SOAH DOCKET NO. 473-17-5771
PUC DOCKET NO. 47527

APPLICATION OF SOUTHWESTERN	§	BEFORE THE STATE OFFICE
PUBLIC SERVICE COMPANY FOR	§	OF
AUTHORITY TO CHANGE RATES	§	ADMINISTRATIVE HEARINGS

REVENUE REQUIREMENT PHASE

DIRECT TESTIMONY AND EXHIBITS

OF

DAVID J. GARRETT

ON BEHALF OF

ALLIANCE OF XCEL MUNICIPALITIES

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<u>TABLE OF CONTENTS</u>

<u>APPENDICES</u>

SOAH DOCKET NO. 473-17-5771
PUC DOCKET NO. 47527

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<u>EXHIBITS</u>

EXHIBIT DJG-1: Curriculum Vitae

EXHIBIT DJG-2: Summary Depreciation Accrual Adjustment

EXHIBIT DJG-3: Detailed Rate Comparison

EXHIBIT DJG-4: Depreciation Rate Development

EXHIBIT DJG-5: Responses to Requests for Information

<u>WORKPAPERS</u>

Provided on CD

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I. INTRODUCTION

Q. STATE YOUR NAME AND OCCUPATION.

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

Q. SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I received a B.B.A. with a major in Finance, an M.B.A. and a Juris Doctor from the University of Oklahoma. I worked in private legal practice for several years before accepting a position as assistant general counsel at the Oklahoma Corporation Commission in 2011. At the Oklahoma Commission, I worked in the Office of General Counsel in regulatory proceedings. In 2012, I began working for the Public Utility Division as a regulatory analyst providing testimony in regulatory proceedings. After leaving the Oklahoma Commission, I formed Resolve Utility Consulting, PLLC, where I have represented various consumer groups, state agencies, and municipalities 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]

Q. WHOSE BEHALF ARE YOU TESTIFYING IN THIS PROCEEDING?

A. I am testifying on behalf of Alliance of Xcel Municipalities ("AXM").

Q. DESCRIBE THE PURPOSE AND SCOPE OF YOUR TESTIMONY IN THIS PROCEEDING.

A. In this case, I am testifying with regard to new depreciation rates proposed by Southwestern Public Service Company ("SPS" or the "Company") for its Tolk production facilities. I am responding to pertinent portions of the Direct Testimonies of SPS witnesses Dane A. Watson, Alan J. Davidson, and Bennie F. Weeks regarding the Company's proposal to reduce the retirement date and increase the depreciation rates for its Tolk units. I will also address limited portions of the Supplemental Direct Testimony of Ellen Lapson regarding depreciation and its relationship to cash flows, credit ratings, and other financial metrics.

II. EXECUTIVE SUMMARY

Q. SUMMARIZE THE KEY POINTS OF YOUR TESTIMONY.

A. In this case, SPS is proposing to reduce the lifespan estimate for its Tolk generating facilities. This would result in an increase in annual depreciation expense of $12.4 million.[2] In PUC Docket No. 35763[3] (2009), the Commission authorized retirement dates for Tolk Units 1 and 2 of 2042 and 2045 respectively.[4] The Company now proposes to significantly reduce the retirement dates for Tolk Units 1 and 2 by 10 years

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[1] Exhibit DJG-1.

[2] Direct Testimony of Melissa L. Ostrom p. 10, lines 5-7.

[3] *Application of Southwestern Public Service Company for Authority to Change Rates, to Reconcile Fuel and Purchased Power Costs for 2006 and 2007 and to Provide a Credit for Fuel Cost Savings*, Docket No. 35763.

[4] *See* response to TIEC 1-27.

and 13 years respectively, with a concurrent retirement date of 2032 for both units.[5] According to Mr. Davidson, the Company's proposal is necessary due to water limitations affecting Tolk and the Company's modeling indicating that 2032 is the most cost effective alternative based on water availability information and environmental regulations in place today.[6] However, testimony of several other Company witnesses indicates that SPS's proposal to reduce the Tolk retirement dates may be heavily influenced by management's desire to affect certain financial metrics, such as cash flow and credit ratings. While it is understandable that Company management would be concerned with SPS's cash flow and credit ratings, it is inappropriate to manipulate the economic service lives of the Company's depreciable assets for the purpose of improving certain financial metrics. Regardless, the Company's proposal to significantly reduce the retirement dates for Tolk is premature and unnecessary at this time. If the Commission were to approve the Company's proposal, it could incentivize the premature retirement of Tolk and result in economic waste.

Q. WHAT IS YOUR RECOMMENDATION TO THE COMMISSION?

A. I recommend the Commission reject SPS's proposal to reduce the lifespan estimate for its Tolk generating facilities. If the current approved retirement dates for the Tolk facilities remain unchanged, it would result in an adjustment of approximately $11.7 million to the Company's proposed depreciation accrual applied to plant balances at June 30, 2017.[7] The table below shows the adjustments by facility.

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5 Direct Testimony of Alan J. Davidson, p. 32.

6 *Id*. at 10:10-15.

7 Please see Direct Testimony and Exhibits of Karl Nalepa for AXM's depreciation expense adjustment to the revenue requirement.

Figure 1:
Tolk Depreciation Adjustment

Tolk Facilities	Plant Balance 6/30/2017	SPS Proposed Accrual	AXM Proposed Accrual	**Difference**
Common Facilities	$ 81,807,355	$ 4,114,550	$ 2,237,738	$ (1,876,812)
Tolk Unit 1	317,341,598	10,164,139	6,178,202	(3,985,937)
Tolk Unit 2	358,664,600	12,872,376	7,000,766	(5,871,610)
Total	$ 757,813,553	$ 27,151,065	$ 15,416,706	**$ (11,734,359)**

The detailed rate calculations are presented in Exhibit DJG-4.

III. LEGAL AND TECHNICAL STANDARDS

Q. DISCUSS THE STANDARD BY WHICH REGULATED UTILITIES ARE ALLOWED TO RECOVER DEPRECIATION EXPENSE.

A. The legal and technical standards governing the appropriate method to recover capital costs through depreciation is a pertinent issue in this case. As discussed further in the testimony, SPS witnesses have testified that the Commission should accelerate depreciation in order to affect cash flow, credit ratings, and other financial metrics. This approach to depreciation is not appropriate. 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."[8] 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.[9] Moreover, the *Lindheimer* Court found:

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

9 *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."

> [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.[10]

Thus, SPS bears the burden of making a convincing showing that its proposed depreciation rates are not excessive.

Q. DISCUSS THE COST ALLOCATION CONCEPT OF DEPRECIATION AND THE STANDARD OF RECOVERY.

A. 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.[11] Adoption of this "value concept" would require annual appraisals of extensive utility plant, and is thus not practical in this context. Rather, the "cost allocation concept" recognizes that depreciation is a cost of providing service, and that in addition to receiving a "return on" invested capital through the allowed rate of return, a utility should also receive a "return of" its invested capital in the form of recovered depreciation expense. The cost allocation concept also satisfies several fundamental accounting principles, including verifiability, neutrality, and the matching principle.[12] The definition of "depreciation accounting" published by the American Institute of Certified Public Accountants ("AICPA") properly reflects the cost allocation concept:

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[10] *Id*. at 169.

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

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

> 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.[13]

Thus, the concept of depreciation as "the allocation of cost has proven to be the most useful and most widely used concept."[14] It is pertinent that neither the Supreme Court standards nor the AICPA definition discussed above indicate that capital recovery through depreciation should be influenced by management's desire to increase the utility's credit ratings, cash flow, or other financial metrics.

Q. DESCRIBE WHY IT IS IMPORTANT NOT TO OVERESTIMATE DEPRECIATION RATES.

A. The issue of depreciation is essentially one of timing. Under the rate-base, rate-of-return model, the utility is allowed to recover the original cost of its prudent investments used and useful to provide service. Depreciation systems are designed to allocate those costs in a systematic and rational manner – specifically, over the service life of the utility's assets. If depreciation rates are overestimated (i.e., service lives are underestimated), it encourages economic inefficiency. Unlike competitive firms, regulated utility companies are not always incentivized by natural market forces to make the most economically efficient decisions. If a utility is allowed to recover the cost of an asset before the end of its useful life, this could incentivize the utility to unnecessarily replace the asset in order to increase rate base in order to increase earnings; this results in economic waste. Thus, from a public policy perspective, it is preferable for regulators to ensure that assets are not depreciated before the end of their true useful lives.

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

14 Wolf *supra* n. 7, at 73.

IV. LIFESPAN OF TOLK GENERATING UNITS

Q. PLEASE SUMMARIZE THE COMPANY'S PROPOSAL REGARDING THE TOLK UNITS.

A. The Company's Tolk facilities consist of two coal-powered units with a total net capacity of 1,067 MW.[15] SPS is proposing to reduce the lifespan estimate for its Tolk generating facilities. This would result in an increase in annual depreciation expense of $12.4 million.[16] The currently-approved retirement dates for Tolk Units 1 and 2 are 2042 and 2045 respectively.[17] The Company's proposal would reduce the retirement dates for Tolk Units 1 and 2 by 10 years and 13 years respectively, with a concurrent retirement date of 2032 for both units.[18] According to Mr. Davidson, the Company's proposal is necessary due to water supply limitations affecting Tolk. The Company's modeling indicates that retiring the units in 2032 is the most cost-effective alternative based on water availability information and environmental regulations in place today.[19]

Q. DO YOU AGREE WITH THE COMPANY'S PROPOSAL TO REDUCE THE LIFESPAN AND INCREASE THE DEPRECIATION RATES FOR ITS TOLK GENERATING UNITS?

A. No. The Company's proposal is unreasonable and results in excessive depreciation rates for current customers. The Company's proposal is problematic for several reasons that fall into two broad categories. First, SPS's proposal is premature and may lead to economic inefficiencies. The proposal is based on multi-factor modeling that attempts to predict 15 years in advance the depletion of a water aquifer utilized by Tolk's generation cooling system. Even the Company admits the modeling is uncertain.[20] Second, the Company's proposal appears to be heavily driven by a desire to improve certain financial

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15 *See* Direct Testimony of Bennie F. Weeks, p. 49, lines 5-11.

16 Direct Testimony of Melissa L. Ostrom p. 10, lines 5-7.

17 *See* response to TIEC 1-27.

18 Direct Testimony of Alan J. Davidson, p. 32.

19 *Id*. at 10:10-15.

20 Direct Testimony of Alan J. Davidson, p. 47, lines 17-20.

metrics, such as cash flow and credit ratings. It is not appropriate to base depreciation rates on these factors. These issues are discussed further below.

A. SPS'S PROPOSAL IS PREMATURE AND COULD RESULT IN ECONOMIC WASTE

Q. ACCORDING TO SPS, WHY IS IT NECESSARY TO ACCELERATE DEPRECIATION RATES ON THE TOLK UNITS?

A. The Company's reasons for proposing early retirement and accelerated depreciation on the Tolk plant are covered by several witnesses. Mr. Watson primarily addresses the new depreciation rate calculations that would result from a shortened lifespan on the Tolk units. However, Mr. Watson also makes an "intergenerational equity" argument that is commonly made by utilities in justifying premature plant retirements. According to Mr. Watson, the adoption of SPS's increased depreciation rates "ensures that future customers are not unduly burdened by having to pay a disproportionate share of any remaining investment balance for the shortening of the asset's useful life."[21]

Q. DO YOU AGREE WITH MR. WATSON ON THIS POINT?

A. No. Mr. Watson's argument is problematic for several reasons. First, this typical intergenerational equity narrative is premised on the notion that plants will actually be retired at the most economically prudent time. However, as discussed later in this testimony, there are a number of other reasons that utility management might be incentivized to retire plants before the end of their economic useful lives. In other words, if a plant is retired before the end of its useful life, it is not appropriate to burden current ratepayers for that decision just for the sake of matching the utility's cost recovery to the plant's retirement date. For example, if the Company proposed to retire the Tolk plant next year (arguably more than 20 years before the end of its useful lives), according to Mr. Watson's logic the Company should recover the entire remaining balance next year in order to protect future customers. The other problem with this logic is that the future customers that utilities are apparently so concerned with will one day be present

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[21] Direct Testimony of Dane A. Watson, p. 11, lines 16-18.

customers, and they will undoubtedly be faced with the same illogical and disingenuous appeals to the equity of future customs, as utility management will predictably attempt to justify the next round of premature plant closures in order to boost earnings growth and cash flows for the benefit of shareholders. If the Commission were to adopt SPS's proposal, it could signal to Company management that this inefficient practice of premature plant retirement is acceptable, and we can all anticipate the cycle to continue.

Q. WHAT OTHER ARGUMENTS HAS SPS MADE TO SUPPORT THE EARLY RETIREMENT OF TOLK?

A. According to SPS witnesses Mr. Weeks and Mr. Davidson, closing the Tolk plants in 2032 will be necessary because of water limitations affecting Tolk. The Company contends that its modeling indicates that 2032 is the most cost-effective alternative based on water availability information and environmental regulations in place today.[22]

Q. ARE YOU PERSUADED BY THE COMPANY'S ARGUMENTS?

A. No. In 2007, SPS proposed an increase to the lives Tolk Units 1 and 2 to 2037 and 2040 respectively.[23] In 2009, SPS agreed to further extend the lives of the plants to 2042 and 2045. According to the Company, however, "in the early 2000's SPS had determined that the water supply could potentially be inadequate to support operations at Tolk to the end of its useful life."[24] Less than 10 years ago the Company agreed to extend the lives of the Tolk units, but now it proposes that it is able to predict 15 years in advance that closing the plant would be in the best economic interest of ratepayers. An additional reason for skepticism is that Mr. Davidson acknowledges predictive groundwater modeling is an "inexact science" and there are "uncertainties inherent" in the model.[25]

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[22] *Id*. at 10:10-15.

[23] *See* response to TIEC 11-4.

[24] *See* response to TIEC 1-25.

[25] Direct Testimony of Alan J. Davidson, p. 47, lines 17-20.

B. SPS'S PROPOSAL APPEARS TO BE INFLUENCED BY INAPPROPRIATE FACTORS

Q. IN YOUR OPINION, DOES IT APPEAR THAT A PRIMARY MOTIVATION FOR SPS'S PROPOSAL TO ACCELERATE DEPRECIATION ON THE TOLK UNITS IS RELATED TO CASH FLOW AND CREDIT METRICS?

A. Yes. In his Supplemental Direct Testimony, Ms. Lapson states that if the Commission does not approve SPS's requested capital structure, the Commission "should consider providing incremental cash flow by other means, such as increasing the authorized ROE, accelerating asset depreciation or amortization, or slowing the flow-back of excess accumulated deferred income taxes."[26] Ms. Lapson also testified:

> The Commission could consider other alternatives to protect SPS's creditworthiness and ability to attract investment on favorable terms; for example, it could boost the ROE by 200-250 basis points, or accelerate the rate of depreciation or amortization of assets. . . .[27]

While Ms. Lapson does not specifically mention the Tolk plant in her testimony, the Tolk plant is the only asset for which SPS requests an increase in depreciation rates. The Tolk issue has an impact of more than $12 million per year and would have a material impact on SPS's credit metrics. Thus, in my opinion the Company's request to accelerate the depreciation rates on the Tolk plant is heavily influenced by management's desire to increase SPS's cash flows and credit ratings.

Q. SHOULD DEPRECIATION RATES BE SET BASED UPON MANAGEMENT'S DESIRE TO INCREASE CASH FLOWS, CREDIT RATINGS, OR ANY OTHER FINANCIAL METRIC?

A. No. A proper depreciation system used to determine depreciation rates should promote a systematic and rational allocation of cost recovery over the service life of an asset. I have reviewed depreciation studies and testimony from utility witnesses and other intervenors regarding depreciation in many rate proceedings. I cannot recall a depreciation witness ever suggesting that his proposed rates were even partially influenced by the utility's cash

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[26] Supplemental Direct Testimony of Ellen Lapson, p. 35, lines 4-10 (emphasis added).

[27] *Id*. at 11:1-6 (emphasis added).

flow, credit ratings, or other financial metric. In this case, the Company's depreciation witness Mr. Watson testifies to the Company's depreciation rates and the technical update for the Tolk plant. Mr. Watson acknowledges that the "function of depreciation is to recognize the cost of an asset spread over its useful life. Book depreciation techniques should not accelerate or defer the recovery of an asset in comparison to its appropriate useful life."[28] An asset's "appropriate" useful life means the most economically prudent useful life, and not necessarily whenever management decides to retire an asset. To say that depreciation rates should be influenced by anything other than a systematic and rational allocation of costs over the useful life of an asset would not only be at odds with the legal and technical standards governing this issue, but would also negate long-standing principals of depreciation analysis that have been developed over the past century and have been consistently relied upon for decades by regulators around the country.

Q. DO YOU HAVE ANY OTHER RESPONSES TO THE COMPANY'S TESTIMONY?

A. Yes. According to Mr. Davidson, if the Commission were to adopt the shortened retirement dates proposed by SPS, the Tolk units will have still operated "well past the timeline originally expected when the units were placed in service."[29] The original design life for the Tolk units was only 30-35 years.[30] In fact, many coal plants built in the U.S. had original design lives around 30 years. However, these original design lives proved to be overly conservative. Recent data indicates that about 75% of all coal-fired plants are at least 30 years old.[31] Moreover, the average retirement age of coal plants in 2015 was 58 years.[32] Even utility depreciation witnesses have acknowledged that typical

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[28] Direct Testimony of Dane A. Watson, p. 9, lines 8-11 (emphasis added).

[29] Direct Testimony of Alan J. Davidson, p. 58, lines 3-10.

[30] *Id*. at 58:7.

[31] *Id*.

[32] Jack Fitzpatrick, "Coal Plants Are Shutting Down, With or Without Clean Power Plan," https://morningconsult.com/2016/05/03/coal-plants-shutting-without-clean-power-plan/, *Morning Consult*, May 3, 2016 (last accessed 9-21-16).

life spans for base load, steam power plants are as high as 65 years.[33] If SPS retires the Tolk Units 1 and 2 in 2032, they will have had lifespans of only 50 years and 47 years respectively.[34] So contrary to the implications of Mr. Davidson's statements, if the Company's proposal is accepted, the Tolk units would have been retired much earlier than the typical life spans for base load steam power plants, according to utility depreciation witnesses.

VIII. CONCLUSION AND RECOMMENDATION

Q. IN THIS CASE, HAS SPS MADE A CONVINCING SHOWING THAT ITS PROPOSED DEPRECIATION RATES ARE NOT EXCESSIVE?

A. No. The Supreme Court has held that the utility has the burden of making a convincing showing that the amounts it has charged to operating expenses for depreciation have not been excessive.[35] SPS's proposal to significantly reduce the currently-approved retirement dates for the Tolk plant results in an additional cost to ratepayers of $12.4 million per year. The Company's proposal is premature and unnecessary at this time. Furthermore, the Company's proposal to reduce the lifespan of the Tolk units appears to be heavily influenced by management's desire to increase its credit metrics and cash flow, rather than a purely objective estimate of economic useful life. If the Commission were to adopt the Company's proposal in this case, it may have the effect of incentivizing Company management to prematurely retirement plant in the future to increase cash flow and credit metrics for the financial benefit of shareholders, despite the economic waste and unfair imposition of additional costs to ratepayers that would result.

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33 *Application of El Paso Electric Company to Change Rates*, SOAH Docket No. 473-15-5257; PUC Docket No. 44941, Depreciation Study for El Paso Electric Company, p. III-6, sponsored by John Spanos of Gannett Fleming.

34 Direct Testimony of Alan J. Davidson, p. 58, lines 4-5.

35 *Id*. at 169.

Q. WHAT IS YOUR RECOMMENDATION TO THE COMMISSION.

A. For the reasons discussed in this testimony, the most fair, economic, and prudent course of action is to reject the Company's proposal to increase depreciation rates on the Tolk plant.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, including any exhibits, appendices, and other items attached hereto. I reserve the right to supplement this testimony as needed with any additional information that has been requested from the Company but not yet provided. To the extent I did not address an opinion expressed by the Company, it does not constitute an agreement with such opinion.

SOAH DOCKET NO. 473-17-1764
PUC DOCKET NO. 46449

APPLICATION OF SOUTHWESTERN ELECTRIC POWER COMPANY FOR AUTHORITY TO CHANGE RATES	**§ § §**	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS OF

DAVID J. GARRETT

APPENDIX A:

THE DEPRECIATION SYSTEM

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.[36] 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.[37] The figure below illustrates the basic concept of a depreciation system and includes some of the available parameters.[38]

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

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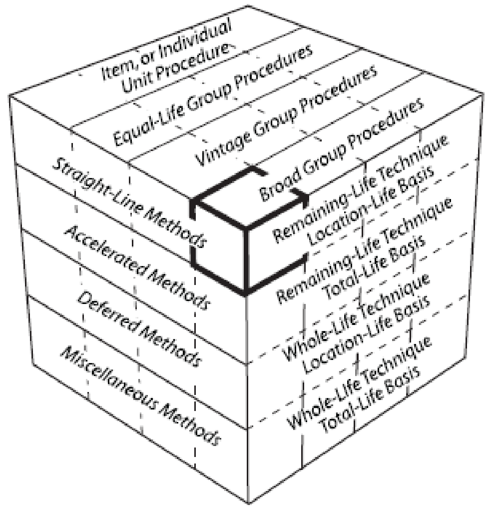
[36] Wolf *supra* n. 7, at 69-70.

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

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

Figure 2:
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.[39] 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.[40] The basic formula for the straight-line method is as follows:[41]

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[39] NARUC *supra* n. 8, at 56.

[40] *Id*.

[41] *Id*.

Equation 1:
Straight-Line Accrual

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

Gross plant is a known amount from the utility's records, while both net salvage and service life must be estimated in order to calculate the annual accrual. The straight-line method differs from accelerated methods of recovery, such as the "sum-of-the-years-digits" method and the "declining balance" method. Accelerated methods are primarily used for tax purposes and are rarely used in the regulatory context for determining annual accruals.[42] In practice, the annual accrual is expressed as a rate which is applied to the original cost of plant in order to determine the annual accrual in dollars. The formula for determining the straight-line rate is as follows:[43]

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.[44] 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 excessively conducting calculations for each unit. Whereas an individual unit of

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42 *Id*. at 57.

43 *Id*. at 56.

44 Wolf *supra* n. 7, at 74-75.

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.[45] 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.[46]

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 depreciation, 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.[47] 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.[48] Under the equal life procedure the property is divided into subgroups that each has a common life.[49]

3. <u>Application Techniques</u>

The third factor of a depreciation system is the "technique" for applying the depreciation rate. There are two commonly used techniques: "whole life" and "remaining life." The whole life technique applies the depreciation rate on the estimated average service life of group, while

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45 *Id*. at 74.

46 NARUC *supra* n. 8, at 61-62.

47 *See* Wolf *supr*a n. 7, at 74-75.

48 *Id*. at 75.

49 *Id*.

the remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.[50]

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.[51] Analysts can calculate the level of imbalance in the accumulated depreciation account by determining the "calculated accumulated depreciation," (a.k.a. "theoretical reserve" and referred to in these appendices as "CAD"). The CAD is the calculated balance that would be in the accumulated depreciation account at a point in time using <u>current</u> depreciation parameters.[52] An imbalance exists when the actual accumulated depreciation account does not equal the CAD. The choice of application technique will affect how the imbalance is dealt with.

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

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[50] NARUC *supra* n. 8, at 63-64.

[51] Wolf *supra* n. 7, at 83.

[52] NARUC *supra* n. 8, at 325.

in the annual accrual.[53] 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:[54]

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.[55]

4. <u>Analysis Model</u>

The fourth parameter of a depreciation system, the "model," relates to the way of viewing the life and salvage characteristics of the vintage groups that have been combined to form a continuous property group for depreciation purposes.[56] 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 used among practitioners, the "broad group" and the "vintage group," are two ways of

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[53] NARUC *supra* n. 8, 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.").

[54] *Id*. at 64.

[55] Wolf *supra* n. 7, at 178.

[56] *See* Wolf *supra* n. 7, at 139 (I added the term "model" to distinguish this fourth depreciation system parameter from the other three parameters).

viewing the life and salvage characteristics of the vintage groups that have been combined to from a continuous property group.

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

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APPLICATION OF SOUTHWESTERN ELECTRIC POWER COMPANY FOR AUTHORITY TO CHANGE RATES	**§ § §**	**BEFORE THE STATE OFFICE OF ADMINISTRATIVE HEARINGS**

DIRECT TESTIMONY AND EXHIBITS OF

DAVID J. GARRETT

APPENDIX B:

IOWA CURVES

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.[57] 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.[58] 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. <u>Development</u>

The survivor curves used by analysts today were developed over several decades from extensive analysis of utility and industrial property. In 1931 Edwin Kurtz and Robley Winfrey used extensive data from a range of 65 industrial property groups to create survivor curves representing the life characteristics of each group of property.[59] They generalized the 65 curves into 13 survivor curve types and published their results in *Bulletin 103: Life Characteristics of*

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57 Wolf *supra* n. 7, at 276.

58 *Id*. at 23.

59 *Id*. at 34.

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.[60] 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."[61] 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.[62] Rather than using the original formulas, analysts typically rely on the published tables containing the percentages surviving. This is because absent knowledge of the integration technique applied to each age interval, it is not possible to recreate the exact original published table values. In the 1970s, John Russo collected data from over 2,000 property accounts reflecting 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

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[60] *Id*.

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

[62] 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. 7, at 305-38 (publishing the percent surviving for each Iowa curve, including "O" type curve, at one percent intervals).

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:[63]

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.[64]

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

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63 *See* Wolf *supra* n. 7, at 37.

64 *Id*.

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).[65] In the figure below, one curve from each family is shown: L0, S3 and R1, with average life at 100 on the x-axis. It is clear from the graphs that the modes for the L0 and R1 curves appear to the left and right of average life respectively, while the S3 mode is coincident with average life.

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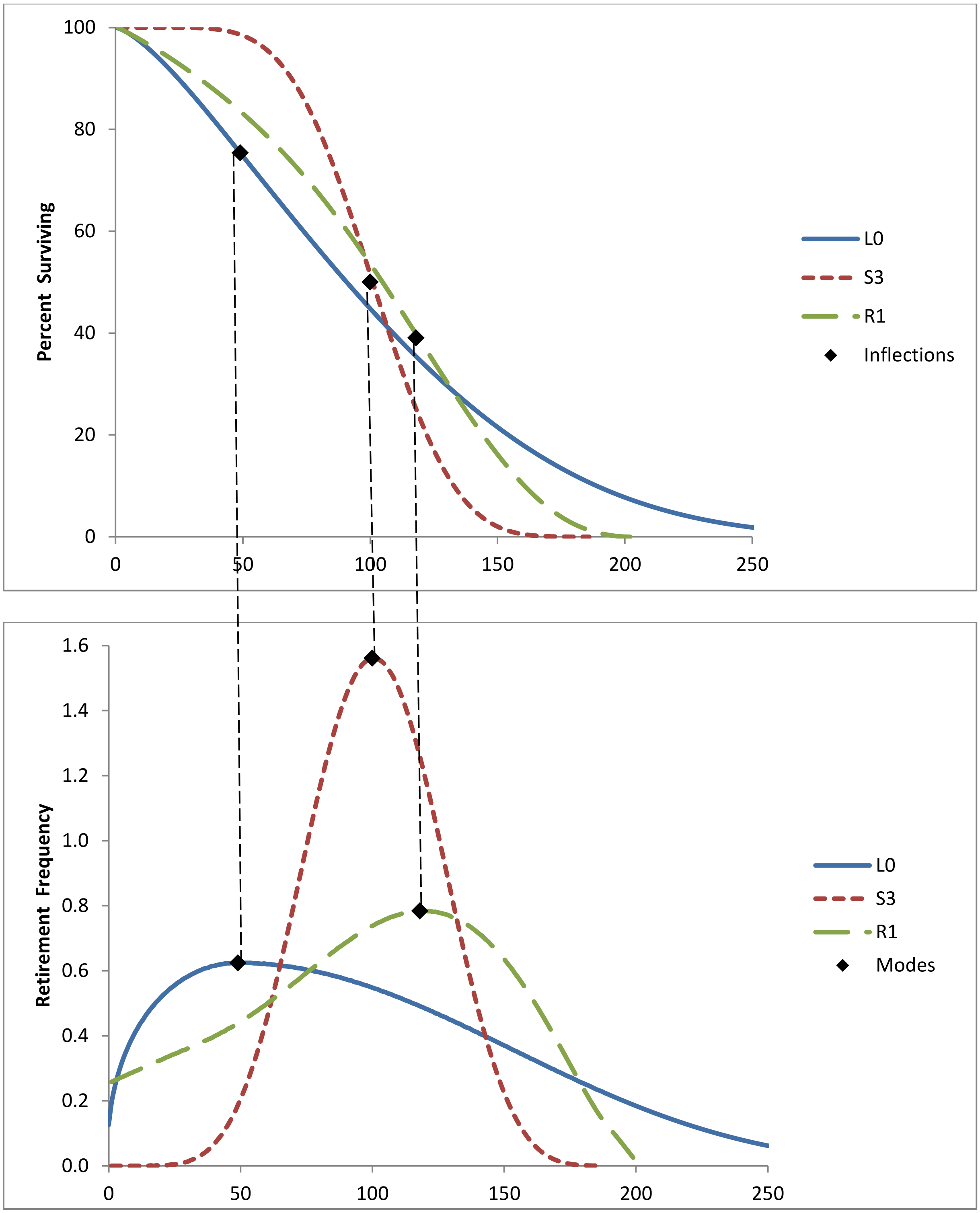
65 In 1967, Harold A. Cowles added four origin-modal curves known as "O type" curves. There are also several "half" curves and a square curve, so the total amount of survivor curves commonly called "Iowa" curves is about 31 (see NARUC supra n. 8, at 68).

Figure 3:
Modal Age Illustration



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

> Since the location of a particular survivor on a graph is affected by both its span in years and the shape of the curve, it is difficult to classify a group of curves unless one of these variables can be controlled. This is easily done by expressing the age in percent of average life."[66]

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

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

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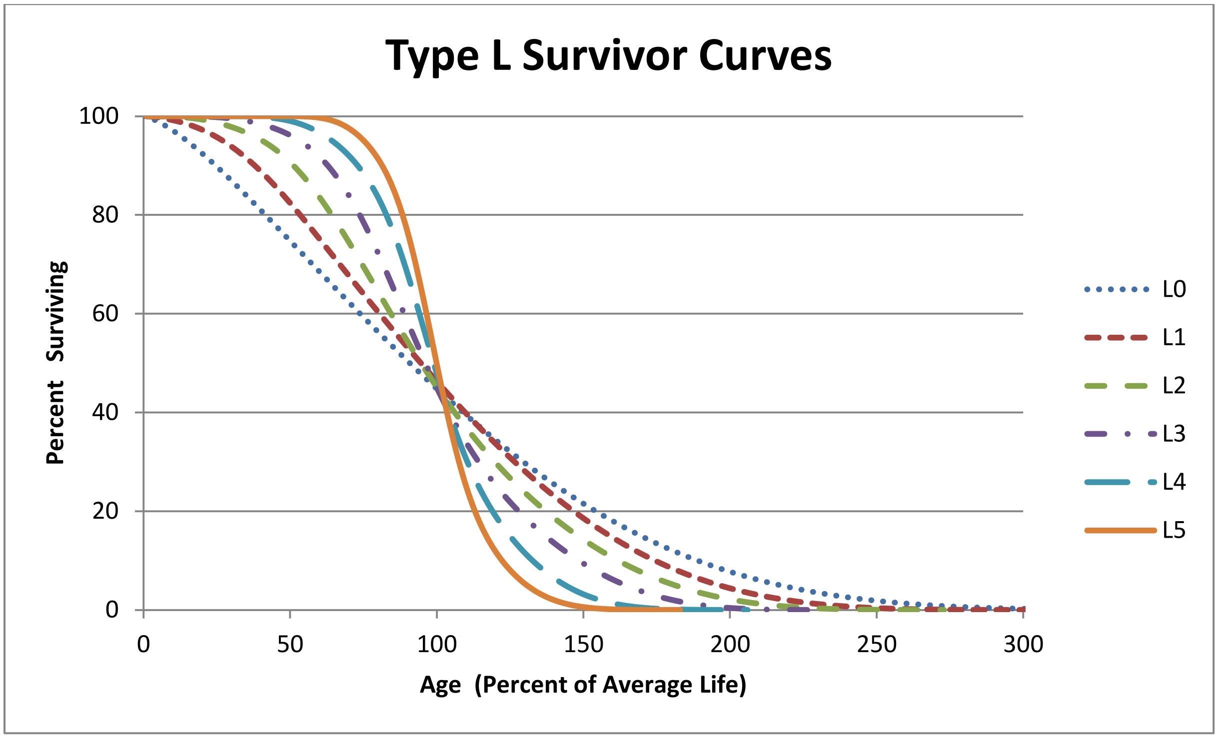
[66] Winfrey, *Bulletin 125: Statistical Analyses of Industrial Property Retirements* 60, Vol. XXXIV, No. 23 (Iowa State College of Agriculture and Mechanic Arts 1935).

Figure 4:
Type L Survivor and Frequency Curves



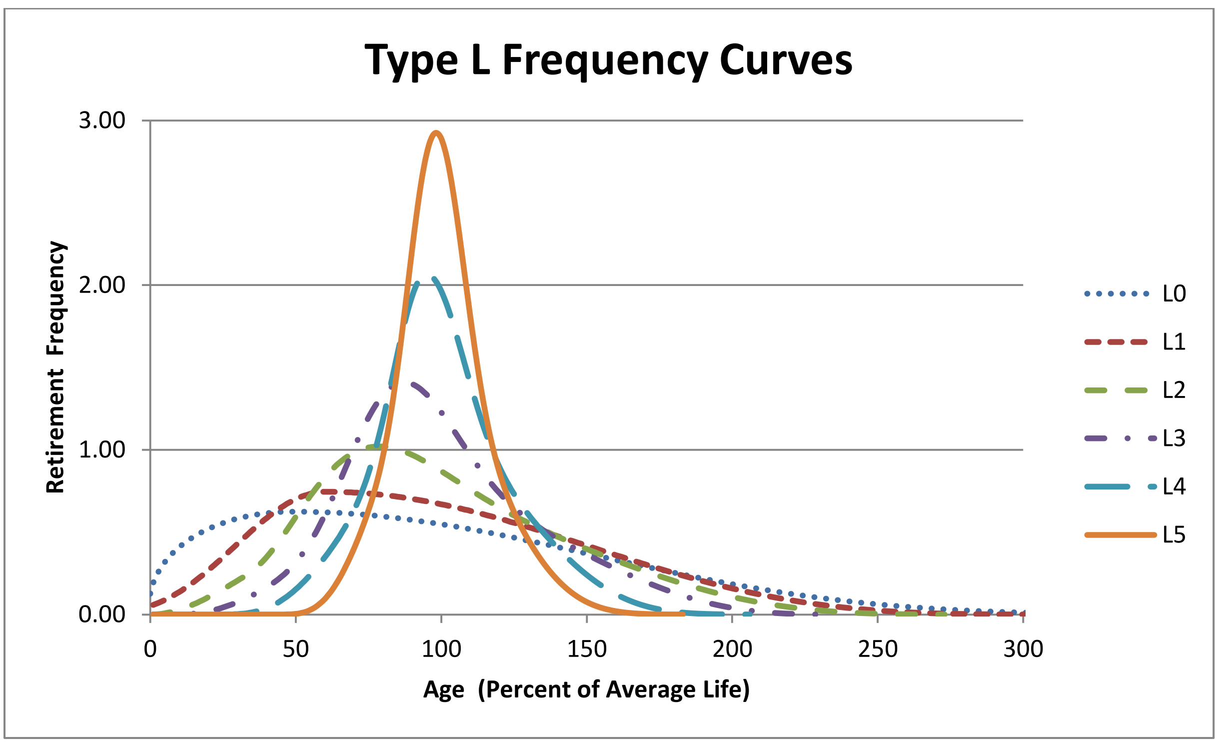
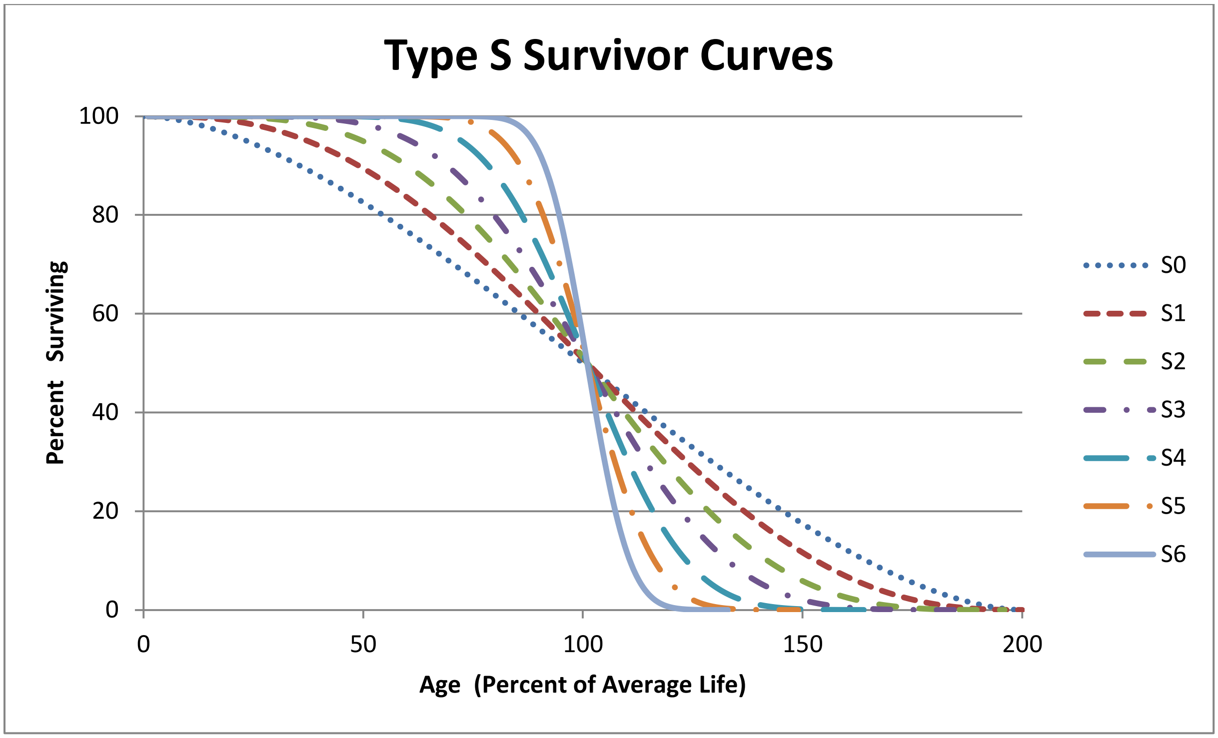


Figure 5:
Type S Survivor and Frequency Curves



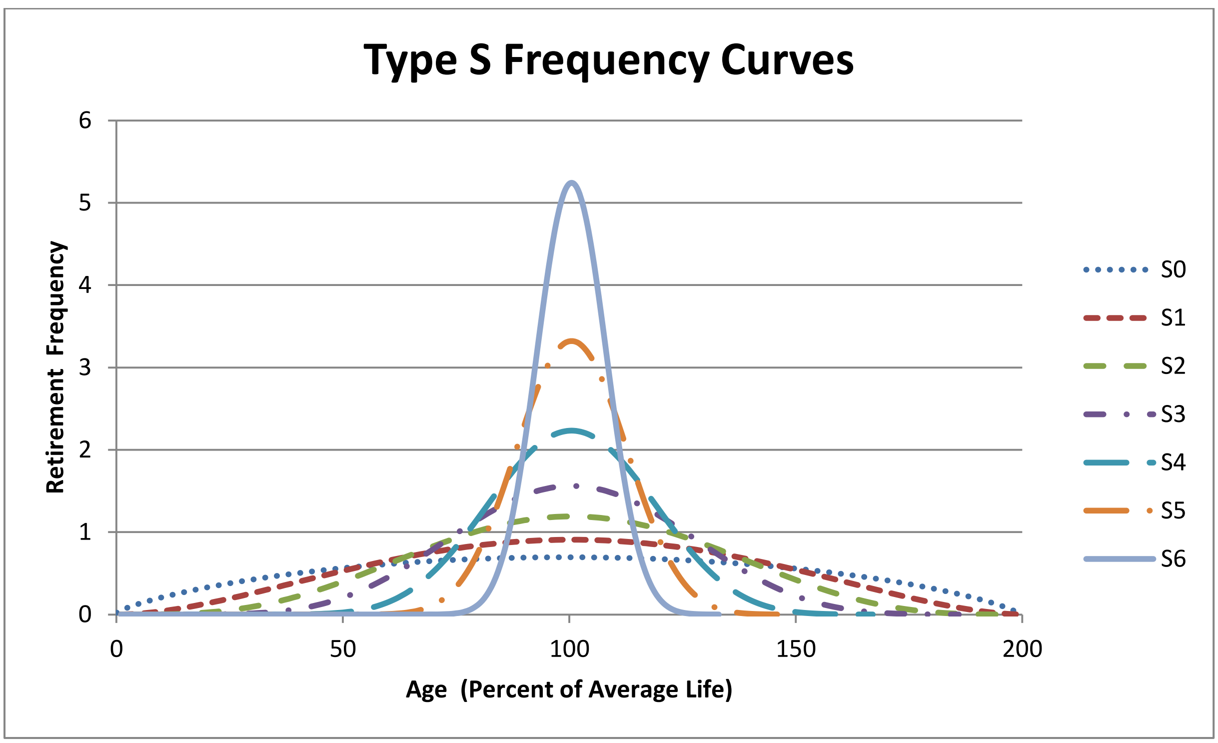
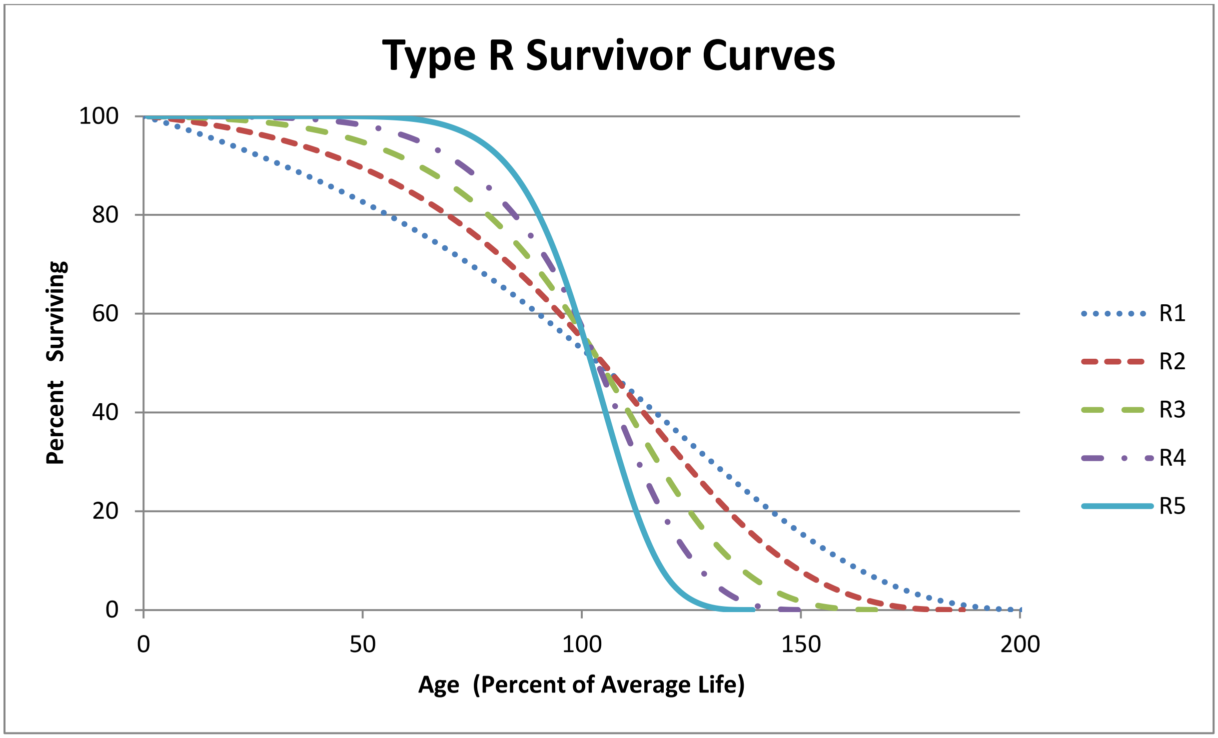
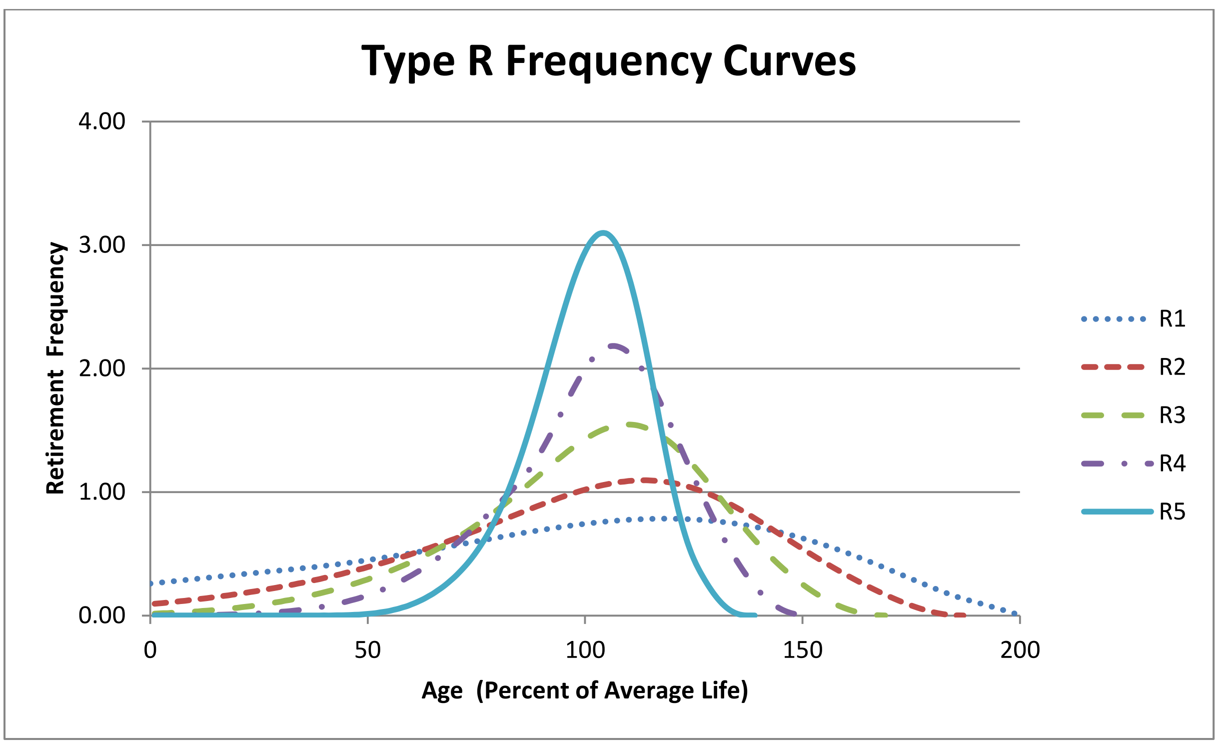


Figure 6:
Type R Survivor and Frequency Curves





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

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

Several other important statistical analyses and types of lives may be derived from an Iowa curve. These include: 1) average life; 2) realized life; 3) remaining life; and 4) probable life. The figure below illustrates these concepts. It shows the frequency curve, survivor curve, and probable life curve. Age M_x on the x-axis represents the modal age, while age AL_x represents the average age. Thus, this figure illustrates an "L type" Iowa curve since the mode occurs before the average.[67]

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:[68]

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 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).

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[67] 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.

[68] *See* NARUC *supra* n. 8, at 71.

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.[69] 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.[70] Remaining life is sometimes referred to as "average remaining life" and "life expectancy." To calculate average remaining life at age x, the area under the estimated future potion of the survivor curve is divided by the percent surviving at age x (denoted S_X). Thus, the average remaining life formula is:

Equation 5:
Average Remaining Life

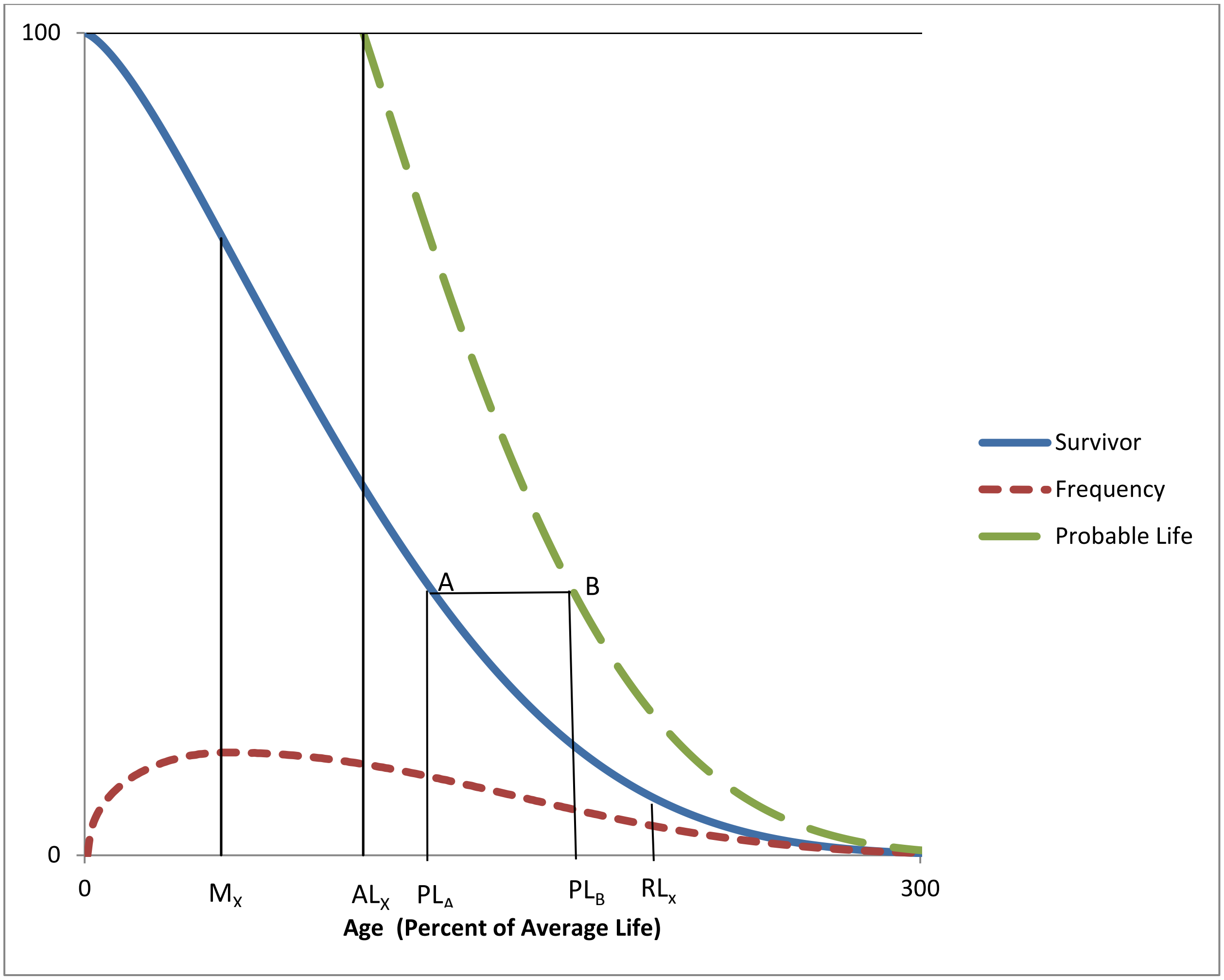
$$Average\ Remaining\ Life = \frac{Area\ Under\ Survivor\ Curve\ from\ Age\ x\ to\ Max\ Life}{S_X}$$

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

[69] *Id*. at 73.

[70] *Id*. at 74.

Figure 7:
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.[71] The probable life is also illustrated in this figure. The probable life at age PL_A is the age at point PL_B. Thus, to read the probable life at age PL_A, see the corresponding point on the survivor curve above at point "A," then horizontally to point "B" on the probable life curve, and back down to the age corresponding to point "B." It is no

[71] Wolf *supra* n. 7, at 28.

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.

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PUC DOCKET NO. 46449

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APPENDIX C:

ACTUARIAL ANALYSIS

ACTUARIAL ANALYSIS

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

The study of human mortality is analogous to estimating service lives of industrial property groups. While some humans die solely from chance, most deaths are related to age; that is, death rates generally increase as age increases. Similarly, physical plant is also subject to forces of retirement. These forces include physical, functional, and contingent factors, as shown in the table below.[72]

Figure 8:
Forces of Retirement

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

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

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[72] NARUC *supra* n. 8, at 14-15.

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.[73] Historical data is used in the retirement rate actuarial method, which is discussed further below.

The Retirement Rate Method

There are several systematic actuarial methods that use historical data in order to calculating observed survivor curves for property groups. Of these methods, the retirement rate method is superior, and is widely employed by depreciation analysts.[74] The retirement rate method is ultimately used to develop an observed survivor curve, which can be fitted with an Iowa curve discussed in Appendix B in order to forecast average life. The observed survivor curve is calculated by using an observed life table ("OLT"). The figures below illustrate how the OLT is developed. First, historical property data are organized in a matrix format, with placement years on the left forming rows, and experience years on the top forming columns. The placement year (a.k.a. "vintage year" or "installation year") is the year of placement of a group of property. The experience year (a.k.a. "activity year") refers to the accounting data for a particular calendar year. The two matrices below use aged data – that is, data for which the dates of placements, retirements, transfers, and other transactions are known. Without aged data, the retirement rate actuarial method may not be employed. The first matrix is the exposure matrix,

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

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

which shows the exposures at the beginning of each year.[75] An exposure is simply the depreciable property subject to retirement during a period. The second matrix is the retirement matrix, which shows the annual retirements during each year. Each matrix covers placement years 2003–2015, and experience years 2008-2015. In the exposure matrix, the number in the 2009 experience column and the 2003 placement row is $192,000. This means at the beginning of 2012, there was $192,000 still exposed to retirement from the vintage group placed in 2003. Likewise, in the retirement matrix, $19,000 of the dollars invested in 2003 was retired during 2012.

Figure 9:
Exposure Matrix

Placement Years	Experience Years Exposures at January 1 of Each Year (Dollars in 000's) 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	

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

Figure 10:
Retirement Matrix

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

These matrices help visualize how exposure and retirement data are calculated for each age interval. An age interval is typically one year. A common convention is to assume that any unit installed during the year is installed in the middle of the calendar year (i.e., July 1st). This convention is called the "half-year convention" and effectively assumes that all units are installed uniformly during the year.[76] 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). The same calculation is applied to each number in the column. The

[76] Wolf *supra* n. 7, at 22.

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

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

Figure 11:
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			

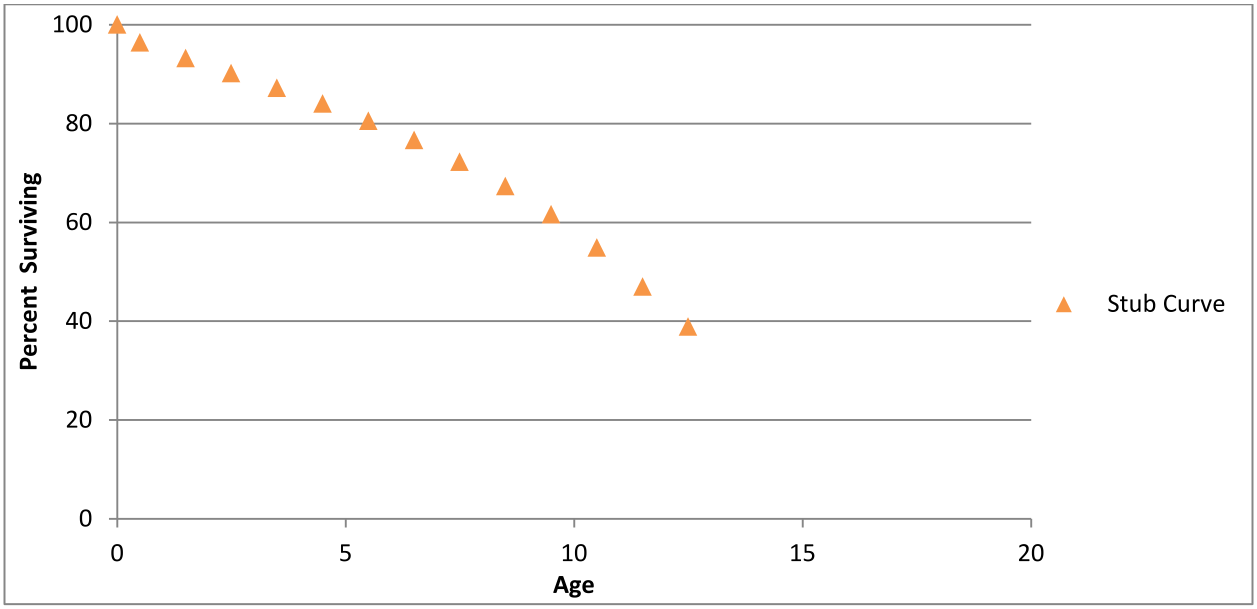
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. 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)[77].

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

77 Multiplying 96.43 by 0.967 does not equal 93.21 exactly due to rounding.

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

Figure 12:
Original "Stub" Survivor Curve



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

Banding

The forces of retirement and characteristics of industrial property are constantly changing. A depreciation analyst may examine the magnitude of these changes. Analysts often use a technique called "banding" to assist with this process. Banding refers to the merging of several years of data into a single data set for further analysis, and it is a common technique associated with the retirement rate method.[78] 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.[79]

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.

[78] NARUC *supra* n. 8, at 113.

[79] *Id*.

Figure 13:
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.[80] Placement bands allow analysts to isolate the effects of changes in technology and materials that occur in successive generations of plant. For example, if in 2005 an electric utility began placing transmission poles with a special chemical treatment that extended the service lives of the poles, an analyst could use placement bands to isolate and analyze the effect of that change in the property group's physical characteristics. While placement bands are very useful in depreciation analysis, they also possess an intrinsic

80 Wolf *supra* n. 7, at 182.

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.[81]

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.

Figure 14:
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

81 NARUC *supra* n. 8, at 114.

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.[82] 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 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

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82 *Id*.

property is studied. An analyst could confine the analysis to older, fully retired vintage groups in order to get complete survivor curves, but such analysis would ignore some the property currently in service and would arguably not provide an accurate description of life characteristics for current plant in service. Because a complete curve is necessary to calculate the average life of the property group, however, curve fitting techniques using Iowa curves or other standardized curves may be employed in order to complete the stub curve.

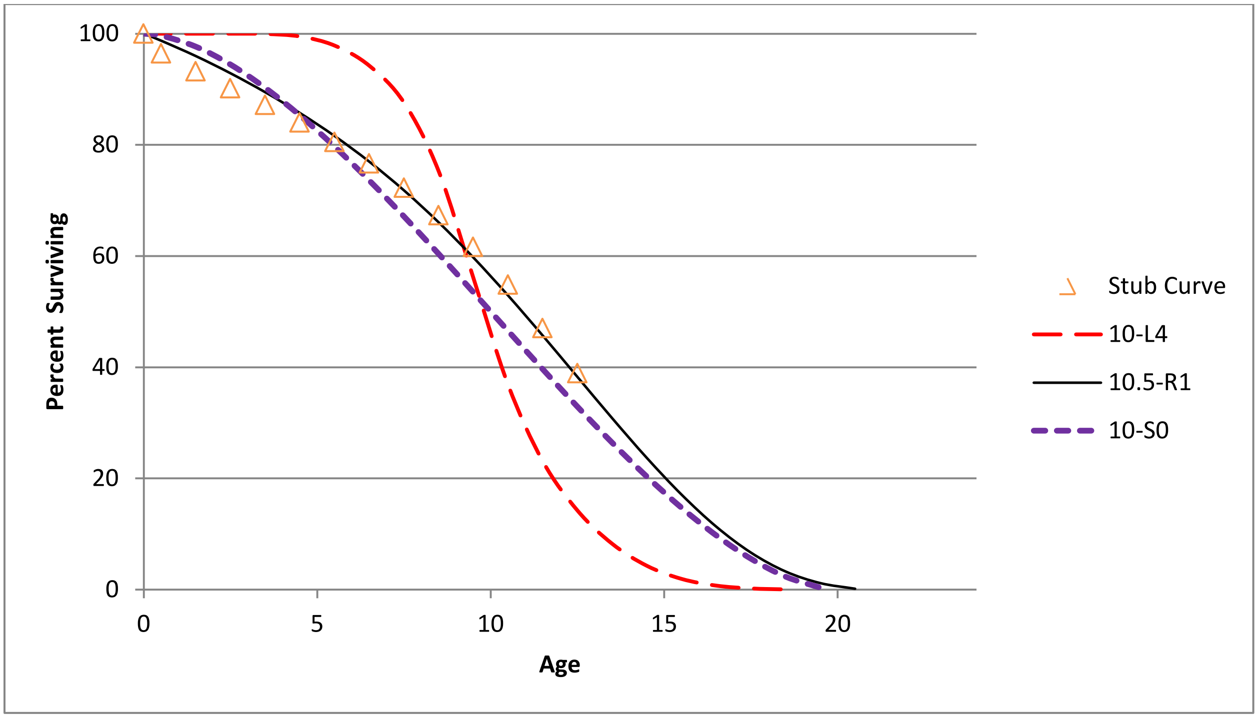
Curve Fitting

Depreciation analysts typically use the survivor curve rather than the frequency curve to fit the observed stub curves. The most commonly used generalized survivor curves used in the curve fitting process are the Iowa curves discussed above. As Wolf notes, if "the Iowa curves are adopted as a model, an underlying assumption is that the process describing the retirement pattern is one of the 22 [or more] processes described by the Iowa curves."[83]

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.

[83] Wolf *supra* n. 7, at 46 (22 curves includes Winfrey's 18 original curves plus Cowles's four "O" type curves).

Figure 15:
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.[84]

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.”[85]

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

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84 Wolf *supra* n. 7, at 47.

85 *Id*. at 48.

Figure 16:
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**

SOAH DOCKET NO. 473-17-5771
PUC DOCKET NO. 47527

APPLICATION OF SOUTHWESTERN	**§**	**BEFORE THE STATE OFFICE**
PUBLIC SERVICE COMPANY FOR	**§**	**OF**
AUTHORITY TO CHANGE RATES	**§**	**ADMINISTRATIVE HEARINGS**

REVENUE REQUIREMENT PHASE

DIRECT TESTIMONY AND EXHIBITS OF MARK E. GARRETT

EXHIBIT DJG-1:

CURRICULUM VITAE

100 Park Avenue, Suite 700
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 – Present
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)

VOLUNTEER EXPERIENCE

Calm Waters — Oklahoma City, OK
Board Member — 2015 – Present
Participate in management of operations, attend meetings, review performance, compensation, and financial records. Assist in fundraising events.

Group Facilitator & Fundraiser — 2014 – Present
Facilitate group meetings designed to help children and families cope with divorce and tragic events. Assist in fundraising events.

St. Jude Children's Research Hospital — Oklahoma City, OK
Oklahoma Fundraising Committee — 2008 – 2010
Raised money for charity by organizing local fundraising events.

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

SELECTED CONTINUING PROFESSIONAL EDUCATION

Society of Depreciation Professionals — Austin, TX
"Life and Net Salvage Analysis" — 2015
Extensive instruction on utility depreciation, including actuarial and simulation life analysis modes, gross salvage, cost of removal, life cycle analysis, and technology forecasting.

Society of Depreciation Professionals — New Orleans, LA
"Introduction to Depreciation" and "Extended Training" — 2014
Extensive instruction on utility depreciation, including average lives and net salvage.

Society of Utility and Regulatory Financial Analysts — Indianapolis, IN
46th Financial Forum. "The Regulatory Compact: Is it Still Relevant?" — 2014
Forum discussions on current issues.

New Mexico State University, Center for Public Utilities — Santa Fe, NM
Current Issues 2012, "The Santa Fe Conference" — 2012
Forum discussions on various current issues in utility regulation.

Michigan State University, Institute of Public Utilities — Clearwater, FL
"39th Eastern NARUC Utility Rate School" — 2011
One-week, hands-on training emphasizing the fundamentals of the utility ratemaking process.

New Mexico State University, Center for Public Utilities — Albuquerque, NM
"The Basics: Practical Regulatory Training for the Changing Electric Industries" — 2010
One-week, hands-on training designed to provide a solid foundation in core areas of utility ratemaking.

The Mediation Institute — Oklahoma City, OK
"Civil / Commercial & Employment Mediation Training" — 2009
Extensive instruction and mock mediations designed to build foundations in conducting mediations in civil matters.

Utility Regulatory Proceedings

State	Regulatory Agency / Company-Applicant	Docket Number	Testimony / Analysis: Issues	Type	Date
WA	Washington Utilities & Transportation Commission Avista Corporation	UE-170485 UG-170486	Cost of capital and authorized rate of return	Prefiled	10/27/2017
WY	Wyoming Public Services Commission Powder River Energy Corporation	PUD 201700151	Risk and credit analysis	Prefiled Live	8/28/2017 9/29/2017
OK	Oklahoma Corporation Commission Public Service Co. of Oklahoma	PUD 201700151	Depreciation rates, terminal salvage, risk analysis	Prefiled Live	9/21/2017 11/6/2017
TX	Public Utility Commission of Texas Oncor Electric Delivery Company	PUC 46957	Depreciation rates, simulated plant record analysis	Pending	
NV	Nevada Public Utilities Commission Nevada Power Company	17-06004	Depreciation rates, net salvage	Prefiled	10/6/2017
TX	Public Utility Commission of Texas El Paso Electric Company	PUC 46831	Depreciation rates, interim retirements	Prefiled	6/23/2017
ID	Idaho Public Utilities Commission Idaho Power Company	IPC-E-16-24	Accelerated depreciation of North Valmy plant	Settled	5/31/2017
ID	Idaho Public Utilities Commission Idaho Power Company	IPC-E-16-23	Depreciation rates	Settled	5/31/2017
TX	Public Utility Commission of Texas Southwestern Electric Power Company	PUC 46449	Depreciation rates, decommissioning costs, terminal net salvage	Prefiled Live	4/25/2017 6/8/2017
MA	Massachusetts Department of Public Utilities Eversource Energy	D.P.U. 17-05	Cost of capital, capital structure, and rate of return	Prefiled	4/28/2017
TX	Railroad Commission of Texas Atmos Pipeline - Texas	GUD 10580	Depreciation rates, depreciation grouping procedure	Prefiled	3/22/2017
TX	Public Utility Commission of Texas Sharyland Utility Co.	PUC 45414	Depreciation rates, simulated and actuarial analysis	Prefiled	2/28/2017
OK	Oklahoma Corporation Commission Empire District Electric Co.	PUD 201600468	Cost of capital, depreciation rates, terminal salvage, lifespans	Prefiled Live	3/13/2017 5/11/2017

Utility Regulatory Proceedings

State	Regulatory Agency / Company-Applicant	Docket Number	Testimony / Analysis: Issues	Type	Date
TX	Railroad Commission of Texas CenterPoint Energy Texas Gas	GUD 10567	Depreciation rates, simulated and actuarial analysis	Prefiled	2/21/2017
AR	Arkansas Public Service Commission Oklahoma Gas & Electric Co.	160-159-GU	Cost of capital, depreciation rates, terminal salvage, lifespans	Prefiled	1/31/2017
FL	Florida Public Service Commission Peoples Gas	16-159-GU	Depreciation rates	Report	11/4/2016
AZ	Arizona Corporation Commission Arizona Public Service Co.	E-01345A-16-0036	Cost of capital, depreciation rates, terminal salvage, lifespans	Pre-filed	12/28/2016
NV	Nevada Public Utilities Commission Sierra Pacific Power Co.	16-06008	Depreciation rates, terminal salvage, lifespans, theoretical reserve	Pre-filed	9/23/2016
OK	Oklahoma Corporation Commission Oklahoma Gas & Electric Co.	PUD 201500273	Cost of capital, depreciation rates, terminal salvage, lifespans	Pre-filed Live	3/21/2016 5/3/2016
OK	Oklahoma Corporation Commission Public Service Co. of Oklahoma	PUD 201500208	Cost of capital, depreciation rates, terminal salvage, lifespans	Pre-filed Live	10/14/2015 12/8/2015
OK	Oklahoma Corporation Commission Oklahoma Natural Gas Co.	PUD 201500213	Cost of capital and depreciation rates	Pre-filed	10/19/2015
OK	Oklahoma Corporation Commission Oak Hills Water System	PUD 201500123	Cost of capital and depreciation rates	Pre-filed Live	7/8/2015 8/14/2015
OK	Oklahoma Corporation Commission CenterPoint Energy Oklahoma Gas	PUD 201400227	Fuel prudence review and fuel adjustment clause	Pre-filed Live	11/3/2014 2/10/2015
OK	Oklahoma Corporation Commission Public Service Co. of Oklahoma	PUD 201400233	Certificate of authority to issue new debt securities	Pre-filed Live	9/12/2014 9/25/2014
OK	Oklahoma Corporation Commission Empire District Electric Co.	PUD 201400226	Fuel prudence review and fuel adjustment clause	Pre-filed Live	12/9/2014 1/22/2015
OK	Oklahoma Corporation Commission Fort Cobb Fuel Authority	PUD 201400219	Fuel prudence review and fuel adjustment clause	Pre-filed Live	 1/29/2015
OK	Oklahoma Corporation Commission Fort Cobb Fuel Authority	PUD 201400140	Outside services, legislative advocacy, payroll expense, and insurance expense	Pre-filed	12/16/2014

Utility Regulatory Proceedings

State	Regulatory Agency / Company-Applicant	Docket Number	Testimony / Analysis Issues	Type	Date
OK	Oklahoma Corporation Commission Public Service Co. of Oklahoma	PUD 201300201	Authorization of standby and supplemental tariff	Pre-filed Live	12/9/2013 12/19/2013
OK	Oklahoma Corporation Commission Fort Cobb Fuel Authority	PUD 201300134	Fuel prudence review and fuel adjustment clause	Pre-filed Live	10/23/2013 1/30/2014
OK	Oklahoma Corporation Commission Empire District Electric Co.	PUD 201300131	Fuel prudence review and fuel adjustment clause	Pre-filed Live	11/21/2013 12/19/2013
OK	Oklahoma Corporation Commission CenterPoint Energy Oklahoma Gas	PUD 201300127	Fuel prudence review and fuel adjustment clause	Pre-filed Live	10/21/2013 1/23/2014
OK	Oklahoma Corporation Commission Oklahoma Gas & Electric Co.	PUD 201200185	Gas transportation contract extension	Pre-filed Live	9/20/2012 10/9/2012
OK	Oklahoma Corporation Commission Empire District Electric Co.	PUD 201200170	Fuel prudence review and fuel adjustment clause	Pre-filed Live	10/31/2012 12/13/2012
OK	Oklahoma Corporation Commission Oklahoma Gas & Electric Co.	PUD 201200169	Fuel prudence review and fuel adjustment clause	Pre-filed Live	12/19/2012 4/4/2013

SOAH DOCKET NO. 473-17-5771
PUC DOCKET NO. 47527

APPLICATION OF SOUTHWESTERN	§	BEFORE THE STATE OFFICE
PUBLIC SERVICE COMPANY FOR	§	OF
AUTHORITY TO CHANGE RATES	§	ADMINISTRATIVE HEARINGS

REVENUE REQUIREMENT PHASE

DIRECT TESTIMONY AND EXHIBITS OF MARK E. GARRETT

EXHIBIT DJG-2:

SUMMARY DEPRECIATION ACCRUAL ADJUSTMENT

Summary Accrual Adjustment

	[1]	[2]	[3]	[4]
Tolk Facilities	Plant Balance 6/30/2017	SPS Proposed Accrual	AXM Proposed Accrual	**Difference**
Common Facilities	$ 81,807,355	$ 4,114,550	$ 2,237,738	$ (1,876,812)
Tolk Unit 1	317,341,598	10,164,139	6,178,202	(3,985,937)
Tolk Unit 2	358,664,600	12,872,376	7,000,766	(5,871,610)
Total	$ 757,813,553	$ 27,151,065	$ 15,416,706	**$ (11,734,359)**

[1], [2] See Exhibit DJG-3.

[3] See Exhibit DJG-4.

[4] = [3] - [2]; See Direct Testimony and Exhibits of Karl Nalepa for AXM's deprciation expense adjustment

SOAH DOCKET NO. 473-17-5771
PUC DOCKET NO. 47527

APPLICATION OF SOUTHWESTERN	§	BEFORE THE STATE OFFICE
PUBLIC SERVICE COMPANY FOR	§	OF
AUTHORITY TO CHANGE RATES	§	ADMINISTRATIVE HEARINGS

REVENUE REQUIREMENT PHASE

DIRECT TESTIMONY AND EXHIBITS OF MARK E. GARRETT

EXHIBIT DJG-3:

DETAILED RATE COMPARISON

Detailed Rate Comparison

		[1]	[2]		[3]		[4]	
			SPS Proposal		AXM Proposal		Difference	
Account No.	Description	Plant 6/30/2017	Rate	Annual Accrual	Rate	Annual Accrual	Rate	Annual Accrual
	TOLK PRODUCTION FACILITIES							
	Common Facilities							
310.00	Water Rights	10,199,108	5.42%	552,823	2.95%	300,658	-2.47%	-252,165
311.00	Structures and Improvements	34,707,776	5.46%	1,895,363	2.97%	1,030,812	-2.49%	-864,552
312.00	Boiler Plant Equipment	16,357,636	4.69%	766,702	2.55%	416,978	-2.14%	-349,724
314.00	Turbogenerators	13,377,761	4.95%	661,559	2.69%	359,795	-2.26%	-301,764
315.00	Accessory Electric Equipment	22,551	7.43%	1,675	4.04%	911	-3.39%	-764
316.00	Miscellaneous Power Plant Equipment	7,142,523	3.31%	236,427	1.80%	128,583	-1.51%	-107,844
	Total Common Facilities	81,807,355	5.03%	4,114,550	2.74%	2,237,738	-2.29%	-1,876,812
	Tolk Unit 1							
310.00	Land Rights	19,917	2.23%	444	1.35%	270	-0.87%	-174
311.00	Structures and Improvements	32,251,575	2.81%	906,460	1.71%	550,986	-1.10%	-355,475
312.00	Boiler Plant Equipment	192,823,981	3.42%	6,592,307	2.08%	4,007,088	-1.34%	-2,585,218
314.00	Turbogenerators	76,180,490	2.90%	2,212,142	1.77%	1,344,635	-1.14%	-867,507
315.00	Accessory Electric Equipment	15,344,204	2.81%	431,401	1.71%	262,224	-1.10%	-169,177
316.00	Miscellaneous Power Plant Equipment	721,430	2.96%	21,386	1.80%	12,999	-1.16%	-8,387
	Total Unit 1	317,341,598	3.20%	10,164,139	1.95%	6,178,202	-1.26%	-3,985,937
	Tolk Unit 2							
310.00	Land Rights	277,377	2.41%	6,692	1.31%	3,640	-1.10%	-3,053
311.00	Structures and Improvements	18,359,028	3.06%	562,438	1.67%	305,888	-1.40%	-256,551
312.00	Boiler Plant Equipment	220,936,758	3.75%	8,291,253	2.04%	4,509,278	-1.71%	-3,781,975
314.00	Turbogenerators	105,153,927	3.38%	3,559,018	1.84%	1,935,606	-1.54%	-1,623,412
315.00	Accessory Electric Equipment	10,423,974	3.37%	351,179	1.83%	190,992	-1.54%	-160,187
316.00	Miscellaneous Power Plant Equipment	3,513,536	2.90%	101,795	1.58%	55,362	-1.32%	-46,433
	Total Unit 2	358,664,600	3.59%	12,872,376	1.95%	7,000,766	-1.64%	-5,871,610
	TOTAL STEAM PRODUCTION TOLK	**$ 757,813,553**	**3.58%**	**$ 27,151,065**	**2.03%**	**$ 15,416,706**	**-1.55%**	**$ (11,734,359)**

[1], [2] See Exhibit DAW-RR-2
[3] See Exhibit DJG-4
[4] = [3] - [2]

SOAH DOCKET NO. 473-17-5771
PUC DOCKET NO. 47527

APPLICATION OF SOUTHWESTERN	**§**	**BEFORE THE STATE OFFICE**
PUBLIC SERVICE COMPANY FOR	**§**	**OF**
AUTHORITY TO CHANGE RATES	**§**	**ADMINISTRATIVE HEARINGS**

REVENUE REQUIREMENT PHASE

DIRECT TESTIMONY AND EXHIBITS OF MARK E. GARRETT

EXHIBIT DJG-4:

DEPRECIATION RATE DEVELOPMENT

Depreciation Rate Development
(SL-AL-RL-BG System)

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
			Iowa Curve							Service Life		Net Salvage		Total	
Account No.	Description	Plant 12/31/2015	Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Accrual	Rate	Accrual	Rate	Accrual	Rate
	TOLK PRODUCTION FACILITIES														
	Common Facilities														
310.00	Water Rights	10,199,108			0.0%	10,199,108	1,630,344	8,568,764	##########	300,658	2.95%	0	0.00%	300,658	**2.95%**
311.00	Structures and Improvements	34,707,776			##########	35,401,932	6,023,801	29,378,131	##########	1,006,455	2.90%	24,356	0.07%	1,030,812	**2.97%**
312.00	Boiler Plant Equipment	16,357,636			##########	16,684,789	4,800,908	11,883,881	##########	405,499	2.48%	11,479	0.07%	416,978	**2.55%**
314.00	Turbogenerators	13,377,761			##########	13,645,316	3,391,147	10,254,169	##########	350,407	2.62%	9,388	0.07%	359,795	**2.69%**
315.00	Accessory Electric Equipment	22,551			##########	23,002	-2,968	25,970	##########	895	3.97%	16	0.07%	911	**4.04%**
316.00	Miscellaneous Power Plant Equipment	7,142,523			##########	7,285,373	3,620,761	3,664,612	##########	123,571	1.73%	5,012	0.07%	128,583	**1.80%**
	Total Common Facilities	81,807,355				83,239,520	19,463,993	63,775,527	##########	2,187,486	2.67%	50,251	0.06%	2,237,738	**2.74%**
	Tolk Unit 1														
310.00	Land Rights	19,917			0.0%	19,917	13,036	6,881	##########	270	1.35%	0	0.00%	270	**1.35%**
311.00	Structures and Improvements	32,251,575			##########	32,896,607	18,846,474	14,050,133	##########	525,690	1.63%	25,295	0.08%	550,986	**1.71%**
312.00	Boiler Plant Equipment	192,823,981			##########	196,680,461	94,499,707	102,180,753	##########	3,855,854	2.00%	151,234	0.08%	4,007,088	**2.08%**
314.00	Turbogenerators	76,180,490			##########	77,704,100	43,415,905	34,288,196	##########	1,284,886	1.69%	59,749	0.08%	1,344,635	**1.77%**
315.00	Accessory Electric Equipment	15,344,204			##########	15,651,088	8,964,371	6,686,717	##########	250,190	1.63%	12,035	0.08%	262,224	**1.71%**
316.00	Miscellaneous Power Plant Equipment	721,430			##########	735,859	404,380	331,479	##########	12,433	1.72%	566	0.08%	12,999	**1.80%**
	Total Unit 1	317,341,598				323,688,031	166,143,872	157,544,159	##########	5,929,323	1.87%	248,880	0.08%	6,178,202	**1.95%**
	Tolk Unit 2														
310.00	Land Rights	277,377			0.0%	277,377	173,648	103,729	##########	3,640	1.31%	0	0.00%	3,640	**1.31%**
311.00	Structures and Improvements	18,359,028			##########	18,726,209	10,008,413	8,717,796	##########	293,004	1.60%	12,884	0.07%	305,888	**1.67%**
312.00	Boiler Plant Equipment	220,936,758			##########	225,355,494	96,841,079	128,514,415	##########	4,354,234	1.97%	155,043	0.07%	4,509,278	**2.04%**
314.00	Turbogenerators	105,153,927			##########	107,257,006	52,092,221	55,164,785	##########	1,861,814	1.77%	73,792	0.07%	1,935,606	**1.84%**
315.00	Accessory Electric Equipment	10,423,974			##########	10,632,453	5,189,178	5,443,275	##########	183,677	1.76%	7,315	0.07%	190,992	**1.83%**
316.00	Miscellaneous Power Plant Equipment	3,513,536			##########	3,583,807	2,005,977	1,577,829	##########	52,897	1.51%	2,466	0.07%	55,362	**1.58%**
	Total Unit 2	358,664,600				365,832,345	166,310,516	199,521,829	##########	6,749,266	1.88%	251,500	0.07%	7,000,766	**1.95%**
	TOTAL DEPRECIABLE PLANT	**$ 757,813,553**				**$ 772,759,896**	**$ 351,918,381**	**$ 420,841,515**	**##########**	**$ 14,866,075**	**1.96%**	**$ 550,631**	**0.07%**	**$ 15,416,706**	**2.03%**

[1] See Exhibit DAW-RR-2
[2] Average life and Iowa curve shape developed through actuarial analysis and professional judgment; no interim retirement curves for production units
[3] See Exhibit DAW-RR-2; proposed net salvage not adjusted
[4] = [1]*(1-[3])
[5] See Exhibit DAW-RR-2
[6] = [4] - [5]
[7] Composite remaining life based on currently-approved retirement dates for Tolk Unit 1 and Tolk Unit 2 of 2042 and 2045 respectively
[8] = ([1] - [5]) / [7]
[9] = [8] / [1]
[10] = [12] - [8]
[11] = [13] - [9]
[12] = [6] / [7]
[13] = [12] / [1]

SOAH DOCKET NO. 473-17-5771
PUC DOCKET NO. 47527

APPLICATION OF SOUTHWESTERN	**§**	**BEFORE THE STATE OFFICE**
PUBLIC SERVICE COMPANY FOR	**§**	**OF**
AUTHORITY TO CHANGE RATES	**§**	**ADMINISTRATIVE HEARINGS**

REVENUE REQUIREMENT PHASE

DIRECT TESTIMONY AND EXHIBITS OF MARK E. GARRETT

EXHIBIT DJG-5:

RESPONSES TO REQUESTS FOR INFORMATION

QUESTION NO. TIEC 1-25:

Please provide a history of SPS's review of the adequacy of the groundwater at Tolk since receiving a CCN for Unit 1.

RESPONSE:

When the Tolk units were placed in service in the early and mid-1980s, SPS assumed that the groundwater in the Ogallala Aquifer ("aquifer") would be sufficient to accommodate Tolk's water needs until the end of its original depreciable life, which was estimated to be 2017. This assumption was premised on normal aquifer depletion rates and SPS's anticipated ability to acquire additional water rights, as needed.

In the mid-1990s, as the retirement dates of the Tolk units were extended beyond 2017, SPS made corresponding efforts to acquire additional water rights for the plants to support the future operation of the units. The changes in depreciable lives are set forth in SPS's response to Question No. TIEC 1-26. Additional water rights were obtained by trading land for water rights with a local rancher.

In the early 2000s, SPS determined that the existing water supply could potentially be inadequate to support operations at Tolk to the end of its useful life, which, as noted earlier, had been extended beyond the originally assumed useful life. In the years that followed, SPS initiated conservation efforts to extend the water supply.

In 2007, SPS identified regional contributors for the groundwater shortage as: less capacity from existing high capacity wells in the area; aquifer decline from agricultural, municipal, and industrial use; and annual well field productivity declines. In 2008, then-current projections showed aquifer depletion in the 2020-2023 timeframe. Also in 2008, SPS determined that shutting down Plant X in 2015 would only extend Tolk's water supply by one year. In 2010-2011, SPS's evaluations noted that extreme drought was accelerating the decline of the aquifer.

From 2011 to the present, SPS has conducted modeling to evaluate groundwater depletion under various scenarios. For example, SPS has modeled depletion of the aquifer assuming additional water rights acquisition or that Tolk could utilize hybrid cooling or effluent diverted from the Jones Plant. Also during this period, SPS engaged the services of outside consultants to conduct modeling to evaluation groundwater depletion. For example, in 2012, Daniel B. Stephens & Associates prepared a report of a groundwater study conducted for SPS, the City of Lubbock, Deaf Smith Electric Cooperative, High Plains Underground Water Conservation District, and Lamb County Electric Cooperative. The report concluded that after studying 2,753 wells in the 5-county area that there has been a 60% reduction in volume in the Ogallala Aquifer since 1950. Please refer to Section V of Mr. Davidson's direct testimony for further discussion of SPS's groundwater modeling (conducted by SPS and by outside consultants) and assessment of Tolk's current and future water limitations.

Preparer: Alan J. Davidson
Sponsor: Alan J. Davidson

QUESTION NO. TIEC 1-27:

Please provide a listing of the planned retirement dates for the Tolk units for all depreciation rates that have been authorized for these units.

RESPONSE:

The following is a listing of the planned retirement dates for Tolk Unit 1 and Unit 2 that have been authorized by the Commission for depreciation purposes. Please note that the date in parenthesis is the year the Commission's order was issued in the cited docket.

- In Docket No. 4387 (1982), the Commission authorized a retirement date of 2017 for Tolk Unit 1;
- In Docket No. 6465 (1986), the Commission authorized retirement dates of 2017 for Tolk Unit 1 and 2020 for Tolk Unit 2;
- In Docket No. 11520 (1993), the Commission authorized retirement dates of 2023 for Tolk Unit 1 and 2025 for Tolk Unit 2.
- In Docket No. 32766 (2007), the Commission authorized retirement dates of 2037 for Tolk Unit 1 and 2040 for Tolk Unit 2; and
- In Docket No. 35763 (2009), the Commission authorized retirement dates of 2042 for Tolk Unit 1 and 2045 for Tolk Unit 2.

Preparer: Deborah A. Dzik
Sponsor: Melissa L. Ostrom

QUESTION NO. TIEC 11-4:

In reference to SPS's Response to TIEC 1-27, did SPS propose to extend the retirement date for Tolk Unit 1 to 2037 and for Tolk Unit 2 to 2040 in its filed depreciation study in Docket No. 32766?

RESPONSE:

Yes. Please also refer to SPS's response to Question No. TIEC 11-5.

Preparer: Stephanie Wells
Sponsor: William A. Grant

QUESTION NO. TIEC 11-5:

If the response to TIEC 11-4 is yes, why were the lives proposed to be extended given that "in the early 2000's SPS had determined that the water supply could potentially be inadequate to support operations at Tolk to the end of its useful life," as stated in SPS's Response to TIEC 1-25?

RESPONSE:

At the time of SPS's application in Docket No. 32766, which was filed in May 2006, SPS's then-current plans and investment in its generating units supported an extension in the useful lives of Tolk. As discussed in SPS's response to Question No. TIEC 1-25, SPS has over the years initiated conservation efforts to extend the water supply at Tolk. When SPS filed its application in Docket No. 32766, SPS reasonably believed that viable water solutions (e.g., construction of new wells, hybrid cooling, water rights acquisition, diverting effluent from other plants, other water sources) existed to support its requested extension. A significant part of SPS's extension analysis in Docket No. 32766 was on the viable life of the plant equipment and whether it would be reasonable from an operations and maintenance perspective to expect that the Tolk plant could operate reliably to SPS's proposed retirement date. Water was not the only factor, as it was reasonable at the time to assume alternative solutions were available. As noted in the depreciation study filed with SPS's application in Docket No. 32766, "retirement can be for a number of reasons such as the physical end of the generating unit but will generally be driven by economic retirement of the unit." At that time, the relative cost of potential water solutions was secondary to the costs of environmental compliance, and higher gas prices made both costs relatively more economic.

Preparer: Alan J. Davidson
Sponsors: Alan J. Davidson, William A. Grant

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WORKPAPERS:

Provided on the attached CD.

REVENUE REQUIREMENT PHASE

WORKPAPERS TO THE
DIRECT TESTIMONY AND EXHIBITS OF MARK E. GARRETT