933,049	5,915,484	7.00	845,069	5.33%	0	0.00%	845,069	**5.33%**
	NEWMAN UNIT 5	25,932,328			0.0%	25,932,328	6,104,581	19,827,747	42.00	472,089	1.82%	0	0.00%	472,089	**1.82%**
	NEWMAN COMMON	18,900,582			0.0%	18,900,582	1,025,528	17,875,054	42.00	425,597	2.25%	0	0.00%	425,597	**2.25%**
	Total Account 311.00	73,389,401			0.0%	73,389,401	25,203,337	48,186,064	22.23	2,168,052	2.95%	0	0.00%	2,168,052	**2.95%**
312.00	BOILER PLANT EQUIPMENT														
	RIO GRANDE UNIT 6	2,973,008			0.0%	2,973,008	3,121,658	-148,650	0.00						
	RIO GRANDE UNIT 7	4,604,495			0.0%	4,604,495	4,604,496	-1							
	RIO GRANDE UNIT 8	15,577,498			0.0%	15,577,498	10,665,565	4,911,932	14.00	350,852	2.25%	0	0.00%	350,852	**2.25%**
	RIO GRANDE COMMON	939,445			0.0%	939,445	267,650	671,795	14.00	47,985	5.11%	0	0.00%	47,985	**5.11%**
	NEWMAN UNIT 1	8,696,638			0.0%	8,696,638	7,905,587	791,050	3.00	263,683	3.03%	0	0.00%	263,683	**3.03%**
	NEWMAN UNIT 2	8,916,414			0.0%	8,916,414	5,846,465	3,069,949	3.00	1,023,316	11.48%	0	0.00%	1,023,316	**11.48%**
	NEWMAN UNIT 3	6,743,234			0.0%	6,743,234	4,948,440	1,794,795	7.00	256,399	3.80%	0	0.00%	256,399	**3.80%**
	NEWMAN UNIT 4	3,303,062			0.0%	3,303,062	1,706,224	1,596,838	7.00	228,120	6.91%	0	0.00%	228,120	**6.91%**
	NEWMAN UNIT 5	112,841,612			0.0%	112,841,612	28,281,943	84,559,669	42.00	2,013,325	1.78%	0	0.00%	2,013,325	**1.78%**
	NEWMAN COMMON	6,752,670			0.0%	6,752,670	715,753	6,036,918	42.00	143,736	2.13%	0	0.00%	143,736	**2.13%**
	Total Account 312.00	171,348,075			0.0%	171,348,075	68,063,781	103,284,294	23.87	4,327,418	2.53%	0	0.00%	4,327,418	**2.53%**
313.00	ENGINES AND ENGINE-DRIVEN GENERATORS														
	NEWMAN UNIT 1	327,497			0.0%	327,497	327,497	0							
	NEWMAN UNIT 4	24,780,032			0.0%	24,780,032	12,500,053	12,279,980	7.00	1,754,283	7.08%	0	0.00%	1,754,283	**7.08%**
	NEWMAN UNIT 5	48,432,717			0.0%	48,432,717	5,328,814	43,103,903	42.00	1,026,283	2.12%	0	0.00%	1,026,283	**2.12%**
	Total Account 313.00	73,540,247			0.0%	73,540,247	18,156,364	55,383,883	19.92	2,780,566	3.78%	0	0.00%	2,780,566	**3.78%**
314.00	TURBOGENERATOR UNITS														
	RIO GRANDE UNIT 6	3,559,998			0.0%	3,559,998	3,734,067	-174,069							
	RIO GRANDE UNIT 7	4,204,367			0.0%	4,204,367	4,117,514	86,853	3.00	28,951	0.69%	0	0.00%	28,951	**0.69%**
	RIO GRANDE UNIT 8	11,776,648			0.0%	11,776,648	9,445,338	2,331,310	14.00	166,522	1.41%	0	0.00%	166,522	**1.41%**
	NEWMAN UNIT 1	13,716,383			0.0%	13,716,383	11,516,540	2,199,844	3.00	733,281	5.35%	0	0.00%	733,281	**5.35%**
	NEWMAN UNIT 2	11,439,310			0.0%	11,439,310	9,493,772	1,945,538	3.00	648,513	5.67%	0	0.00%	648,513	**5.67%**
	NEWMAN UNIT 3	12,089,865			0.0%	12,089,865	6,855,613	5,234,253	7.00	747,750	6.18%	0	0.00%	747,750	**6.18%**
	NEWMAN UNIT 4	33,968,975			0.0%	33,968,975	30,609,768	3,359,207	7.00	479,887	1.41%	0	0.00%	479,887	**1.41%**
	NEWMAN UNIT 5	61,650,972			0.0%	61,650,972	9,414,378	52,236,594	42.00	1,243,728	2.02%	0	0.00%	1,243,728	**2.02%**
	NEWMAN COMMON	58,097			0.0%	58,097	107,629	-49,532	0.00						
	Total Account 314.00	152,464,615			0.0%	152,464,615	85,294,619	67,169,996	16.59	4,048,632	2.66%	0	0.00%	4,048,632	**2.66%**
315.00	ACCESSORY ELECTRIC EQUIPMENT														
	RIO GRANDE UNIT 6	784,259			0.0%	784,259	739,032	45,227	2.00	22,614	2.88%	0	0.00%	22,614	**2.88%**
	RIO GRANDE UNIT 7	856,688			0.0%	856,688	646,912	209,776	3.00	69,925	8.16%	0	0.00%	69,925	**8.16%**
	RIO GRANDE UNIT 8	6,535,523			0.0%	6,535,523	2,002,447	4,533,076	14.00	323,791	4.95%	0	0.00%	323,791	**4.95%**
	NEWMAN UNIT 1	1,148,175			0.0%	1,148,175	1,147,547	628	3.00	209	0.02%	0	0.00%	209	**0.02%**
	NEWMAN UNIT 2	1,052,955			0.0%	1,052,955	1,052,959	-4							
	NEWMAN UNIT 3	1,150,892			0.0%	1,150,892	785,370	365,522	7.00	52,217	4.54%	0	0.00%	52,217	**4.54%**
	NEWMAN UNIT 4	6,332,763			0.0%	6,332,763	6,332,739	24	8.00	3	0.00%	0	0.00%	3	**0.00%**
	NEWMAN UNIT 5	24,098,577			0.0%	24,098,577	5,716,844	18,381,733	42.00	437,660	1.82%	0	0.00%	437,660	**1.82%**
	NEWMAN COMMON	157,237			0.0%	157,237	4	157,233	42.00	3,744	2.38%	0	0.00%	3,744	**2.38%**
	Total Account 315.00	42,117,069			0.0%	42,117,069	18,423,853	23,693,216	26.03	910,164	2.16%	0	0.00%	910,164	**2.16%**
316.00	MISCELLANEOUS POWER PLANT EQUIPMENT														
	RIO GRANDE UNIT 6	1,489,364			0.0%	1,489,364	1,489,365	-1							
	RIO GRANDE UNIT 7	1,851,433			0.0%	1,851,433	1,896,993	-45,560							
	RIO GRANDE UNIT 8	5,951,707			0.0%	5,951,707	4,746,012	1,205,695	14.00	86,121	1.45%	0	0.00%	86,121	**1.45%**
	RIO GRANDE COMMON	1,938,696			0.0%	1,938,696	799,702	1,138,994	14.00	81,357	4.20%	0	0.00%	81,357	**4.20%**

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Account No.	Description	Plant 12/31/2019	Iowa Curve Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Service Life Accrual	Service Life Rate	Net Salvage Accrual	Net Salvage Rate	Total Accrual	Total Rate
	NEWMAN UNIT 1	2,177,691			0.0%	2,177,691	2,176,490	1,201	3.00	400	0.02%	0	0.00%	400	**0.02%**
	NEWMAN UNIT 2	2,829,108			0.0%	2,829,108	2,829,106	2	2.00	1	0.00%	0	0.00%	1	**0.00%**
	NEWMAN UNIT 3	5,645,296			0.0%	5,645,296	5,395,175	250,121	7.00	35,732	0.63%	0	0.00%	35,732	**0.63%**
	NEWMAN UNIT 4	11,495,252			0.0%	11,495,252	11,495,252	-1							
	NEWMAN UNIT 5	1,771,257			0.0%	1,771,257	773,576	997,681	42.00	23,754	1.34%	0	0.00%	23,754	**1.34%**
	NEWMAN ZERO LIQUID DISCHARGE	14,375,574			0.0%	14,375,574	3,273,166	11,102,408	42.00	264,343	1.84%	0	0.00%	264,343	**1.84%**
	NEWMAN COMMON	3,070,930			0.0%	3,070,930	657,238	2,413,692	42.00	57,469	1.87%	0	0.00%	57,469	**1.87%**
	Total Account 316.00	52,596,308			0.0%	52,596,308	35,532,076	17,064,233	31.07	549,177	1.04%	0	0.00%	549,177	**1.04%**
	Total Steam Production Plant	565,455,715			0.0%	565,455,715	250,674,029	314,781,685	21.29	14,784,009	2.61%	0	0.00%	14,784,009	**2.61%**
	GAS TURBINE PLANT														
341.00	STRUCTURES AND IMPROVEMENTS														
	COPPER POWER STATION	791,864			0.0%	791,864	676,484	115,380	11.00	10,489	1.32%	0	0.00%	10,489	**1.32%**
	RIO GRANDE UNIT 9	22,158,133			0.0%	22,158,133	2,511,851	19,646,282	38.00	517,007	2.33%	0	0.00%	517,007	**2.33%**
	MONTANA POWER STATION UNIT 1	315,347			0.0%	315,347	29,788	285,559	41.00	6,965	2.21%	0	0.00%	6,965	**2.21%**
	MONTANA POWER STATION UNIT 2	257,181			0.0%	257,181	24,321	232,860	41.00	5,680	2.21%	0	0.00%	5,680	**2.21%**
	MONTANA POWER STATION UNIT 3	206,815			0.0%	206,815	18,930	187,885	42.00	4,473	2.16%	0	0.00%	4,473	**2.16%**
	MONTANA POWER STATION UNIT 4	237,486			0.0%	237,486	19,541	217,945	42.00	5,189	2.19%	0	0.00%	5,189	**2.19%**
	MONTANA POWER STATION COMMON	18,007,977			0.0%	18,007,977	1,381,319	16,626,658	42.00	395,873	2.20%	0	0.00%	395,873	**2.20%**
	SOLAR FACILITIES	91,868			0.0%	91,868	28,369	63,499	15.00	4,233	4.61%	0	0.00%	4,233	**4.61%**
	Total Account 341.00	42,066,673			0.0%	42,066,673	4,690,603	37,376,069	39.35	949,910	2.26%	0	0.00%	949,910	**2.26%**
342.00	FUEL HOLDERS														
	COPPER POWER STATION	511,691			0.0%	511,691	480,918	30,773	11.00	2,798	0.55%	0	0.00%	2,798	**0.55%**
	RIO GRANDE UNIT 9	3,768,778			0.0%	3,768,778	541,045	3,227,734	38.00	84,940	2.25%	0	0.00%	84,940	**2.25%**
	MONTANA POWER STATION COMMON	20,877,428			0.0%	20,877,428	1,344,928	19,532,500	42.00	465,060	2.23%	0	0.00%	465,060	**2.23%**
	Total Account 342.00	25,157,897			0.0%	25,157,897	2,366,890	22,791,006	41.23	552,797	2.20%	0	0.00%	552,797	**2.20%**
343.00	PRIME MOVERS														
	RIO GRANDE UNIT 9	59,555,058			0.0%	59,555,058	8,957,443	50,597,615	38.00	1,331,516	2.24%	0	0.00%	1,331,516	**2.24%**
	MONTANA POWER STATION UNIT 1	78,609,841			0.0%	78,609,841	8,434,351	70,175,490	41.00	1,711,597	2.18%	0	0.00%	1,711,597	**2.18%**
	MONTANA POWER STATION UNIT 2	73,503,725			0.0%	73,503,725	7,883,880	65,619,845	41.00	1,600,484	2.18%	0	0.00%	1,600,484	**2.18%**
	MONTANA POWER STATION UNIT 3	63,009,557			0.0%	63,009,557	5,360,075	57,649,482	42.00	1,372,607	2.18%	0	0.00%	1,372,607	**2.18%**
	MONTANA POWER STATION UNIT 4	62,425,439			0.0%	62,425,439	4,746,607	57,678,832	42.00	1,373,306	2.20%	0	0.00%	1,373,306	**2.20%**
	MONTANA POWER STATION COMMON	34,687,535			0.0%	34,687,535	3,863,968	30,823,567	42.00	733,894	2.12%	0	0.00%	733,894	**2.12%**
	Total Account 343.00	371,791,155			0.0%	371,791,155	39,246,324	332,544,832	40.94	8,123,404	2.18%	0	0.00%	8,123,404	**2.18%**
344.00	GENERATORS														
	COPPER POWER STATION	10,369,392			0.0%	10,369,392	6,437,801	3,931,591	11.00	357,417	3.45%	0	0.00%	357,417	**3.45%**
	RIO GRANDE UNIT 9	8,420,577			0.0%	8,420,577	977,806	7,442,771	38.00	195,862	2.33%	0	0.00%	195,862	**2.33%**
	MONTANA POWER STATION UNIT 1	6,122,691			0.0%	6,122,691	398,681	5,724,010	41.00	139,610	2.28%	0	0.00%	139,610	**2.28%**
	MONTANA POWER STATION UNIT 2	6,122,691			0.0%	6,122,691	405,064	5,717,627	41.00	139,454	2.28%	0	0.00%	139,454	**2.28%**
	MONTANA POWER STATION UNIT 3	6,241,096			0.0%	6,241,096	459,179	5,781,917	42.00	137,665	2.21%	0	0.00%	137,665	**2.21%**
	MONTANA POWER STATION UNIT 4	6,126,228			0.0%	6,126,228	416,026	5,710,202	42.00	135,957	2.22%	0	0.00%	135,957	**2.22%**
	MONTANA POWER STATION COMMON	63			0.0%	63	10	53	53.00	1	1.59%	0	0.00%	1	**1.59%**
	SOLAR FACILITIES	1,187,262			0.0%	1,187,262	367,724	819,538	15.00	54,636	4.60%	0	0.00%	54,636	**4.60%**
	Total Account 344.00	44,590,001			0.0%	44,590,001	9,462,291	35,127,709	30.27	1,160,603	2.60%	0	0.00%	1,160,603	**2.60%**
345.00	ACCESSORY ELECTRIC EQUIPMENT														
	COPPER POWER STATION	2,306,861			0.0%	2,306,861	649,418	1,657,443	11.00	150,677	6.53%	0	0.00%	150,677	**6.53%**
	RIO GRANDE UNIT 9	5,186,611			0.0%	5,186,611	834,096	4,352,515	38.00	114,540	2.21%	0	0.00%	114,540	**2.21%**
	MONTANA POWER STATION UNIT 1	3,115,518			0.0%	3,115,518	271,887	2,843,632	41.00	69,357	2.23%	0	0.00%	69,357	**2.23%**
	MONTANA POWER STATION UNIT 2	3,029,962			0.0%	3,029,962	269,436	2,760,527	41.00	67,330	2.22%	0	0.00%	67,330	**2.22%**
	MONTANA POWER STATION UNIT 3	2,686,650			0.0%	2,686,650	192,777	2,493,873	42.00	59,378	2.21%	0	0.00%	59,378	**2.21%**
	MONTANA POWER STATION UNIT 4	2,250,774			0.0%	2,250,774	138,436	2,112,338	42.00	50,294	2.23%	0	0.00%	50,294	**2.23%**
	MONTANA POWER STATION COMMON	9,316,081			0.0%	9,316,081	1,059,360	8,256,721	42.00	196,589	2.11%	0	0.00%	196,589	**2.11%**
	SOLAR FACILITIES	167,360			0.0%	167,360	53,304	114,056	15.00	7,604	4.54%	0	0.00%	7,604	**4.54%**
	Total Account 345.00	28,059,816			0.0%	28,059,816	3,468,713	24,591,104	34.36	715,767	2.55%	0	0.00%	715,767	**2.55%**

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Account No.	Description	Plant 12/31/2019	Iowa Curve Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Service Life Accrual	Service Life Rate	Net Salvage Accrual	Net Salvage Rate	Total Accrual	Total Rate
346.00	MISCELLANEOUS POWER PLANT EQUIPMENT														
	COPPER POWER STATION	4,170,624			0.0%	4,170,624	4,034,370	136,254	11.00	12,387	0.30%	0	0.00%	12,387	**0.30%**
	RIO GRANDE UNIT 9	410,060			0.0%	410,060	62,171	347,889	38.00	9,155	2.23%	0	0.00%	9,155	**2.23%**
	MONTANA POWER STATION UNIT 1	297,569			0.0%	297,569	32,999	264,570	41.00	6,453	2.17%	0	0.00%	6,453	**2.17%**
	MONTANA POWER STATION UNIT 2	275,751			0.0%	275,751	31,927	243,823	41.00	5,947	2.16%	0	0.00%	5,947	**2.16%**
	MONTANA POWER STATION UNIT 3	229,358			0.0%	229,358	21,831	207,528	42.00	4,941	2.15%	0	0.00%	4,941	**2.15%**
	MONTANA POWER STATION UNIT 4	231,228			0.0%	231,228	19,538	211,690	42.00	5,040	2.18%	0	0.00%	5,040	**2.18%**
	MONTANA POWER STATION COMMON	740,931			0.0%	740,931	126,522	614,409	42.00	14,629	1.97%	0	0.00%	14,629	**1.97%**
	Total Account 346.00	6,355,521			0.0%	6,355,521	4,329,358	2,026,163	34.60	58,552	0.92%	0	0.00%	58,552	**0.92%**
	Total Gas Turbine Plant	518,021,063			0.0%	518,021,063	63,564,180	454,456,883	39.31	11,561,033	2.23%	0	0.00%	11,561,033	**2.23%**
	TRANSMISSION PLANT														
350.10	LAND RIGHTS	18,917,746	R3	80	0.0%	18,917,746	6,016,208	12,901,538	66.90	192,848	1.02%	0	0.00%	192,848	**1.02%**
350.10	LAND RIGHTS - ISLETA	16,824,156	SQ		0.0%	16,824,156	1,540,524	15,283,632	24.00	636,818	3.79%	0	0.00%	636,818	**3.79%**
352.00	STRUCTURES AND IMPROVEMENTS	12,463,443	R4	75	-5.0%	13,086,615	4,224,229	8,862,386	61.20	134,628	1.08%	10,183	0.08%	144,810	**1.16%**
353.00	STATION EQUIPMENT	188,643,566	R3	58	-5.0%	198,075,744	88,164,203	109,911,541	41.52	2,420,023	1.28%	227,172	0.12%	2,647,195	**1.40%**
354.00	STEEL TOWERS AND FIXTURES	30,170,782	R4	75	-10.0%	33,187,860	14,800,075	18,387,784	51.10	300,797	1.00%	59,043	0.20%	359,839	**1.19%**
355.00	WOOD AND STEEL POLES	163,484,540	S3	55	-15.0%	188,007,221	64,248,195	123,759,026	42.40	2,340,480	1.43%	578,365	0.35%	2,918,845	**1.79%**
356.00	OVERHEAD CONDUCTORS AND DEVICES	98,265,749	R4	65	-10.0%	108,092,324	54,924,539	53,167,785	39.99	1,083,801	1.10%	245,726	0.25%	1,329,527	**1.35%**
359.00	ROADS AND TRAILS	3,573,353	R3	70	0.0%	3,573,353	662,951	2,910,402	63.40	45,905	1.28%	0	0.00%	45,905	**1.28%**
	Total Transmission Plant	532,343,334			-8.9%	579,765,018	234,580,925	345,184,094	41.71	7,155,300	1.34%	1,120,488	0.21%	8,275,788	**1.55%**
	DISTRIBUTION PLANT														
360.10	LAND RIGHTS	2,578,795	R4	70	0.0%	2,578,795	622,987	1,955,808	57.60	33,955	1.32%	0	0.00%	33,955	**1.32%**
361.00	STRUCTURES AND IMPROVEMENTS	21,788,555	R3	70	-5.0%	22,877,983	2,820,363	20,057,620	63.10	300,605	1.38%	17,265	0.08%	317,870	**1.46%**
362.00	STATION EQUIPMENT	287,622,780	R1.5	71	0.0%	287,622,780	70,431,015	217,191,765	60.86	3,568,711	1.24%	0	0.00%	3,568,711	**1.24%**
364.00	POLES, TOWERS AND FIXTURES	183,367,772	R3	45	-25.0%	229,209,715	61,904,538	167,305,177	31.00	3,918,169	2.14%	1,478,772	0.81%	5,396,941	**2.94%**
365.00	OVERHEAD CONDUCTORS AND DEVICES	117,036,296	R2.5	48	-15.0%	134,591,740	35,065,798	99,525,943	36.20	2,264,378	1.93%	484,957	0.41%	2,749,335	**2.35%**
366.00	UNDERGROUND CONDUIT	141,830,292	R4	71	0.0%	141,830,292	40,502,369	101,327,924	56.16	1,804,272	1.27%	0	0.00%	1,804,272	**1.27%**
367.00	UNDERGROUND CONDUCTORS AND DEVICES	166,797,046	S2	41	-20.0%	200,156,456	48,664,055	151,492,400	29.60	3,990,979	2.39%	1,127,007	0.68%	5,117,987	**3.07%**
368.00	LINE TRANSFORMERS	283,609,012	R3	52	-10.0%	311,969,913	67,802,856	244,167,057	39.00	5,533,491	1.95%	727,203	0.26%	6,260,694	**2.21%**
369.00	SERVICES	56,297,452	S3	65	0.0%	56,297,452	26,484,850	29,812,602	49.10	607,181	1.08%	0	0.00%	607,181	**1.08%**
370.00	METERS	61,010,255	R2.5	35	-15.0%	70,161,794	28,815,140	41,346,653	25.90	1,243,055	2.04%	353,341	0.58%	1,596,396	**2.62%**
371.00	INSTALLATIONS ON CUSTOMERS' PREMISES	14,098,584	R2	35	-15.0%	16,213,371	5,638,247	10,575,125	23.30	363,105	2.58%	90,763	0.64%	453,868	**3.22%**
373.00	STREET LIGHTING AND SIGNAL SYSTEMS	11,751,010	R3	55	-20.0%	14,101,212	6,077,418	8,023,794	33.10	171,408	1.46%	71,003	0.60%	242,411	**2.06%**
	Total Distribution Plant	1,347,787,849			-10.4%	1,487,611,503	394,829,634	1,092,781,869	38.82	23,799,310	1.77%	4,350,312	0.32%	28,149,622	**2.09%**
	GENERAL PLANT														
390.00	STRUCTURES AND IMPROVEMENTS														
	SYSTEMS OPERATIONS BUILDING	15,318,735	R2.5	80	0.0%	15,318,735	3,475,891	11,842,845	21.10	561,272	3.66%	0	0.00%	561,272	**3.66%**
	STANTON TOWER	38,933,123	R2.5	80	0.0%	38,933,123	5,776,854	33,156,269	37.00	896,115	2.30%	0	0.00%	896,115	**2.30%**
	EASTSIDE OPERATIONS CENTER	42,631,420	R2.5	80	0.0%	42,631,420	3,214,715	39,416,705	43.90	897,875	2.11%	0	0.00%	897,875	**2.11%**
	OTHER STRUCTURES	17,628,831	S0.5	40	0.0%	17,628,831	3,113,647	14,515,184	27.70	524,014	2.97%	0	0.00%	524,014	**2.97%**
	Total Account 390.00	114,512,108			0.0%	114,512,108	15,581,106	98,931,002	34.36	2,879,276	2.51%	0	0.00%	2,879,276	**2.51%**
391.00	OFFICE FURNITURE AND EQUIPMENT	6,751,956	SQ	20	0.0%	6,751,956	6,175,042	576,914	17.60	32,779	0.49%	0	0.00%	32,779	**0.49%**
393.00	STORES EQUIPMENT	53,348	SQ	25	0.0%	53,348	51,489	1,858	9.50	196	0.37%	0	0.00%	196	**0.37%**
394.00	TOOLS, SHOP AND GARAGE EQUIPMENT	5,680,076	SQ	25	0.0%	5,680,076	1,853,025	3,827,051	19.60	195,258	3.44%	0	0.00%	195,258	**3.44%**
395.00	LABORATORY EQUIPMENT	5,226,132	SQ	15	0.0%	5,226,132	1,910,104	3,316,028	9.50	349,056	6.68%	0	0.00%	349,056	**6.68%**
396.00	POWER OPERATED EQUIPMENT	4,300,329	R2.5	21	15.0%	3,655,279	1,036,366	2,618,914	15.80	206,580	4.80%	-40,826	-0.95%	165,754	**3.85%**
397.00	COMMUNICATION EQUIPMENT	30,616,208	SQ	15	0.0%	30,616,208	12,705,626	17,910,582	6.90	2,595,737	8.48%	0	0.00%	2,595,737	**8.48%**
398.00	MISCELLANEOUS EQUIPMENT	4,575,362	SQ	15	0.0%	4,575,362	1,385,677	3,189,685	8.00	398,711	8.71%	0	0.00%	398,711	**8.71%**
	Total General Plant	171,715,519			0.4%	171,070,469	40,698,436	130,372,033	19.70	6,657,591	3.88%	-40,826	-0.02%	6,616,766	**3.85%**
	TOTAL DEPRECIABLE PLANT	**$ 3,135,323,480**			**-6.0%**	**$ 3,321,923,768**	**$ 984,347,203**	**$ 2,337,576,565**	**33.69**	**$ 63,957,243**	**2.04%**	**$ 5,429,974**	**0.17%**	**$ 69,387,217**	**2.21%**

Depreciation Rate Development

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Account		Plant	Iowa Curve		Net	Depreciable	Book	Future	Remaining	Service Life		Net Salvage		Total	
No.	Description	12/31/2019	Type	AL	Salvage	Base	Reserve	Accruals	Life	Accrual	Rate	Accrual	Rate	Accrual	Rate

[1] From depreciation study
[2] Average life and Iowa curve shape developed through statistical analysis and professional judgment
[3] Mass net salvage rates developed through statistical analysis and professional judgment; see response to CEP 7-37, Attach 1 for mass property salvage rates used assuming no interim retirements or net salvage
[4] = [1]*(1-[3])
[5] From depreciation study
[6] = [4] - [5]
[7] Composite remaining life based on Iowa cuve in [2]; see remaining life exhibit for detailed calculations
[8] = ([1] - [5]) / [7]
[9] = [8] / [1]
[10] = [12] - [8]
[11] = [13] - [9]
[12] = [6] / [7]
[13] = [12] / [1]

Account 353 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] Company R4-50	[5] City R3-58	[6] Company SSD	[7] Garrett SSD
0.0	124,971,285	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	123,285,263	100.00%	100.00%	99.99%	0.0000	0.0000
1.5	119,973,354	100.00%	100.00%	99.96%	0.0000	0.0000
2.5	114,067,017	100.00%	99.99%	99.92%	0.0000	0.0000
3.5	106,098,721	99.99%	99.99%	99.88%	0.0000	0.0000
4.5	98,012,081	99.99%	99.99%	99.84%	0.0000	0.0000
5.5	98,507,346	99.98%	99.98%	99.79%	0.0000	0.0000
6.5	93,945,324	99.68%	99.97%	99.73%	0.0000	0.0000
7.5	90,095,080	99.68%	99.96%	99.66%	0.0000	0.0000
8.5	108,423,856	99.68%	99.95%	99.59%	0.0000	0.0000
9.5	107,733,043	99.68%	99.93%	99.51%	0.0000	0.0000
10.5	99,773,471	99.51%	99.91%	99.41%	0.0000	0.0000
11.5	87,162,295	99.45%	99.88%	99.31%	0.0000	0.0000
12.5	88,268,362	99.41%	99.85%	99.19%	0.0000	0.0000
13.5	87,576,947	99.34%	99.81%	99.06%	0.0000	0.0000
14.5	91,177,671	99.34%	99.76%	98.92%	0.0000	0.0000
15.5	89,422,538	99.06%	99.70%	98.76%	0.0000	0.0000
16.5	81,791,927	99.03%	99.62%	98.59%	0.0000	0.0000
17.5	80,820,992	99.03%	99.53%	98.39%	0.0000	0.0000
18.5	81,053,283	99.01%	99.43%	98.18%	0.0000	0.0001
19.5	76,601,021	99.01%	99.30%	97.95%	0.0000	0.0001
20.5	77,068,074	98.20%	99.14%	97.70%	0.0001	0.0000
21.5	77,510,512	98.20%	98.96%	97.42%	0.0001	0.0001
22.5	70,282,388	98.06%	98.75%	97.12%	0.0000	0.0001
23.5	70,034,193	97.83%	98.50%	96.79%	0.0000	0.0001
24.5	68,442,289	96.09%	98.20%	96.44%	0.0004	0.0000
25.5	67,603,103	96.06%	97.87%	96.06%	0.0003	0.0000
26.5	66,668,069	94.73%	97.47%	95.64%	0.0008	0.0001
27.5	66,330,609	94.60%	97.02%	95.20%	0.0006	0.0000
28.5	65,772,107	94.49%	96.51%	94.72%	0.0004	0.0000
29.5	64,567,954	94.49%	95.92%	94.20%	0.0002	0.0000
30.5	46,253,006	94.48%	95.25%	93.65%	0.0001	0.0001
31.5	46,137,531	94.32%	94.50%	93.06%	0.0000	0.0002
32.5	42,338,532	94.18%	93.65%	92.42%	0.0000	0.0003
33.5	41,712,188	93.60%	92.70%	91.75%	0.0001	0.0003
34.5	41,239,758	93.54%	91.65%	91.02%	0.0004	0.0006
35.5	10,632,523	92.47%	90.48%	90.25%	0.0004	0.0005
36.5	10,564,176	92.47%	89.18%	89.43%	0.0011	0.0009
37.5	9,990,821	91.60%	87.76%	88.56%	0.0015	0.0009
38.5	9,522,704	91.48%	86.20%	87.63%	0.0028	0.0015
39.5	7,704,316	90.82%	84.51%	86.65%	0.0040	0.0017
40.5	7,408,332	89.36%	82.67%	85.60%	0.0045	0.0014
41.5	4,031,385	86.73%	80.69%	84.49%	0.0037	0.0005
42.5	3,951,237	85.00%	78.55%	83.31%	0.0042	0.0003
43.5	3,291,692	85.00%	76.25%	82.07%	0.0076	0.0009
44.5	3,279,082	85.00%	73.76%	80.74%	0.0126	0.0018
45.5	2,821,871	85.00%	71.02%	79.35%	0.0195	0.0032
46.5	1,991,746	85.00%	68.03%	77.88%	0.0288	0.0051

Account 353 Curve Fitting

[1]	[2]	[3]	[4]	[5]	[6]	[7]
Age (Years)	**Exposures (Dollars)**	**Observed Life Table (OLT)**	**Company R4-50**	**City R3-58**	**Company SSD**	**Garrett SSD**
47.5	526,623	85.00%	64.75%	76.32%	0.0410	0.0075
48.5	0	85.00%	61.20%	74.68%	0.0567	0.0107
49.5	0	85.00%	57.38%	72.95%	0.0763	0.0145
50.5			53.33%	71.14%		
Sum of Squared Differences				[8]	0.2684	0.0537
Up to 1% of Beginning Exposures				[9]	0.0944	0.0209

[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 356 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] Company R5-60	[5] City R4-65	[6] Company SSD	[7] Garrett SSD
0.0	37,130,703	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	36,274,644	100.00%	100.00%	100.00%	0.0000	0.0000
1.5	36,881,807	100.00%	100.00%	100.00%	0.0000	0.0000
2.5	36,735,606	100.00%	100.00%	100.00%	0.0000	0.0000
3.5	63,229,141	100.00%	100.00%	99.99%	0.0000	0.0000
4.5	56,982,661	100.00%	100.00%	99.99%	0.0000	0.0000
5.5	57,783,965	99.99%	100.00%	99.99%	0.0000	0.0000
6.5	52,500,290	99.99%	100.00%	99.98%	0.0000	0.0000
7.5	52,548,878	99.99%	100.00%	99.98%	0.0000	0.0000
8.5	62,700,553	99.99%	100.00%	99.97%	0.0000	0.0000
9.5	62,310,752	99.96%	100.00%	99.96%	0.0000	0.0000
10.5	61,916,385	99.96%	100.00%	99.95%	0.0000	0.0000
11.5	57,020,862	99.93%	100.00%	99.94%	0.0000	0.0000
12.5	57,295,950	99.93%	100.00%	99.93%	0.0000	0.0000
13.5	57,409,383	99.93%	100.00%	99.91%	0.0000	0.0000
14.5	63,722,385	99.93%	100.00%	99.89%	0.0000	0.0000
15.5	62,164,974	99.93%	100.00%	99.87%	0.0000	0.0000
16.5	61,816,251	99.91%	100.00%	99.84%	0.0000	0.0000
17.5	62,027,451	99.91%	100.00%	99.81%	0.0000	0.0000
18.5	62,128,749	99.91%	100.00%	99.77%	0.0000	0.0000
19.5	62,079,752	99.91%	100.00%	99.73%	0.0000	0.0000
20.5	61,975,597	99.91%	100.00%	99.68%	0.0000	0.0000
21.5	61,350,363	99.90%	100.00%	99.62%	0.0000	0.0000
22.5	60,087,186	99.90%	100.00%	99.55%	0.0000	0.0000
23.5	62,761,294	99.90%	100.00%	99.47%	0.0000	0.0000
24.5	62,517,012	99.90%	100.00%	99.38%	0.0000	0.0000
25.5	62,463,173	99.89%	100.00%	99.28%	0.0000	0.0000
26.5	59,404,758	99.88%	99.99%	99.16%	0.0000	0.0001
27.5	59,505,121	99.88%	99.99%	99.03%	0.0000	0.0001
28.5	58,023,920	99.86%	99.98%	98.87%	0.0000	0.0001
29.5	57,515,559	99.85%	99.96%	98.70%	0.0000	0.0001
30.5	25,352,994	99.85%	99.94%	98.51%	0.0000	0.0002
31.5	25,371,981	99.83%	99.90%	98.29%	0.0000	0.0002
32.5	24,071,047	99.78%	99.85%	98.04%	0.0000	0.0003
33.5	24,117,396	99.76%	99.78%	97.76%	0.0000	0.0004
34.5	24,129,708	99.75%	99.69%	97.46%	0.0000	0.0005
35.5	14,373,832	99.67%	99.57%	97.11%	0.0000	0.0007
36.5	14,669,872	99.66%	99.41%	96.73%	0.0000	0.0009
37.5	14,746,512	99.61%	99.20%	96.31%	0.0000	0.0011
38.5	14,654,961	99.55%	98.95%	95.84%	0.0000	0.0014
39.5	14,380,984	99.50%	98.64%	95.33%	0.0001	0.0017
40.5	14,261,057	99.49%	98.25%	94.77%	0.0002	0.0022
41.5	8,044,440	98.92%	97.80%	94.15%	0.0001	0.0023
42.5	8,002,933	98.89%	97.25%	93.47%	0.0003	0.0029
43.5	7,715,623	96.35%	96.59%	92.74%	0.0000	0.0013
44.5	7,426,012	95.40%	95.83%	91.94%	0.0000	0.0012
45.5	7,173,179	93.56%	94.92%	91.08%	0.0002	0.0006
46.5	7,071,433	93.35%	93.86%	90.14%	0.0000	0.0010

Account 356 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] Company R5-60	[5] City R4-65	[6] Company SSD	[7] Garrett SSD
47.5	7,060,264	93.26%	92.63%	89.13%	0.0000	0.0017
48.5	6,912,388	93.13%	91.20%	88.04%	0.0004	0.0026
49.5	6,656,994	92.93%	89.53%	86.87%	0.0012	0.0037
50.5	2,260,928	92.65%	87.61%	85.63%	0.0025	0.0049
51.5	2,191,311	92.51%	85.41%	84.30%	0.0050	0.0067
52.5	2,133,882	92.21%	82.90%	82.88%	0.0087	0.0087
53.5	1,923,329	91.58%	80.08%	81.39%	0.0132	0.0104
54.5	1,818,010	91.25%	76.90%	79.80%	0.0206	0.0131
55.5	1,739,384	91.22%	73.38%	78.12%	0.0318	0.0172
56.5	1,317,527	91.11%	69.52%	76.34%	0.0466	0.0218
57.5	1,257,211	91.06%	65.32%	74.44%	0.0662	0.0276
58.5	1,225,741	90.98%	60.82%	72.42%	0.0909	0.0344
59.5	1,051,041	90.83%	56.07%	70.23%	0.1208	0.0424
60.5	990,508	90.73%	51.11%	67.90%	0.1570	0.0521
61.5	854,819	90.66%	46.01%	65.40%	0.1994	0.0638
62.5	146,908	90.34%	40.85%	62.73%	0.2449	0.0762
63.5	0	89.95%	35.72%	59.90%	0.2941	0.0903
64.5			30.72%	56.92%		
Sum of Squared Differences				[8]	1.3043	0.4972
Up to 1% of Beginning Exposures				[9]	0.7653	0.3306

[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 362 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] Company R2-65	[5] City R1.5-71	[6] Company SSD	[7] Garrett SSD
0.0	248,828,114	100.00%	100.00%	100.00%	0.0000	0.0000
0.5	201,849,775	100.00%	99.93%	99.88%	0.0000	0.0000
1.5	176,409,889	100.00%	99.78%	99.62%	0.0000	0.0000
2.5	165,161,928	99.98%	99.62%	99.36%	0.0000	0.0000
3.5	161,826,959	99.98%	99.45%	99.10%	0.0000	0.0001
4.5	154,548,514	99.95%	99.27%	98.82%	0.0000	0.0001
5.5	139,248,866	99.90%	99.09%	98.54%	0.0001	0.0002
6.5	126,903,879	99.88%	98.89%	98.25%	0.0001	0.0003
7.5	112,196,449	99.82%	98.69%	97.95%	0.0001	0.0003
8.5	108,902,705	99.69%	98.47%	97.65%	0.0001	0.0004
9.5	104,297,485	99.42%	98.25%	97.34%	0.0001	0.0004
10.5	91,740,879	99.29%	98.01%	97.02%	0.0002	0.0005
11.5	81,733,466	99.15%	97.77%	96.69%	0.0002	0.0006
12.5	82,480,744	98.99%	97.51%	96.35%	0.0002	0.0007
13.5	75,916,167	97.23%	97.24%	96.01%	0.0000	0.0001
14.5	72,817,079	96.99%	96.95%	95.65%	0.0000	0.0002
15.5	63,288,093	96.26%	96.66%	95.29%	0.0000	0.0001
16.5	59,875,959	96.15%	96.35%	94.92%	0.0000	0.0002
17.5	59,670,008	95.75%	96.02%	94.54%	0.0000	0.0001
18.5	57,375,543	95.59%	95.68%	94.15%	0.0000	0.0002
19.5	52,939,249	95.41%	95.33%	93.75%	0.0000	0.0003
20.5	52,603,940	95.18%	94.96%	93.34%	0.0000	0.0003
21.5	49,537,435	95.16%	94.58%	92.93%	0.0000	0.0005
22.5	47,755,815	90.33%	94.17%	92.50%	0.0015	0.0005
23.5	44,599,419	89.56%	93.75%	92.06%	0.0018	0.0006
24.5	42,812,608	88.88%	93.32%	91.61%	0.0020	0.0007
25.5	37,854,351	87.94%	92.86%	91.15%	0.0024	0.0010
26.5	33,965,172	87.44%	92.39%	90.68%	0.0025	0.0011
27.5	33,459,976	86.81%	91.90%	90.20%	0.0026	0.0011
28.5	31,712,819	86.47%	91.39%	89.71%	0.0024	0.0010
29.5	29,127,131	85.97%	90.85%	89.20%	0.0024	0.0010
30.5	31,869,456	85.68%	90.30%	88.68%	0.0021	0.0009
31.5	32,202,120	84.76%	89.72%	88.15%	0.0025	0.0012
32.5	30,513,599	84.35%	89.13%	87.61%	0.0023	0.0011
33.5	30,495,791	83.95%	88.50%	87.05%	0.0021	0.0010
34.5	29,497,777	83.19%	87.86%	86.48%	0.0022	0.0011
35.5	29,199,281	82.91%	87.19%	85.90%	0.0018	0.0009
36.5	26,795,173	82.52%	86.50%	85.30%	0.0016	0.0008
37.5	27,537,745	82.23%	85.78%	84.68%	0.0013	0.0006
38.5	26,911,602	81.57%	85.03%	84.05%	0.0012	0.0006
39.5	25,096,668	80.89%	84.26%	83.40%	0.0011	0.0006
40.5	25,010,695	80.38%	83.45%	82.74%	0.0009	0.0006
41.5	23,825,171	80.09%	82.63%	82.06%	0.0006	0.0004
42.5	23,705,122	79.77%	81.77%	81.36%	0.0004	0.0003
43.5	21,787,906	79.36%	80.88%	80.65%	0.0002	0.0002
44.5	20,026,479	78.92%	79.96%	79.92%	0.0001	0.0001
45.5	19,198,028	78.48%	79.01%	79.17%	0.0000	0.0000
46.5	18,948,452	77.96%	78.03%	78.40%	0.0000	0.0000

Account 362 Curve Fitting

[1] Age (Years)	[2] Exposures (Dollars)	[3] Observed Life Table (OLT)	[4] Company R2-65	[5] City R1.5-71	[6] Company SSD	[7] Garrett SSD
47.5	17,890,985	76.73%	77.02%	77.61%	0.0000	0.0001
48.5	17,128,820	76.32%	75.97%	76.81%	0.0000	0.0000
49.5	16,435,498	76.04%	74.90%	75.98%	0.0001	0.0000
50.5	15,602,745	75.42%	73.78%	75.14%	0.0003	0.0000
51.5	14,512,462	75.24%	72.64%	74.27%	0.0007	0.0001
52.5	13,619,252	72.26%	71.46%	73.39%	0.0001	0.0001
53.5	12,853,322	70.85%	70.25%	72.48%	0.0000	0.0003
54.5	12,431,615	70.14%	69.01%	71.56%	0.0001	0.0002
55.5	11,939,540	69.63%	67.73%	70.61%	0.0004	0.0001
56.5	11,796,546	69.30%	66.42%	69.65%	0.0008	0.0000
57.5	5,749,888	68.95%	65.07%	68.66%	0.0015	0.0000
58.5	4,769,299	68.05%	63.70%	67.66%	0.0019	0.0000
59.5	4,133,619	66.14%	62.29%	66.63%	0.0015	0.0000
60.5	3,582,340	65.19%	60.85%	65.58%	0.0019	0.0000
61.5	3,349,527	64.32%	59.38%	64.52%	0.0024	0.0000
62.5	2,942,965	63.71%	57.89%	63.43%	0.0034	0.0000
63.5	2,273,680	63.49%	56.36%	62.32%	0.0051	0.0001
64.5	1,120,932	63.01%	54.81%	61.20%	0.0067	0.0003
65.5	877,104	62.23%	53.23%	60.06%	0.0081	0.0005
66.5	485,016	61.90%	51.64%	58.89%	0.0105	0.0009
67.5	301,737	61.53%	50.02%	57.72%	0.0133	0.0015
68.5	287,268	61.52%	48.38%	56.52%	0.0173	0.0025
69.5	132,785	61.52%	46.73%	55.31%	0.0219	0.0039
70.5			45.07%	54.08%		
Sum of Squared Differences				[8]	0.1372	0.0338
Up to 1% of Beginning Exposures				[9]	0.0544	0.0241

[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.