SOAH DOCKET NO. 473-17-2686
PUC DOCKET NO. 46831

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

DIRECT TESTIMONY AND EXHIBITS

OF

DAVID J. GARRETT

ON BEHALF OF

THE CITY OF EL PASO

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JUNE 23, 2017

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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. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE PUBLIC UTILITY COMMISSION OF TEXAS?

A. Yes. Recently, I filed testimony in Docket No. 473-16-4051 (Review of the Rates of Sharyland Utility Company) and Docket No. 46449 (Application of Southwestern Electric Power Company for Authority to Change Rates) before the Public Utility Commission of Texas ("PUC" or "Commission").

Q. WHOSE BEHALF ARE YOU TESTIFYING IN THIS PROCEEDING?

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

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

A. In this case, I am testifying in response to the proposed depreciation rates presented in the Direct Testimony of Mr. John J. Spanos on behalf of El Paso Electric Company ("EPE" or the "Company"). EPE's depreciation rates were settled in its last rate case in 2016. In this case, EPE is only requesting new depreciation rates related to certain assets at the Montana Power Station and assets in Account 390.[2] Thus, my testimony will focus on these assets.

II. EXECUTIVE SUMMARY

Q. SUMMARIZE THE KEY POINTS OF YOUR TESTIMONY.

A. In the context of utility ratemaking, "depreciation" refers to a cost allocation system designed to measure the rate by which a utility may recover its capital investments in a systematic and rational manner. In this case, the Company is proposing the Commission reverse its position on interim retirements, which has been in place more than 25 years. In this case, I recommend the Commission maintain its long-standing practice of excluding

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1 Exhibit DJG-1.

2 Direct Testimony of John J. Spanos, p. 2:1-4.

interim retirements from the calculation of production plant depreciation rates. Excluding interim retirements from the Montana plant in this case results in an adjustment of $1.9 million to EPE's proposed annual accrual as presented in the depreciation study. The table below compares City's and EPE's proposed depreciation accrual by plant function.

Figure 1:
City's Summary Depreciation Adjustment

Plant Function	EPE Proposal Rates	EPE Proposal Accrual	City Proposal Rates	City Proposal Accrual	City Adjustment Rates	City Adjustment Accrual
Gas Turbine						
Montana Power Plant	2.79%	$ 10,544,917	2.29%	$ 8,647,656	-0.50%	$ (1,897,261)
General						
Account 390	2.03%	2,074,700	2.03%	2,074,700	0.00%	-
Total		$ 12,619,617		$ 10,722,356		**$ (1,897,261)**

City's total adjustment reduces the Company's proposed annual depreciation accrual by $1,897,261.[3]

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

[3] Exhibit DJG-4.

policy perspective, it is preferable for regulators to ensure that assets are not depreciated before the end of their true useful lives.

While underestimating the useful lives of depreciable assets could financially harm current ratepayers and encourage economic waste, unintentionally overestimating depreciable lives (i.e., underestimating depreciation rates) does not produce these unwanted results, and does not harm the Company. This is because if an asset's life is overestimated, there are a variety of measures that regulators can use to ensure the utility is not financially harmed and recovers the full cost of its plant investment. One such measure would be the use of a regulatory asset account. In that case, the Company's original cost investment in these assets would remain in the Company's rate base until they are recovered. Thus, the process of depreciation strives for a perfect match between actual and estimated useful life. When these estimates are not exact, however, it is better from a public policy perspective that useful lives are overestimated rather than underestimated.

III. LEGAL STANDARDS

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

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

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

[5] *Id.* (Referring to the straight-line method, the *Lindheimer* Court stated that "[a]ccording to the principle of this accounting practice, the loss is computed upon the actual cost of the property as entered upon the books, less the expected salvage, and the amount charged each year is one year's pro rata share of the total amount."). The original cost standard was reaffirmed by the Court in *Federal Power Commission v. Hope Natural Gas Co.*, 320 U.S. 591, 606 (1944). The *Hope* Court stated: "Moreover, this Court recognized in [*Lindheimer*], supra, the propriety of basing annual depreciation on cost. By such a procedure the utility is made whole and the integrity of its investment maintained. No more is required."

> [T]he company has the burden of making a convincing showing that the amounts it has charged to operating expenses for depreciation have not been excessive. That burden is not sustained by proof that its general accounting system has been correct. The calculations are mathematical, but the predictions underlying them are essentially matters of opinion.[6]

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

Q. SHOULD DEPRECIATION REPRESENT AN ALLOCATED COST OF CAPITAL TO OPERATION, RATHER THAN A MECHANISM TO DETERMINE LOSS OF VALUE?

A. Yes. While the *Lindheimer* case and other early literature recognized depreciation as a necessary expense, the language indicated that depreciation was primarily a mechanism to determine loss of value.[7] Adoption of this "value concept" 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.[8] 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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6 *Id*. at 169.

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

8 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.[9]

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

IV. ANALYTIC METHODS

Q. DISCUSS THE DEFINITION AND PURPOSE OF A DEPRECIATION SYSTEM, AS WELL AS THE DEPRECIATION SYSTEM YOU EMPLOYED FOR THIS PROJECT.

A. The legal standards set forth above do not mandate a specific procedure for conducting depreciation analyses. These standards, however, direct that analysts use a system for estimating depreciation rates that will result in the "systematic and rational" allocation of capital recovery for the utility. Over the years, analysts have developed "depreciation systems" designed to analyze grouped property in accordance with this standard. A depreciation system may be defined by several primary parameters: 1) a method of allocation; 2) a procedure for applying the method of allocation; 3) a technique of applying the depreciation rate; and 4) a model for analyzing the characteristics of vintage property groups.[11] In this case, I used the straight-line method, the average life procedure, the remaining life technique, and the broad group model. This system would be denoted as an "SL-AL-RL-BG" system. This depreciation system conforms to the legal standards set forth above, and is commonly used by depreciation analysts in regulatory proceedings. I provide a more detailed discussion of depreciation system parameters, theories, and equations in Appendix A.

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

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

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

Q. DID MR. SPANOS USE A SIMILAR DEPRECIATION SYSTEM IN HIS ANALYSIS?

A. Yes. Essentially, Mr. Spanos and I used the same depreciation system to develop our proposed depreciation rates. Thus, the discrepancy in our recommendations is not driven by the use of different depreciation systems.

Q. DESCRIBE THE PROCESS YOU USED TO ANALYZE THE COMPANY'S DEPRECIABLE PROPERTY.

A. The study of retirement patterns of industrial property is derived from the actuarial process used to study human mortality. Just as actuarial analysts study historical human mortality data to estimate how long people will survive, depreciation analysts study historical plant retirement data to estimate how long property will survive. The most common actuarial method used by depreciation analysts is called the "retirement rate method." In the retirement rate method, original property data, including additions, retirements, transfers, and other transactions, are organized by vintage and transaction year.[12] The retirement rate method is ultimately used to develop an "observed life table," ("OLT") which shows the percentage of property surviving at each age interval. This pattern of property retirement is described as a "survivor curve." The survivor curve derived from the observed life table, however, must be fitted and smoothed with a complete curve in order to determine the ultimate average life of the group.[13] The most widely used survivor curves for this curve-fitting process were developed at Iowa State University in the early 1900s and are commonly known as the "Iowa curves."[14] A more detailed explanation of how the Iowa curves are used in the actuarial analysis of depreciable property is set forth in Appendix C.

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

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

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

Q. PLEASE DESCRIBE HOW YOU DEVELOPED YOU DEPRECIATION RATES?

A. Using the SL-AL-RL-BG depreciation system discussed above, I developed depreciation rates for each account at issue in this case. The basic remaining life formula is presented as follows:

$$Annual\ Accrual = \frac{Gross\ Plant\ (1 - Net\ Salvage\ \%) - BookReserve}{Average\ Remaining\ Life}$$

The annual accrual is divided by original cost to obtain the depreciation rate. For the Montana plant, average life and remaining life are essentially the same (45 years) for all accounts since the plant is relatively new. Using Account 341 at the Montana Unit 1 location as an example, the rate for this account is calculated using the same formula above:

$$\$410{,}290 = \frac{\$17{,}899{,}881\ (1 - (-5\%)) - \$619{,}027}{44.3\ years}$$

When the annual accrual of $410,290 is divided by the plant balance of $17.9 million for this account, it equates to a depreciation rate of 2.29%. Exhibit DJG-5 shows the detailed calculations for every account.

V. LIFE SPAN PROPERTY ANALYSIS

Q. DESCRIBE LIFE SPAN PROPERTY.

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

Q. DESCRIBE THE APPROACH TO ANALYZING LIFE SPAN PROPERTY.

A. For life span property, there are essentially three steps to the analytical process. First, I reviewed the Company's proposed life spans for each of its production units and compared the life span estimates of other similar production units in other jurisdictions. Second, I examined the Company's proposed interim retirement curves for each account in order to assess the remaining lives and depreciation rates for each production unit. Finally, I analyzed the proposed terminal net salvage for each production unit, which includes estimated decommissioning costs. I will discuss each of these issues in turn.

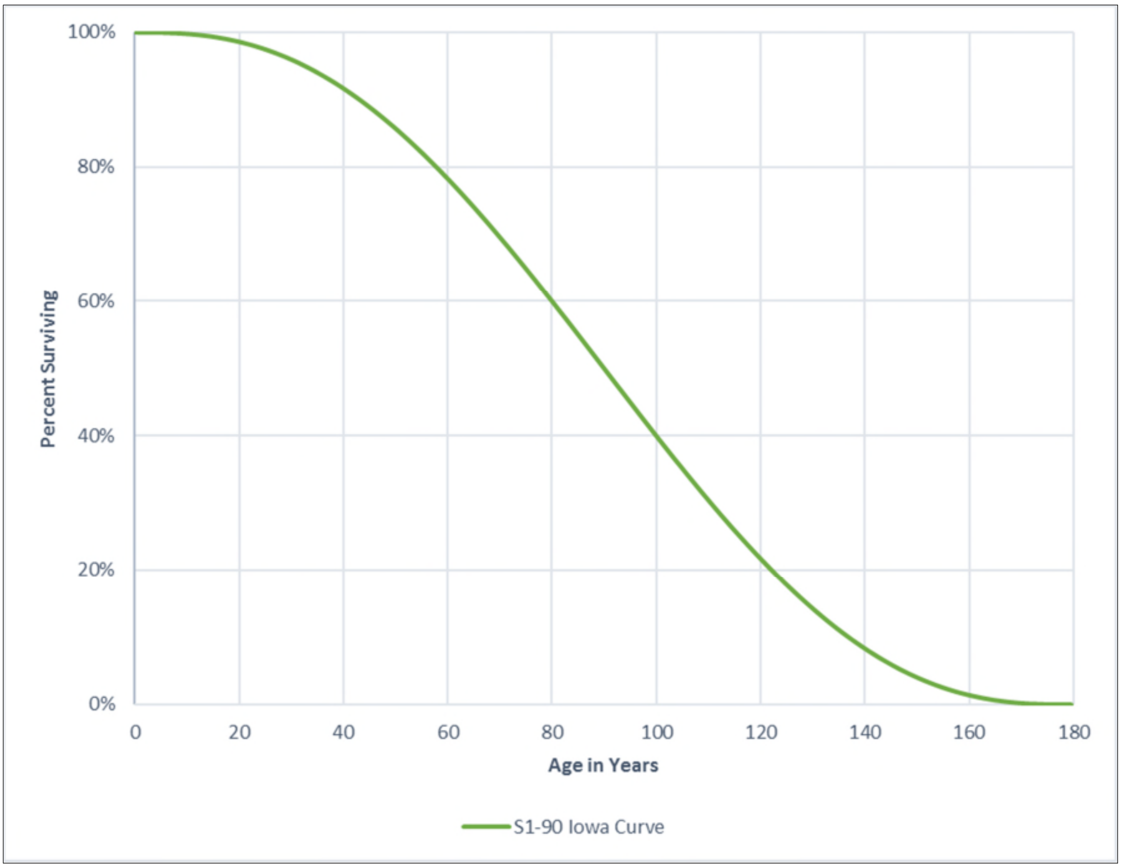
Q. DO YOU AGREE WITH THE COMPANY'S PROPOSED LIFE SPANS FOR THE MONTANA GENERATING UNITS?

A. Yes. Mr. Spanos has proposed estimated retirement dates of 2060 for Montana Units 1 and 2, and 2061 for Montana Units 3 and 4. This equates to a 45-year life span for these units. It would not be surprising if these units were in service longer than 45 years, but at this time, City does not recommend an adjustment to the Company's proposal on this issue.

Q. PLEASE ILLUSTRATE THE CONCEPT OF INTERIM RETIREMENTS.

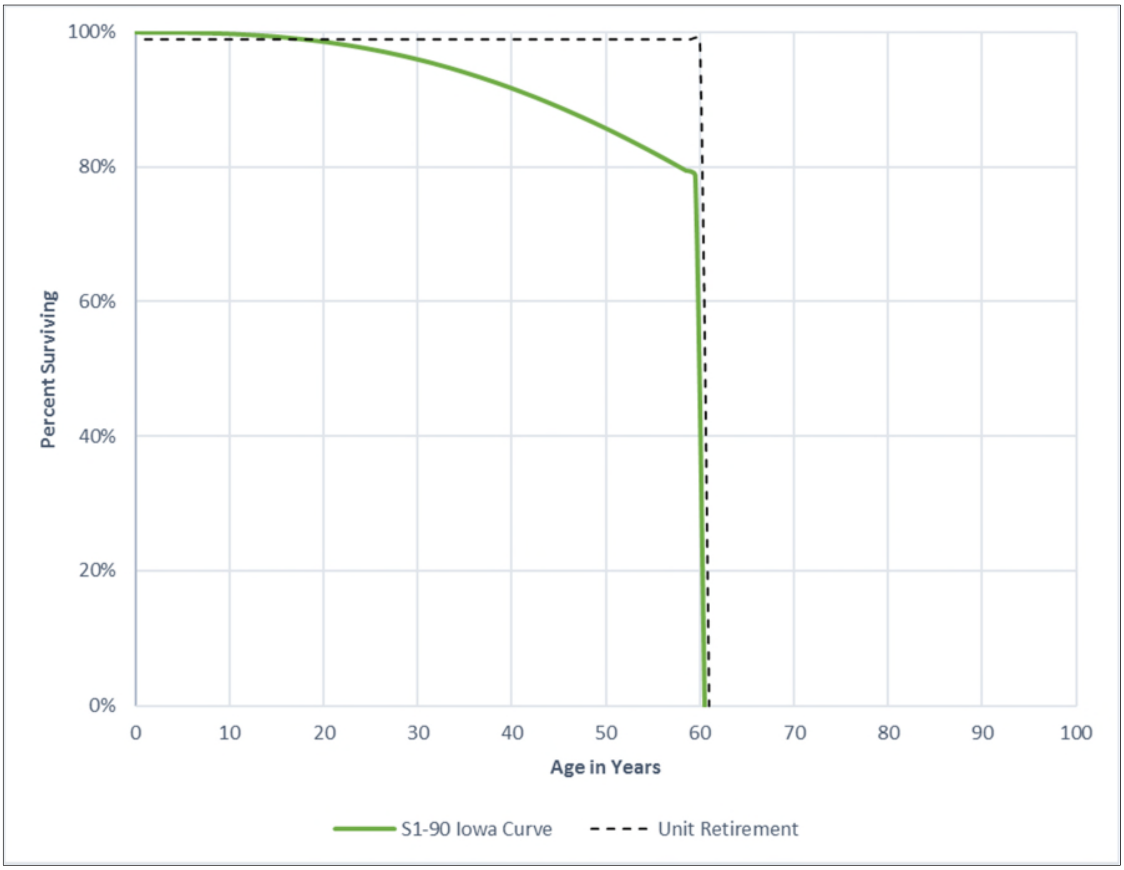
A. As discussed further below, the concept of interim retirements is an issue in this case. While some jurisdictions allow for interim retirements to be included in the determination of depreciation rates for production units, the Commission does not. Interim retirements relate to the individual accounts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

Figure 2:
S1-90 Iowa Curve



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

Figure 3:
S1-90 Curve for Interim Retirements



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

Q. THE COMPANY IS PROPOSING THE COMMISSION DEVIATE FROM ITS WELL-ESTABLISHED PRECEDENT OF EXCLUDING INTERIM RETIREMENTS. DO YOU AGREE?

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

> The rate at which interim retirements will be made is not known and measurable. Incorporation of interim retirements would best be done when those retirements are actually made. It is not reasonable to incorporate interim retirements, resulting in a reduction in the depreciation expense of $1 million on a Texas retail basis.[15]

The ALJ in that case found that the "Commission has consistently rejected interim retirements for any production plant account under any methodology."[16]

Q. IN RESPONSE TO THIS RULING, DID SWEPCO REQUEST THE INCLUSION OF INTERIM RETIREMENTS IN ITS MOST RECENT RATE CASE?

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

> The Commission order in PUC Docket No. 40443 (Finding of Fact, No. 195) 15 indicated that it was not reasonable to include interim retirements in the calculation of production plant depreciation rates since the rate at which interim retirements will be made is not known and measurable. Therefore, interim retirements of production plant were not used in the current study's calculation of production plant depreciation rates.[17]

No party to the case, including Staff, took issue with SWEPCO's decision to exclude interim retirements from its proposed depreciation rates.

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

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

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

Q. IN HIS DIRECT TESTIMONY, MR. SPANOS CITES SEVERAL TREATISES AND RULES IN SUPPORT OF HIS POSITION ON INTERIM RETIREMENTS. WHAT IS YOUR GENERAL RESPONSE TO THIS TESTIMONY?

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

Q. DO YOU AGREE WITH MR. SPANOS THAT IT IS "MANDATORY" TO INCLUDE INTERIM RETIREMENTS ACCORDING TO THE *PUBLIC UTILITY DEPRECIATION PRACTICES* MANUAL?

A. No. In support of his position regarding interim retirements, Mr. Spanos cites[19] a portion of *Public Utility Depreciation Practices*,[20] and describes this excerpt as "mandatory

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[18] *See generally* Direct Testimony of John J. Spanos pp. 9-12.

[19] Direct Testimony of John J. Spanos, pp. 9-10.

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

language." Of course, this treatise is not binding the Commission, and should not be described as "mandatory" in this context.

Q. DO YOU AGREE WITH MR. SPANOS THAT THE UNIFORM SYSTEM OF ACCOUNTS REQUIRES THAT INTERIM RETIREMENTS BE INCLUDED IN DEPRECIATION?

A. No. Mr. Spanos argues that the Uniform System of Accounts "requires" that interim retirements be included in depreciation.[21] This is a questionable assertion, as it inherently suggests that for more than 25 years, the Commission has consistently rendered decisions that have not been in accordance with the Uniform System of Accounts. This cannot be right. The specific provision at issue is General Instruction 22.A, which simply states that "[u]tilities must use a method of depreciation that allocates in a systematic and rational manner the service value of depreciable property over the service life of the property."[22] In this context, the "method of depreciation," refers to the method of allocation, such as the straight-line method, which is employed by the vast majority of depreciation analysts and accountants. I am not aware of any decision rendered by this Commission (or any other utility commission), that has been at odds with this basic accounting standard. Furthermore, this provision does not relate to interim retirements, and should not be construed as to "require" the Commission to deviate from its well-established precedent. As with the treatise discussed above which Mr. Spanos mischaracterized as "mandatory," he has also mischaracterized Instruction 22.A as "requiring" the Commission to take a particular course of action. Regardless, there is nothing about the Commission precedent regarding interim retirements that is at odds with the Uniform System of Accounts. To my knowledge, the Commission has consistently applied depreciation rates calculated under the straight-line allocation method, which is consistent with the standards outlined in Instruction 22.A.

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[21] Direct Testimony of John J. Spanos, p. 10:19-24.

[22] Uniform System of Accounts, General Instruction 22(A).

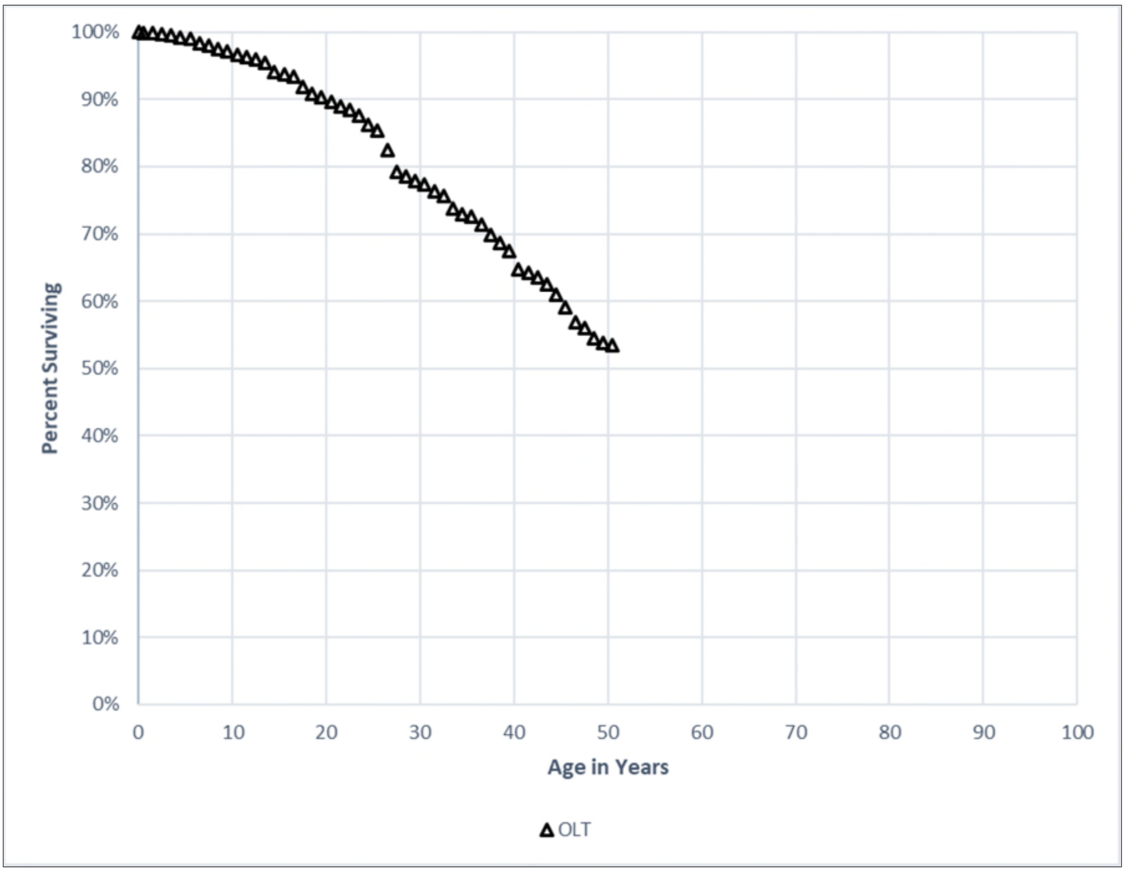
Q. EVEN IF THE COMMISSION WANTED TO DEVIATE FROM ITS PRECEDENT REGARDING INTERIM RETIREMENTS, DOES THIS CASE PROVIDE A GOOD SITUATION IN WHICH TO DO SO?

A. No. In my opinion, this case would be the least ideal case for the Commission to deviate from its precedent of excluding interim retirements, for two reasons. First, EPE does not have sufficient interim retirement history to establish a meaningful estimate of interim retirement rates for the Montana units. Second, the depreciation rates for the remainder of EPE's production units (i.e., the units not included in this case), are based on the exclusion of interim retirements. Thus, it would be especially inconsistent to include interim retirements for only one of the Company's production plants, which excluding them for the other plants. If the Commission wants to deviate from its precedent of excluding interim retirements, at the very least, it should consider that decision in the context of a full depreciation study that includes sufficient interim retirement history.

Q. PLEASE EXPLAIN AND ILLUSTRATE HOW EPE HAS INSUFFICIENT RETIREMENT DATA TO ESTABLISH MEANINGFUL INTERIM RETIREMENT ESTIMATES IN THIS CASE.

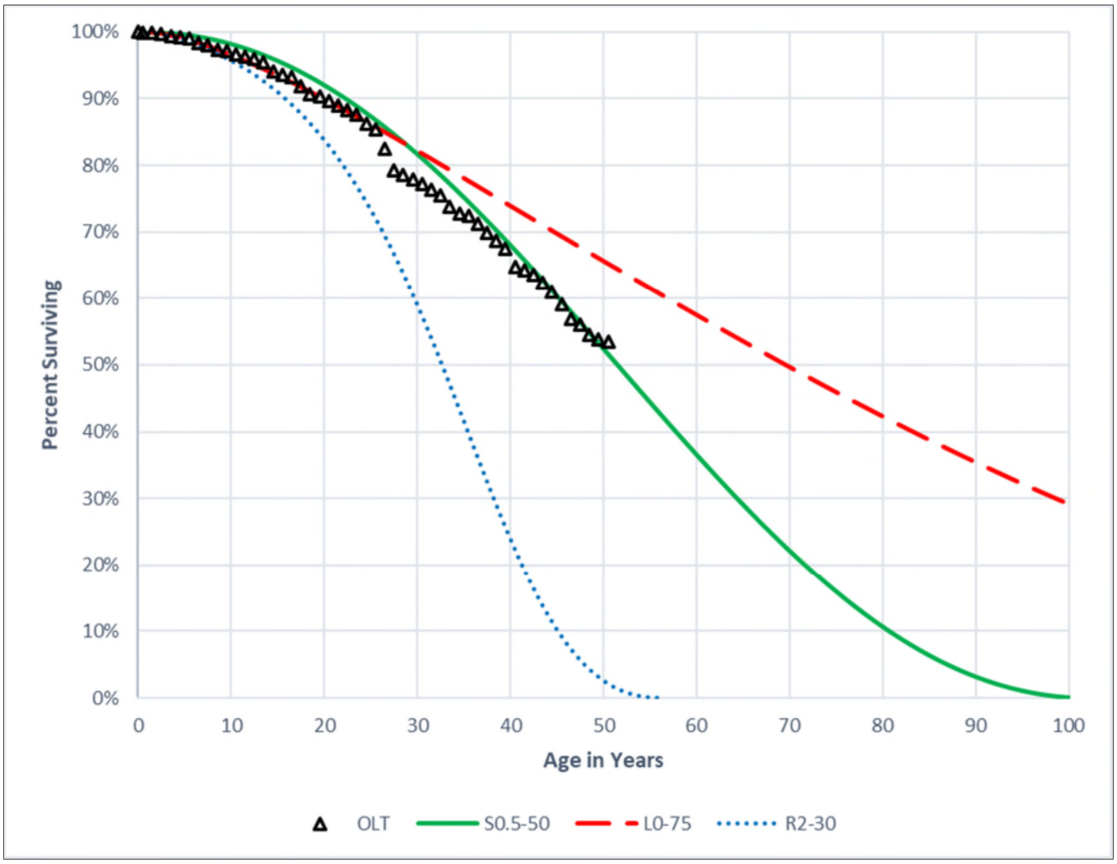
A. Estimates of interim retirement rates are based on Iowa curve-fitting analysis. This type of analysis considers the historical retirement pattern for a particular group of assets (i.e., an account), and attempts to predict the retirement rate going forward by using an empirically-derived set of survivor curves called "Iowa Curves." Analysts use a utility's historical property data and create an observed life table ("OLT") for each account. The data points on the OLT can be plotted to form a curve (the "OLT curve"). The OLT curve is not a theoretical curve, rather, it is actual observed data from the Company's records that indicate the rate of retirement for each property group. An OLT curve by itself, however, is rarely a smooth curve, and is often not a "complete" curve (i.e., it does not end at zero percent surviving). To calculate average life (the area under a curve), a complete survivor curve is required. The Iowa curves are empirically-derived curves based on the extensive studies of the actual mortality patterns of many different types of industrial property. The curve-fitting process involves selecting the best Iowa curve to fit the OLT curve. This can be accomplished through a combination of visual and mathematical curve-fitting techniques, as well as professional judgment. For interim retirement curves in production accounts, the Iowa curve is usually "truncated" at the expected retirement year of the production unit, since all assets comprising the production unit will be retired concurrently. The following chart illustrates a basic, example OLT curve.

Figure 4:
Example OLT Curve



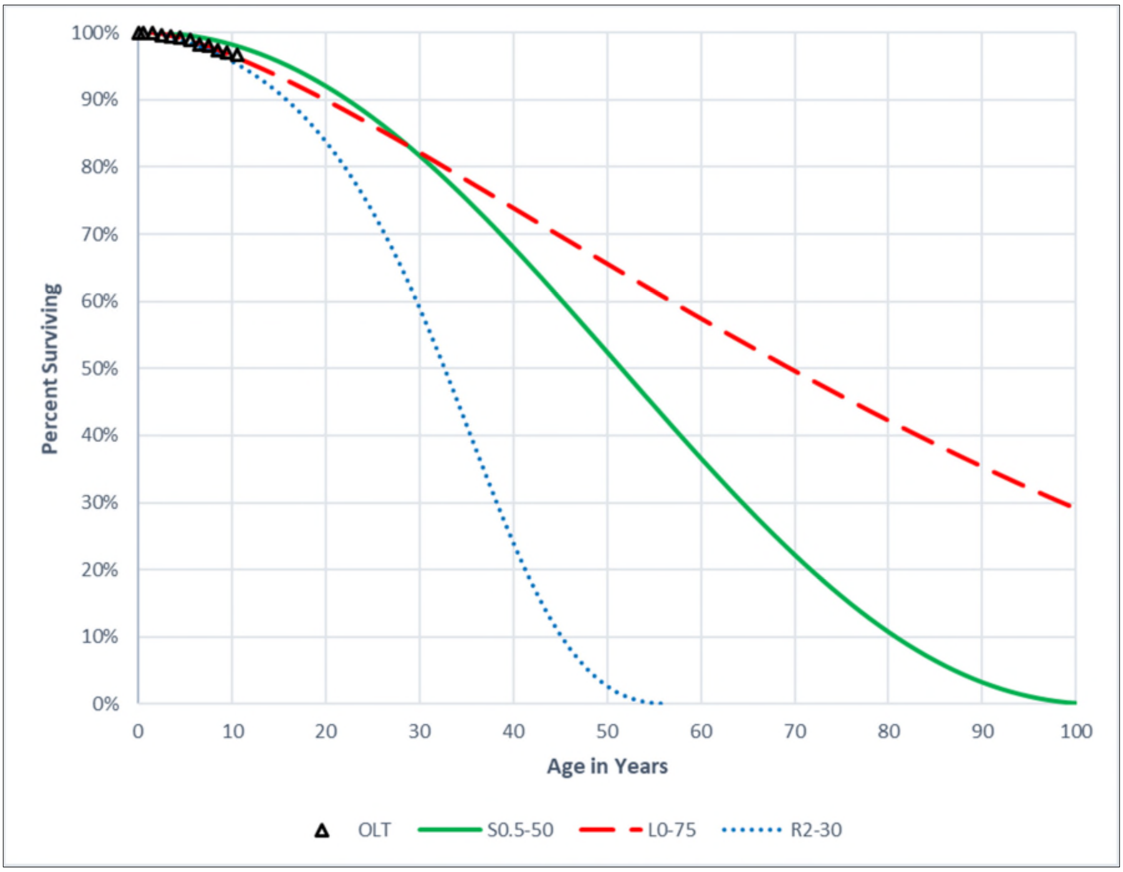
In this chart, the black triangles comprising the OLT curve represent historical data. However, the data only reaches about 50% surviving. Like many OLT curves, this OLT curve is not complete because it does not reach zero percent surviving. However, this OLT curve is "long" enough to give the analyst a sufficient retirement history upon which to conduct the Iowa curve-fitting process. We can use Iowa curves to smooth and complete the data in order to calculate average life and the ultimate depreciation rate for this hypothetical account. The graph below shows the same OLT curve along with three potential Iowa curve selections, the R2-30 curve, the S0.5-50 curve, and the L0-75 curve.

Figure 5:
Same OLT Curve with Three Iowa Curves



While mathematical curve fitting is often used in the curve-fitting process, mere visual curve fitting in this basic example is all that is required to see that the S0.5-50 curve provides the best fit to the observed data. However, if there is inadequate or nonexistent historical data, we cannot use the Iowa curve-fitting process to reveal reliable indications of remaining life. The graph below shows the same OLT curve, but only up to 10 years of age, and about 96% surviving (as opposed to 50% surviving in the charts above).

Figure 6:
Insufficient OLT Curve



As shown in this chart, it is not useful to attempt the curve-fitting process on inadequate OLT curves. In this example, all three Iowa curves provide close fits to the observed data, even though there are substantial differences in the curve shapes and average lives.

Q. IN THIS CASE, IS THERE SUFFICIENT HISTORICAL DATA FOR THE MONTANA PLANT TO PROVIDE ACCURATE INDICATIONS OF REMAINING LIFE FOR INTERIM RETIREMENTS?

A. No. There is insufficient data for the Montana generating units to conduct a reliable Iowa curve-fitting analysis for interim retirements. Thus, as discussed above, even if the Commission were to consider reversing its long-held precedent of excluding interim retirements, this would not be a good case in which to do it because the Company is not able to adequately support its interim retirement curve recommendations due to insufficient retirement history.

Q. HAVE YOU PROPOSED INTERIM RETIREMENT CURVES IN OTHER JURISDICTIONS?

A. Yes. In jurisdictions that allow interim retirements, I have included my own proposals for such retirements in response to utility depreciation studies that propose interim retirements. Thus, I do not think it is "wrong" to include interim retirements in the determination of depreciation rates for production units from a technical standpoint. Unlike Mr. Spanos, however, I do not think it is unreasonable for Texas to exclude interim retirements. Moreover, unlike Mr. Spanos, I do not believe the Commission has been violating various mandatory provisions for more than 25 years by choosing to exclude interim retirements from life span depreciation rates. The Company has not offered a compelling reason for the Commission to deviate from its long-held precedent.

Q. HAS THE COMPANY INCURRED FINANCIAL HARM AS A RESULT OF THE EXCLUSION OF INTERIM RETIREMENTS?

A. No. The Commission has been excluding interim retirements for more than 25 years, which has given us adequate time to observe that Texas utilities have not suffered financial harm as a direct result of the exclusion of interim retirements. There are several ways to assess the overall financial health of a company. Value Line provides good financial summaries on many companies, including EPE. According to Value Line's most recent report, EPE received positive financial strength ratings. More specific to depreciation, the Company has reported generally increasing cash flows per share over the past 15 years.[23] Looking forward, Value Line expects positive cash flow, earnings, and dividend growth over the next five years. In fact, Mr. Spanos does not appear to argue that EPE will incur any type of unfairness or financial hardship if the Commission continues to exclude interim retirements. Rather, Mr. Spanos generally centers his arguments in support of interim retirements on the notion that various "authoritative"[24] sources "require"[25] that interim

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[23] Value Line Investment Survey, EPE Report (April 28, 2017), attached hereto as Exhibit DJG-7.

[24] Direct Testimony of John J. Spanos pp. 9:19, 15:4, 22:9.

[25] *Id*. at 9:10, 10:21-23, 11:10, 11:16-19, 22:3.

retirements "must"[26] be included and that the Commission's failure to do so "violates"[27] these "mandatory"[28] principles. As discussed above, these arguments are misleading and unfounded because none of the sources cited by Mr. Spanos are mandatory or binding authority on the Commission's ability to make ratemaking decisions, such as the decision to exclude interim retirements. In addition, Mr. Spanos asserts that future ratepayers will be harmed if interim retirements are excluded, resulting in intergenerational inequity.[29]

Q. DO YOU AGREE WITH MR. SPANOS THAT INTERGENERATIONAL INEQUITY WILL OCCUR IF THE COMMISSION EXCLUDES INTERIM RETIREMENTS IN THIS CASE?

A. No. In general, I do not subscribe to the "intergenerational inequity" narrative routinely offered by utility depreciation witnesses, and I do not subscribe to it in this case either. In this case particularly, intergenerational inequity will not result if the Commission continues its disallowance in interim retirements because it has been consistently doing so for more than 25 years. In other words, today's current customers were once the "future" customers that utility witnesses are often so concerned about. According to Mr. Spanos, excluding interim retirements results I higher depreciation rates in "later" years and this occurs "earlier generations of customers do not pay their fair share."[30] If that it is true, then current customers have actually been paying more than their "fair share" on older plant (i.e., current customers were formerly "future" customers). Thus, according to this theory, if the Commission decides to disallow interim retirements in this case, current customers will be treated unfairly because they have been paying more than their "fair share" on older plant, and will not receive the same benefit of interim retirement exclusion on new plant as did earlier generations of customers. In other words, because the Commission has been consistently disallowing interim retirements for over 25 years, there could actually be

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[26] *Id*. at 10:4, 14:24, 22:10

[27] *Id*. at 13:30, 17:13.

[28] *Id*. at 10:3.

[29] *Id*. at 17:10.

[30] *Id*. at 21:20-23.

inequities imposed on current customers if interim retirements are suddenly included in this case.

Q. DESCRIBE THE COMPANY'S RECOMMENDATIONS REGARDING NET SALVAGE FOR PRODUCTION PLANT.

A. Net salvage refers to the value received for an asset when it is retirement, less the cost to remove the asset from service. In this case, Mr. Spanos estimated net salvage rates for both interim and terminal retirements, and calculated a weighted net salvage rate for each production account. The concept of interim retirements is discussed above. Terminal retirements refer to the final demolition of the production unit.

Q. ARE YOU PROPOSING ANY ADJUSTMENTS TO THE COMPANY'S PROPOSED NET SALVAGE RATES FOR ITS PRODUCTION ACCOUNTS?

A. Yes. I am actually proposing a slight decrease to the Company's overall weighted net salvage rate proposals (i.e., a higher overall negative net salvage rate that results in an increasing effect on depreciation rates and expense). To be consistent with my recommendation to exclude interim retirements, I also excluded interim retirements from the weighted net salvage calculation. This means I gave a 100% weighting to the terminal net salvage component proposed by Mr. Spanos.[31] Because the total terminal net salvage component is less than the total interim net salvage component, adding additional weight to the terminal component increased the total negative net salvage rate estimates, resulting otherwise higher depreciation rates.[32]

Q. DID EPE PROVIDE ANY DECOMMISSIONING STUDIES IN THIS CASE TO SUPPORT ITS PROPOSED TERMINAL NET SALVAGE ESTIMATES?

A. No. Requests for terminal net salvage involving a dismantlement component should be supported by site-specific decommissioning studies (aka, "demolition studies" or "dismantlement studies"). In this case, the Company did not provide such site-specific demolition studies; instead, EPE merely relied upon "studies for comparable facilities," yet

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[31] *See* Exhibit DJG-6.

[32] *See* Exhibit JJS-2, Table 2 (p. 16 of 30); *compare with* Exhibit DJG-6.

did not provide these studies to the Commission.[33] Even if the Company had provided these studies, they would have been of little value to the Commission because they would not be related to EPE's production facilities.

Q. ARE YOU RECOMMENDING DISALLOWANCE OF THE COMPANY'S PROPOSED TERMINAL NET SALVAGE RATES?

A. No. While the Company has arguably failed to meet its burden of proof on this issue, I am not recommending disallowance of any of the Company's proposed terminal net salvage in this case in the interest of being reasonable and because the Montana units are relatively new. Removing the Company's proposed terminal net salvage from the depreciation rate calculation would have resulted in an additional adjustment of about $421,000.[34] However, the Commission should instruct EPE to file complete decommissioning studies on all of its generating units in its next rate case.

VI. CONCLUSION AND RECOMMENDATION

Q. SUMMARIZE THE KEY POINTS OF YOUR TESTIMONY.

A. I employed a well-established depreciation system in order to develop reasonable depreciation rates in this case. The Company did not offer a compelling reason for the Commission to deviate from a long-held precedent that excludes interim retirements from the calculation of depreciation rates for production units. The Company's arguments in support of the inclusion of interim retirements center on the erroneous notion that various secondary and non-binding sources require the Commission to include interim retirements. The Company's arguments necessarily suggest that the Commission has been "violating" these non-binding sources for more than 25 years, which is simply not the case. Furthermore, the Company has insufficient retirement history upon which to conduct a reliable analysis using interim survivor curves. Thus, even if the Commission was

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[33] *See* EPE's Response to City's RFI CEP 1-23 (when asked to provide all decommissioning studies relied upon for support of any terminal net salvage requested in this case, the Company simply provided a one-page sheet with supposed "common values for similar facilities," but did not actually provide these studies as part of the response; *see also* Direct Testimony of John J. Spanos, p. 24:4-5.

[34] *See* Exhibit DJG-5 (the total net salvage accrual rate for the Montana units in the data [12] column amounts to $420,928).

persuaded to deviate from its precedent, it would be much better to consider this course of action in case that included sufficient and reliable interim retirement history. Additionally, the Company arguably did not provide adequate support for its terminal net salvage rates, which included a dismantlement component based on studies that were not made available to the Commission. While I am not recommending a disallowance of the Company's proposed terminal net salvage rates in this case, the Commission should instruct EPE to file complete, site-specific dismantlement studies for all of its production units in its next rate case.

Q. WHAT IS CITY'S RECOMMENDATION TO THE COMMISSION REGARDING EPE'S DEPRECIATION RATES?

A. City recommends that the Commission adopt the proposed depreciation rates presented in Exhibit DJG-4, which results in an adjustment reducing the Company's proposed annual depreciation accrual by $1.9 million.[35]

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, including any exhibits, appendices, and other items attached hereto. To the extent I did not address an opinion expressed by the Company, it does not constitute an agreement with such opinion.

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[35] *See* Exhibit DJG-4. These depreciation rates should be applied to the appropriate plant balances in order to determine the exact depreciation expense charged to ratepayers.

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 <u>method</u> of allocation; 2) a <u>procedure</u> for applying the method of allocation to a group of property; 3) a <u>technique</u> for applying the depreciation rate; and 4) a <u>model</u> 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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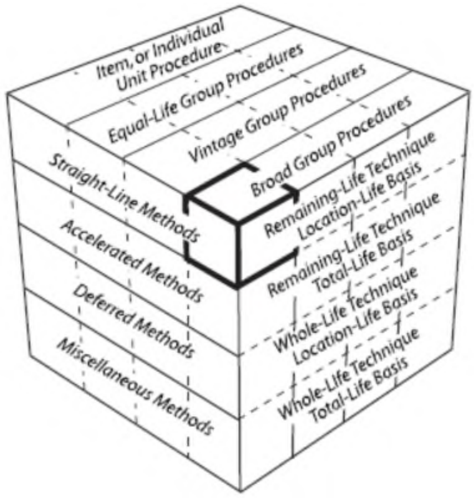
[36] Wolf *supra* n. 7, at 69-70.

[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 7:
The Depreciation System Cube



1. <u>Allocation Methods</u>

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

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 property has a

[42] *Id*. at 57.

[43] *Id*. at 56.

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

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. Application Techniques

The third factor of a depreciation system is the "technique" for applying the depreciation rate. There are two commonly used techniques: "whole life" and "remaining life." The whole life technique applies the depreciation rate on the estimated average service life of group, while the remaining life technique seeks to recover undepreciated costs over the remaining life of the plant.[50]

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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*.

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

In choosing the application technique, consideration should be given to the proper level of the accumulated depreciation account. Depreciation accrual rates are calculated using estimates of service life and salvage. Periodically these estimates must be revised due to changing conditions, which cause the accumulated depreciation account to be higher or lower than necessary. Unless some corrective action is taken, the annual accruals will not equal the original cost of the plant at the time of final retirement.[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 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]

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

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

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.

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. Analysis Model

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

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[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).

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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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 to develop the

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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).

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*.

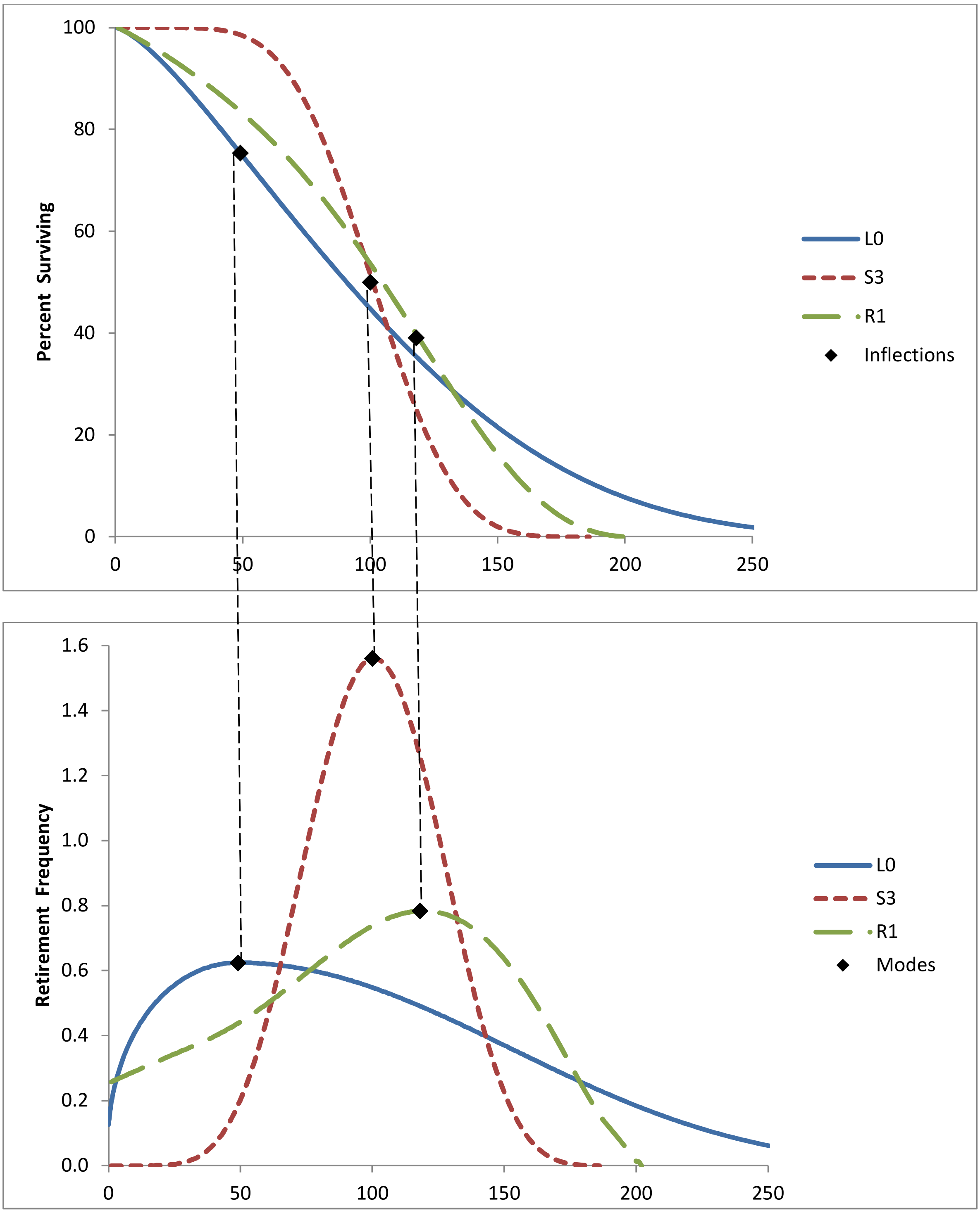
2. Classification

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.

[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 8:
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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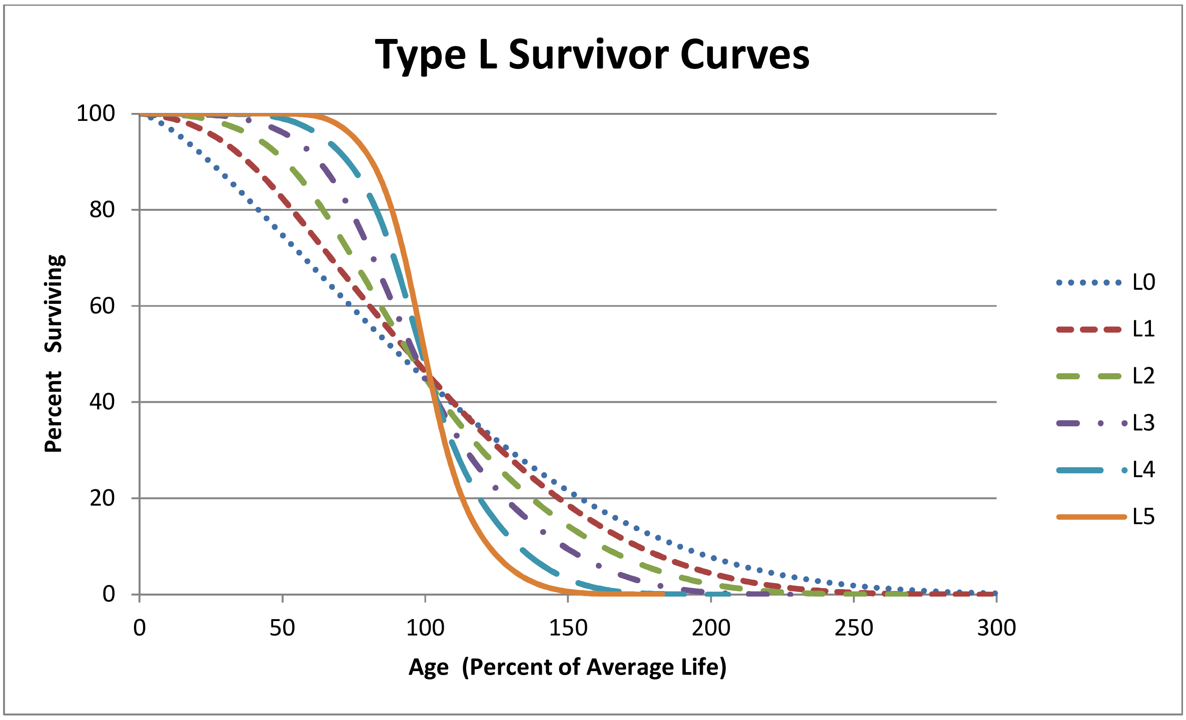
[66] Winfrey, *Bulletin 125: Statistical Analyses of Industrial Property Retirements* 60, Vol. XXXIV, No. 23 (Iowa State College of Agriculture and Mechanic Arts 1935).

Figure 9:
Type L Survivor and Frequency Curves



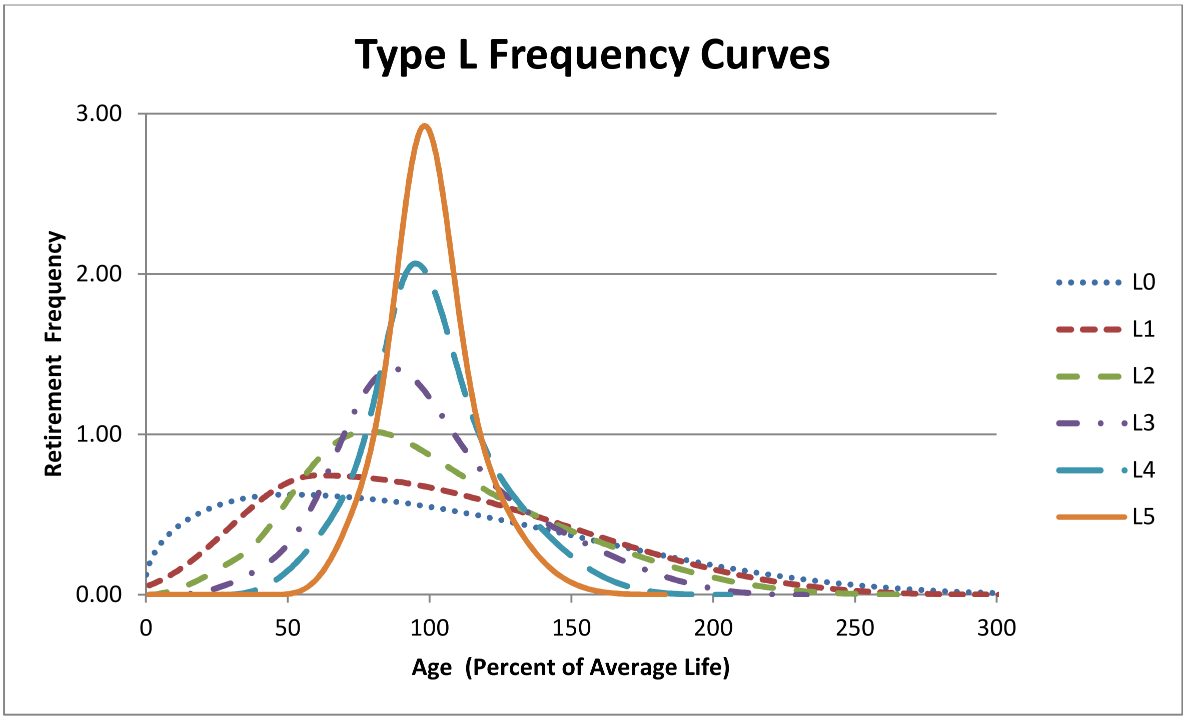
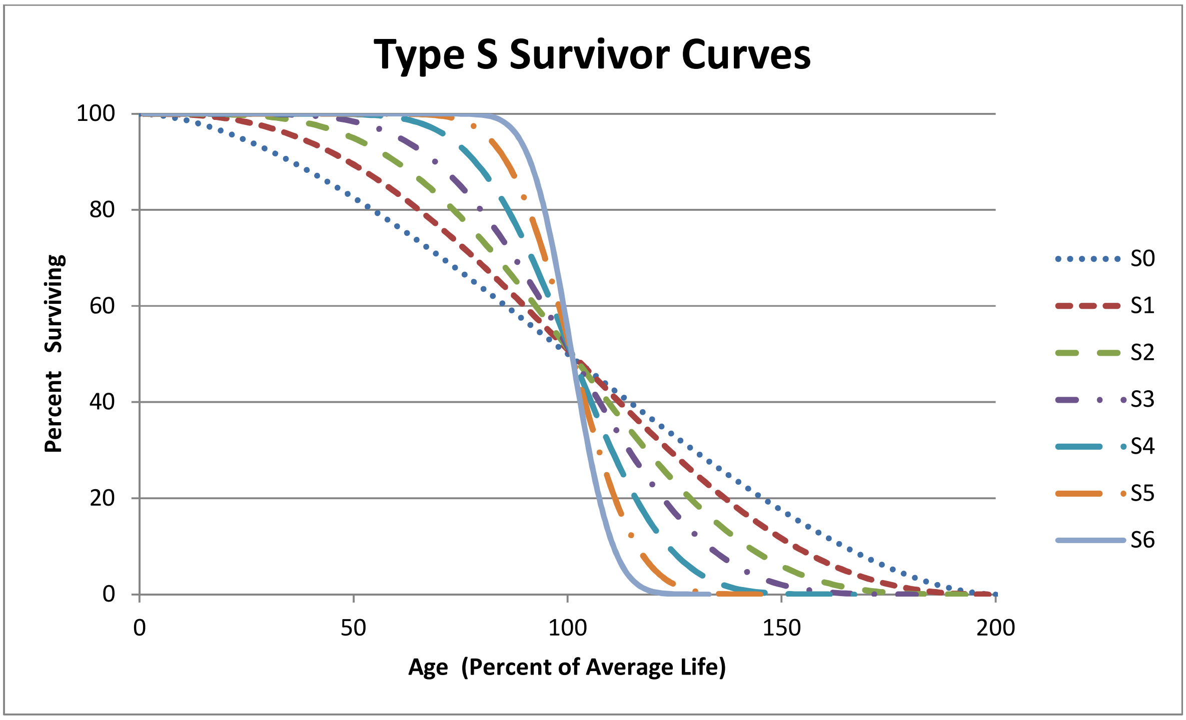


Figure 10:
Type S Survivor and Frequency Curves



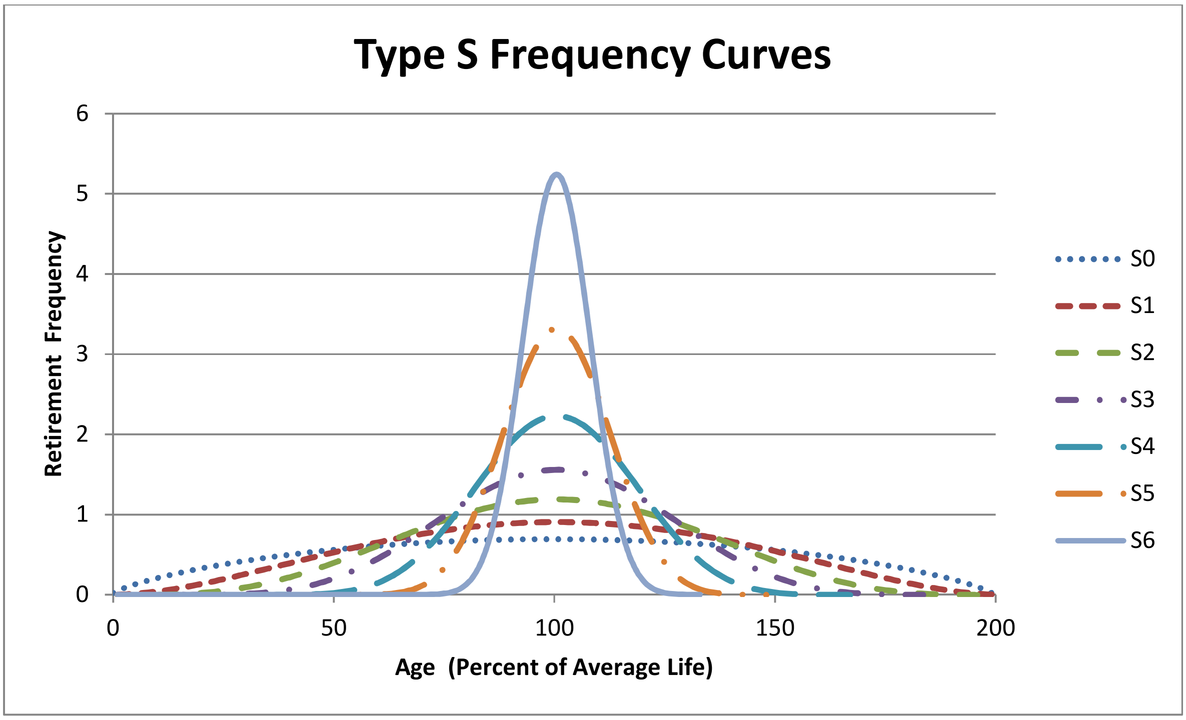
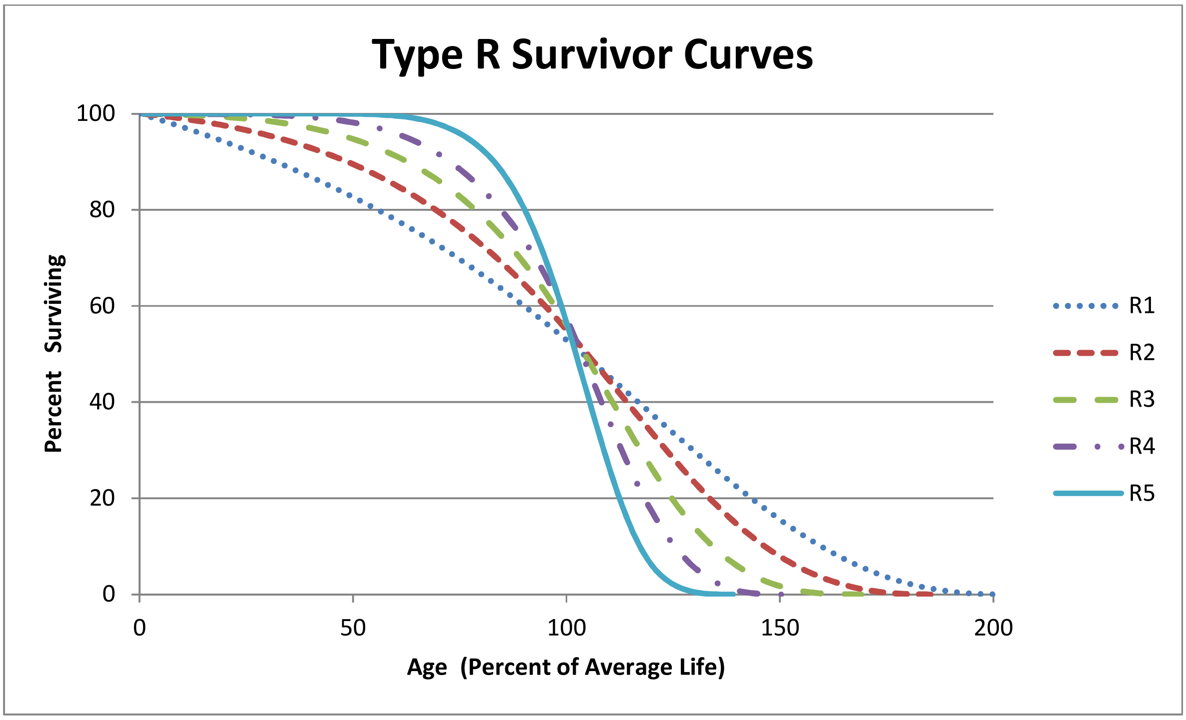
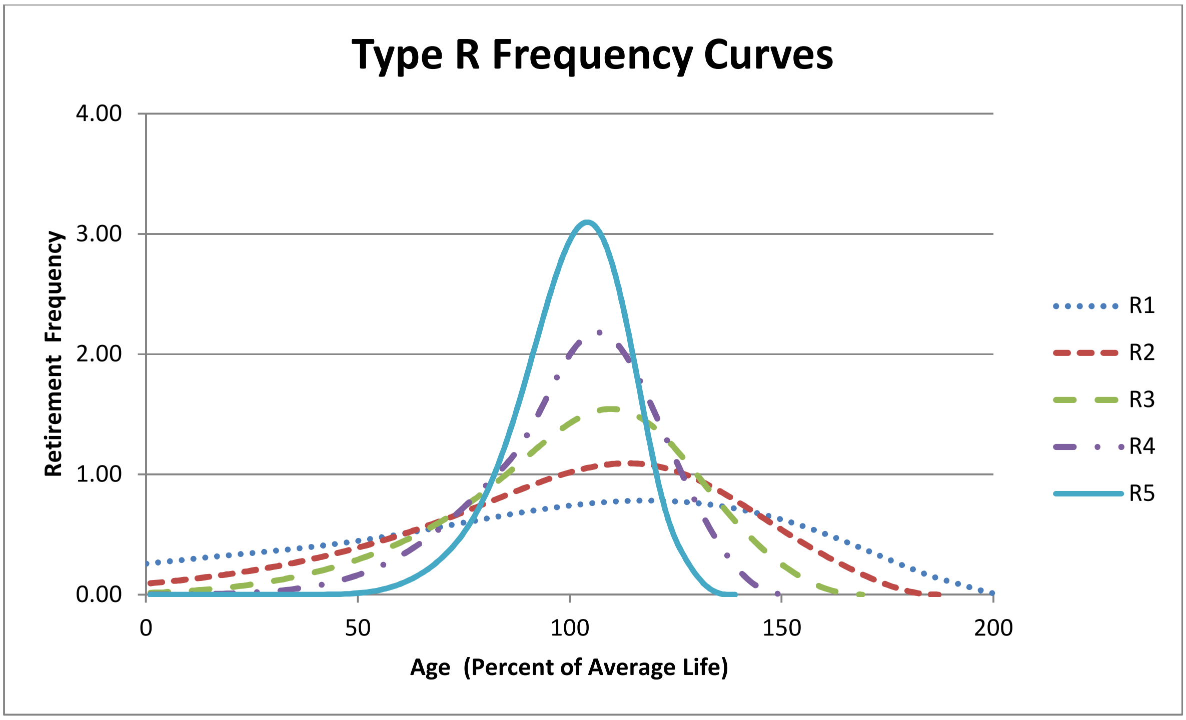


Figure 11:
Type R Survivor and Frequency Curves





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.

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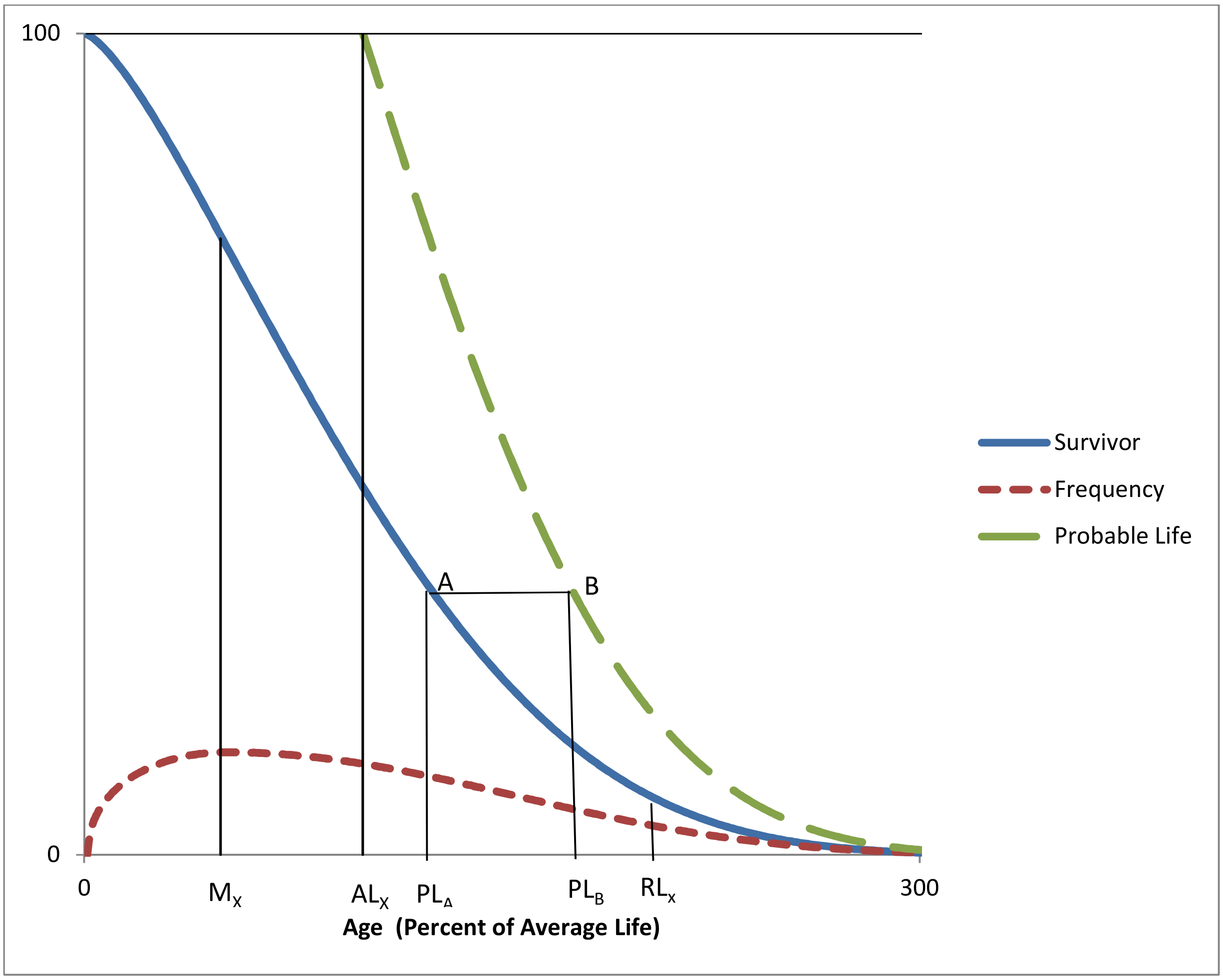
69 *Id*. at 73.

70 *Id*. at 74.

Figure 12:
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 coincidence

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

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.

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 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 13:
Forces of Retirement

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

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

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

units; 2) the association of costs with such units; and 3) the dates of installation and removal of plant. Since actuarial analysis includes the examination of historical data to forecast future retirements, the historical data used in the analysis should not contain events that are anomalous or unlikely to recur.[73] Historical data is used in the retirement rate actuarial method, which is discussed further below.

<u>The Retirement Rate Method</u>

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, which shows the exposures

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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).

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 14:
Exposure Matrix

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

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 15:
Retirement Matrix

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

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

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

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 16:
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			

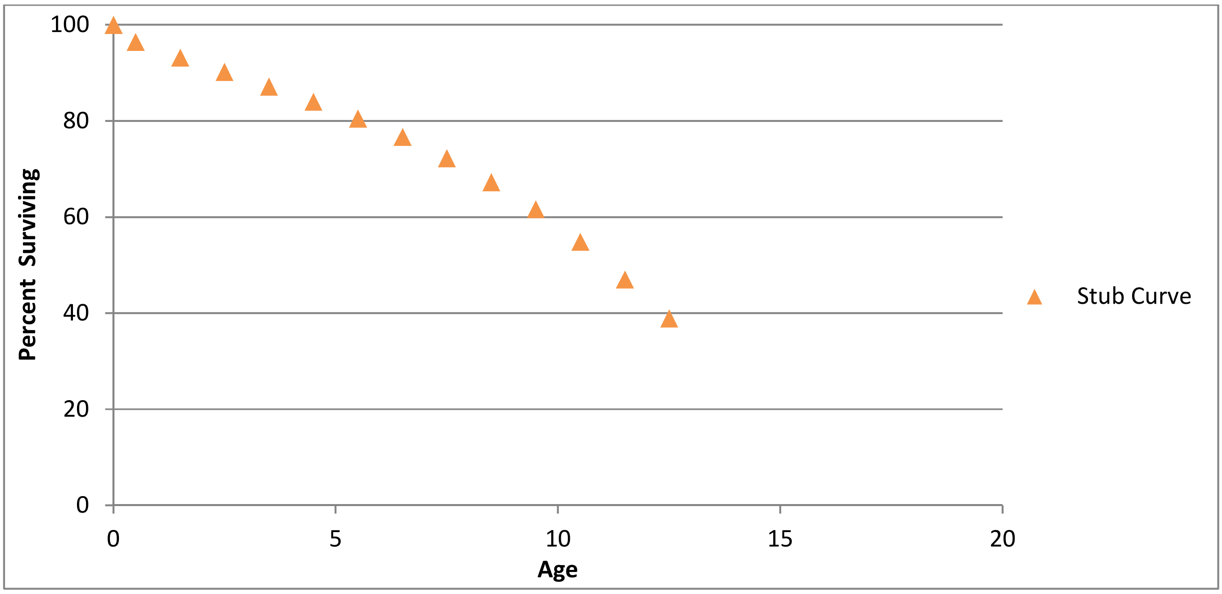
Column F on the right shows the percentages surviving at the beginning of each age interval. This column starts at 100% surviving. Each consecutive number below is calculated by multiplying the percent surviving from the previous age interval by the corresponding survivor ratio for that age interval. 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 17:
Original "Stub" Survivor Curve



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

<u>Banding</u>

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

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

79 *Id*.

Figure 18:
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 dilemma. A

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

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 19:
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 property is

[82] *Id*.

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.

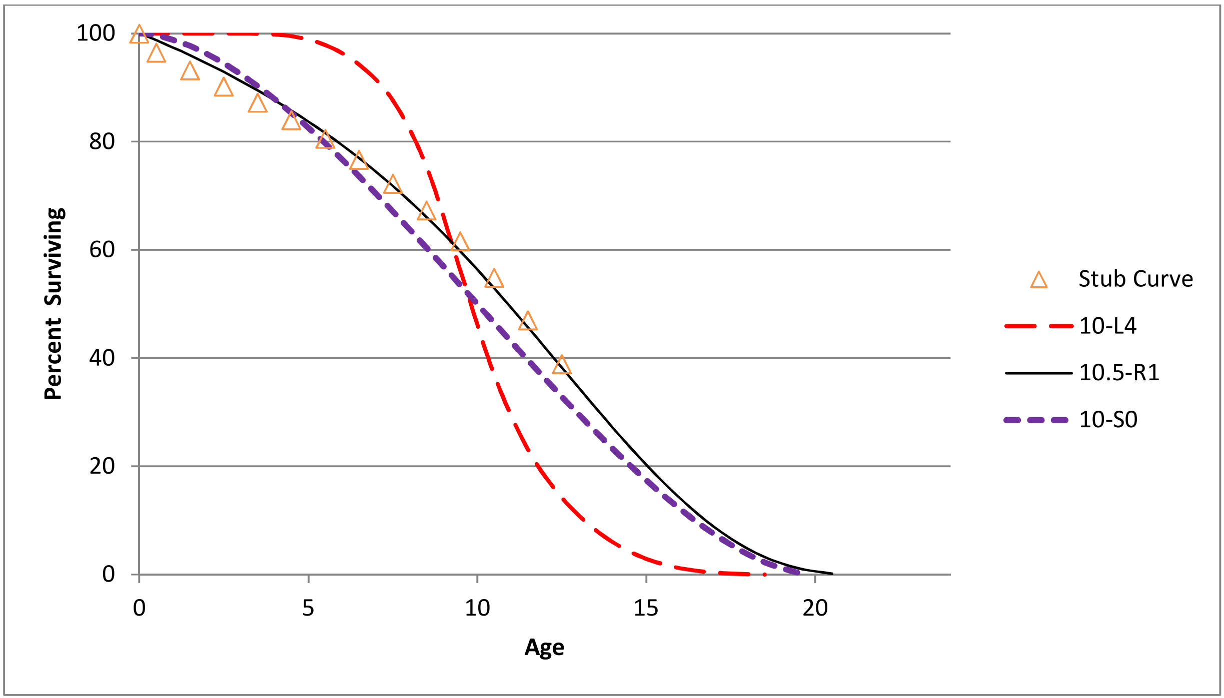
Curve Fitting

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 20:
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 21:
Mathematical Fitting

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

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

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Resolve Utility Consulting PLLC — Oklahoma City, OK
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PUBLICATIONS

American Indian Law Review — Norman, OK
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(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
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	3/13/2017
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	160-159-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

Utility Regulatory Proceedings

State	Regulatory Agency / Company-Applicant	Docket Number	Testimony / Analysis Issues	Type	Date
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
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	PUD 201200185	Gas transportation contract extension	Pre-filed	9/20/2012

Utility Regulatory Proceedings

State	Regulatory Agency / Company-Applicant	Docket Number	Testimony / Analysis Issues	Type	Date
	Oklahoma Gas & Electric Co.			Live	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

Summary Rate and Accrual Adjustment

Plant Function	Current Rates	Current Accrual	EPE Proposal Rates	EPE Proposal Accrual	City Proposal Rates	City Proposal Accrual	City Adjustment Rates	City Adjustment Accrual
Gas Turbine								
Montana Power Plant	2.22%	$ 8,379,716	2.79%	$ 10,544,917	2.29%	$ 8,647,656	-0.50%	$ (1,897,261)
General								
Account 390	1.27%	1,300,927	2.03%	2,074,700	2.03%	2,074,700	0.00%	-
Total		$ 9,680,643		$ 12,619,617		$ 10,722,356		**$ (1,897,261)**

Detailed Expense Adjustment
(Montana Plant Only)

		[1]	[2]		[3]		[4]	
			EPE'S REQUESTED TEST YEAR		CITY'S PROPOSAL		CITY'S ADJUSTMENT	
Account No.	Description	Plant 9/30/2016	Rate	Depreciation Expense	Rate	Depreciation Expense	Rate	Depreciation Expense
	MONTANA POWER PLANT							
	Montana Power Unit 1							
341.00	Structures and Improvements	17,899,881	2.39%	427,807	2.29%	410,290	-0.10%	(17,517)
342.00	Fuel Holders, Producers, and Accessories	58,684	2.46%	1,444	2.30%	1,347	-0.16%	(97)
343.00	Prime Movers	53,635,257	2.96%	1,587,604	2.28%	1,222,675	-0.68%	(364,929)
344.00	Generators	4,453,465	2.68%	119,353	2.37%	105,432	-0.31%	(13,921)
345.00	Accessory Electrical Equipment	2,304,518	2.60%	59,917	2.29%	52,694	-0.31%	(7,223)
346.00	Miscellaneous Power Plant Equipment	278,999	2.52%	7,031	2.29%	6,394	-0.23%	(637)
	Total Unit 1	78,630,804	2.80%	2,203,156	2.29%	1,798,832	-0.51%	(404,324)
	Montana Power Unit 2							
341.00	Structures and Improvements	17,835,782	2.39%	426,275	2.29%	408,987	-0.10%	(17,288)
342.00	Fuel Holders, Producers, and Accessories	73,845	2.46%	1,817	2.30%	1,695	-0.16%	(122)
343.00	Prime Movers	50,230,578	2.96%	1,486,825	2.28%	1,145,178	-0.68%	(341,647)
344.00	Generators	4,518,954	2.68%	121,108	2.37%	106,933	-0.31%	(14,175)
345.00	Accessory Electrical Equipment	2,319,983	2.60%	60,320	2.29%	53,159	-0.31%	(7,161)
346.00	Miscellaneous Power Plant Equipment	286,229	2.52%	7,213	2.30%	6,572	-0.22%	(641)
	Total Unit 2	75,265,371	2.79%	2,103,558	2.29%	1,722,524	-0.51%	(381,034)
	Montana Power Unit 3							
341.00	Structures and Improvements	14,057,148	2.40%	337,372	2.30%	323,344	-0.10%	(14,028)
343.00	Prime Movers	50,466,834	2.98%	1,503,912	2.30%	1,161,845	-0.68%	(342,067)
344.00	Generators	4,533,708	2.60%	117,876	2.30%	104,151	-0.30%	(13,725)
345.00	Accessory Electrical Equipment	2,305,511	2.61%	60,174	2.30%	52,964	-0.31%	(7,210)
346.00	Miscellaneous Power Plant Equipment	245,497	2.52%	6,187	2.30%	5,641	-0.22%	(546)
	Total Unit 3	71,608,698	2.83%	2,025,521	2.30%	1,647,945	-0.53%	(377,576)
	Montana Power Unit 4							
341.00	Structures and Improvements	14,295,206	2.42%	345,944	2.32%	331,055	-0.10%	(14,889)
343.00	Prime Movers	49,277,670	3.00%	1,478,330	2.32%	1,141,194	-0.68%	(337,136)
344.00	Generators	4,506,950	2.62%	118,082	2.32%	104,374	-0.30%	(13,708)
345.00	Accessory Electrical Equipment	1,807,757	2.63%	47,544	2.32%	41,865	-0.31%	(5,679)
346.00	Miscellaneous Power Plant Equipment	242,926	2.54%	6,170	2.32%	5,638	-0.22%	(532)
	Total Unit 4	70,130,509	2.85%	1,996,070	2.32%	1,624,126	-0.53%	(371,944)
	Montana Power Common							

Detailed Expense Adjustment
(Montana Plant Only)

Exhibit DJG-3

		[1]	[2]		[3]		[4]	
			EPE'S REQUESTED TEST YEAR		CITY'S PROPOSAL		CITY'S ADJUSTMENT	
Account No.	**Description**	**Plant 9/30/2016**	**Rate**	**Depreciation Expense**	**Rate**	**Depreciation Expense**	**Rate**	**Depreciation Expense**
341.00	Structures and Improvements	12,747,423	2.35%	299,564	2.25%	286,456	-0.10%	(13,108)
342.00	Fuel Holders, Producers, and Accessories	15,155,162	2.47%	374,333	2.30%	348,216	-0.17%	(26,117)
343.00	Prime Movers	39,548,415	2.96%	1,170,633	2.27%	895,902	-0.69%	(274,731)
344.00	Generators	3,084,944	2.56%	78,975	2.24%	69,123	-0.32%	(9,852)
345.00	Accessory Electrical Equipment	10,031,597	2.58%	258,815	2.25%	226,045	-0.33%	(32,770)
346.00	Miscellaneous Power Plant Equipment	1,261,756	2.47%	31,165	2.26%	28,489	-0.21%	(2,676)
347.00	Asset Retirement Obligation	189,335		-		-	0.00%	-
	Total Common	82,018,632	2.70%	2,213,485	2.26%	1,854,230	-0.44%	(359,255)
	Total Montana Plant	377,654,014	2.79%	10,541,790	2.29%	8,647,656	-0.50%	(1,894,134)

[1] From Company Depreciation Study

[2] From Schedule D-04.

[3] From Rate Development exhibit (some unadjusted rates and accruals are hard coded to match Company's to account for rounding discrepancies)

[4] = [3] - [2]

Detailed Rate Comparison

		[1]			[2]				[3]			[4]
			EPE'S PROPOSAL				CITY'S PROPOSAL				Difference	
			Iowa Curve			Annual	Iowa Curve			Annual		Annual
Account No.	Description	Original Cost 9/30/2016	Type	AL	Rate	Accrual	Type	AL	Rate	Accrual	Rate	Accrual
	GAS TURBINE PLANT											
341.00	STRUCTURES AND IMPROVEMENTS											
	MONTANA POWER STATION UNIT 1	17,899,881	S2.5	60	2.39%	428,171	SQ		2.29%	410,290	-0.10%	(17,881)
	MONTANA POWER STATION UNIT 2	17,835,782	S2.5	60	2.39%	426,811	SQ		2.29%	408,987	-0.10%	(17,824)
	MONTANA POWER STATION UNIT 3	14,057,148	S2.5	60	2.40%	337,344	SQ		2.30%	323,344	-0.10%	(14,000)
	MONTANA POWER STATION UNIT 4	14,295,206	S2.5	60	2.42%	345,389	SQ		2.32%	331,055	-0.10%	(14,334)
	MONTANA POWER STATION COMMON	12,748,374	S2.5	60	2.35%	300,091	SQ		2.25%	286,478	-0.10%	(13,613)
	Total 341.00	76,836,391			2.39%	1,837,806			2.29%	1,760,153	-0.10%	(77,653)
342.00	FUEL HOLDERS											
	MONTANA POWER STATION UNIT 1	58,683	R4	45	2.46%	1,445	SQ		2.30%	1,347	-0.16%	(98)
	MONTANA POWER STATION UNIT 2	73,845	R4	45	2.46%	1,819	SQ		2.30%	1,695	-0.16%	(124)
	MONTANA POWER STATION COMMON	15,155,161	R4	45	2.47%	375,022	SQ		2.30%	348,216	-0.17%	(26,806)
	Total 342.00	15,287,689			2.47%	378,286			2.30%	351,258	-0.18%	(27,028)
343.00	PRIME MOVERS											
	MONTANA POWER STATION UNIT 1	53,635,257	S0.5	40	2.96%	1,587,582	SQ		2.28%	1,222,675	-0.68%	(364,907)
	MONTANA POWER STATION UNIT 2	50,230,578	S0.5	40	2.96%	1,486,982	SQ		2.28%	1,145,178	-0.68%	(341,804)
	MONTANA POWER STATION UNIT 3	50,466,834	S0.5	40	2.98%	1,503,016	SQ		2.30%	1,161,845	-0.68%	(341,171)
	MONTANA POWER STATION UNIT 4	49,277,670	S0.5	40	3.00%	1,479,568	SQ		2.32%	1,141,194		
	MONTANA POWER STATION COMMON	39,548,415	S0.5	40	2.96%	1,172,437	SQ		2.27%	895,902	-0.69%	(276,535)
	Total 343.00	243,158,754			2.97%	7,229,585			2.29%	5,566,794	-0.68%	(1,662,791)
344.00	GENERATORS											
	MONTANA POWER STATION UNIT 1	4,453,465	R3	45	2.68%	119,275	SQ		2.37%	105,432	-0.31%	(13,843)
	MONTANA POWER STATION UNIT 2	4,518,954	R3	45	2.68%	120,973	SQ		2.37%	106,933	-0.31%	(14,040)
	MONTANA POWER STATION UNIT 3	4,533,708	R3	45	2.60%	117,951	SQ		2.30%	104,151	-0.30%	(13,800)
	MONTANA POWER STATION UNIT 4	4,506,950	R3	45	2.62%	118,204	SQ		2.32%	104,374	-0.30%	(13,830)
	MONTANA POWER STATION COMMON	3,083,993	R3	45	2.56%	78,829	SQ		2.24%	69,102	-0.32%	(9,727)
	Total 344.00	21,097,070			2.63%	555,232			2.32%	489,992	-0.31%	(65,240)
345.00	ACCESSORY ELECTRIC EQUIPMENT											
	MONTANA POWER STATION UNIT 1	2,304,518	R2.5	45	2.60%	59,853	SQ		2.29%	52,694	-0.31%	(7,159)
	MONTANA POWER STATION UNIT 2	2,319,983	R2.5	45	2.60%	60,246	SQ		2.29%	53,159	-0.31%	(7,087)
	MONTANA POWER STATION UNIT 3	2,305,511	R2.5	45	2.61%	60,137	SQ		2.30%	52,964	-0.31%	(7,173)
	MONTANA POWER STATION UNIT 4	1,807,757	R2.5	45	2.63%	47,542	SQ		2.32%	41,865	-0.31%	(5,677)
	MONTANA POWER STATION COMMON	10,031,597	R2.5	45	2.58%	258,470	SQ		2.25%	226,045	-0.33%	(32,425)
	Total 345.00	18,769,366			2.59%	486,248			2.27%	426,726	-0.32%	(59,522)
346.00	MISCELLANEOUS POWER PLANT EQUIPMENT											
	MONTANA POWER STATION UNIT 1	278,999	S3	45	2.52%	7,021	SQ		2.29%	6,394	-0.23%	(627)

Detailed Rate Comparison

		[1]	[2]				[3]				[4]	
			EPE'S PROPOSAL				CITY'S PROPOSAL				Difference	
Account		Original Cost	Iowa Curve			Annual	Iowa Curve			Annual		Annual
No.	Description	9/30/2016	Type	AL	Rate	Accrual	Type	AL	Rate	Accrual	Rate	Accrual
	MONTANA POWER STATION UNIT 2	286,229	S3	45	2.52%	7,217	SQ		2.30%	6,572	-0.22%	(645)
	MONTANA POWER STATION UNIT 3	245,496	S3	45	2.52%	6,189	SQ		2.30%	5,641	-0.22%	(548)
	MONTANA POWER STATION UNIT 4	242,926	S3	45	2.54%	6,174	SQ		2.32%	5,638	-0.22%	(536)
	MONTANA POWER STATION COMMON	1,261,756	S3	45	2.47%	31,159	SQ		2.26%	28,489	-0.21%	(2,670)
	Total 346.00	2,315,406			2.49%	57,760			2.28%	52,734	-0.22%	(5,026)
	Total Gas Turbine Plant	377,464,676			2.79%	10,544,917			2.29%	8,647,656	-0.50%	(1,897,261)
	General Plant											
390.00	STRUCTURES AND IMPROVEMENTS											
	SYSTEMS OPERATIONS BUILDING	11,067,334	R2.5	80	2.28%	252,004	R2.5	80	2.28%	252,004	0.00%	-
	STATION TOWER	35,112,758	R2.5	80	1.84%	645,202	R2.5	80	1.84%	645,202	0.00%	-
	EASTSIDE OPERATIONS CENTER	40,665,138	R2.5	80	1.78%	722,272	R2.5	80	1.78%	722,272	0.00%	-
	OTHER STRUCTURES	15,589,931	R2.5	80	2.92%	455,222	R2.5	80	2.92%	455,222	0.00%	-
	Total 390.00	102,435,161			2.03%	2,074,700			2.03%	2,074,700	0.00%	-
	TOTAL PLANT STUDIED	**$ 479,899,837**			**2.63%**	**$ 12,619,617**			**2.23%**	**$ 10,722,031**	**-0.40%**	**$ (1,897,261)**

[1] From Company Depreciation Study
[2] From Company Depreciation Study
[3] From Rate Development exhibit (some unadjusted rates and accruals are hard coded to match Company's to account for rounding discrepancies)
[4] = [3] - [2]

Depreciation Rate Development

(SL-AL-RL-BG System)

		[1]	[2]		[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]
Account No.	Description	Original Cost	Iowa Curve Type	AL	Net Salvage	Depreciable Base	Book Reserve	Future Accruals	Remaining Life	Service Life Accrual	Rate	Net Salvage Accrual	Rate	Total Accrual	Rate
	GAS TURBINE PLANT														
341.00	STRUCTURES AND IMPROVEMENTS														
	MONTANA POWER STATION UNIT 1	17,899,881	SQ		-5.0%	18,794,875	619,027	18,175,848	44.3	390,087	2.18%	20,203	0.11%	410,290	**2.29%**
	MONTANA POWER STATION UNIT 2	17,835,782	SQ		-5.0%	18,727,571	609,450	18,118,121	44.3	388,856	2.18%	20,131	0.11%	408,987	**2.29%**
	MONTANA POWER STATION UNIT 3	14,057,148	SQ		-5.0%	14,760,005	112,513	14,647,492	45.3	307,829	2.19%	15,516	0.11%	323,344	**2.30%**
	MONTANA POWER STATION UNIT 4	14,295,206	SQ		-5.0%	15,009,966	13,190	14,996,776	45.3	315,276	2.21%	15,778	0.11%	331,055	**2.32%**
	MONTANA POWER STATION COMMON	12,748,374	SQ		-5.0%	13,385,793	408,357	12,977,436	45.3	272,407	2.14%	14,071	0.11%	286,478	**2.25%**
	Total 341.00	76,836,391			-5.0%	80,678,211	1,762,537	78,915,674	44.8	1,674,455	2.18%	85,699	0.11%	1,760,153	**2.29%**
342.00	FUEL HOLDERS														
	MONTANA POWER STATION UNIT 1	58,683	SQ		-5.0%	61,617	2,078	59,539	44.2	1,281	2.18%	66	0.11%	1,347	**2.30%**
	MONTANA POWER STATION UNIT 2	73,845	SQ		-5.0%	77,537	2,610	74,927	44.2	1,612	2.18%	84	0.11%	1,695	**2.30%**
	MONTANA POWER STATION COMMON	15,155,161	SQ		-5.0%	15,912,919	173,566	15,739,353	45.2	331,451	2.19%	16,765	0.11%	348,216	**2.30%**
	Total 342.00	15,287,689			-5.0%	16,052,073	178,254	15,873,819	45.2	334,344	2.19%	16,914	0.11%	351,258	**2.30%**
343.00	PRIME MOVERS														
	MONTANA POWER STATION UNIT 1	53,635,257	SQ		-5.0%	56,317,020	2,274,785	54,042,235	44.2	1,162,002	2.17%	60,673	0.11%	1,222,675	**2.28%**
	MONTANA POWER STATION UNIT 2	50,230,578	SQ		-5.0%	52,742,107	2,125,222	50,616,885	44.2	1,088,356	2.17%	56,822	0.11%	1,145,178	**2.28%**
	MONTANA POWER STATION UNIT 3	50,466,834	SQ		-5.0%	52,990,176	474,796	52,515,380	45.2	1,106,019	2.19%	55,826	0.11%	1,161,845	**2.30%**
	MONTANA POWER STATION UNIT 4	49,277,670	SQ		-5.0%	51,741,554	45,464	51,696,090	45.3	1,086,804	2.21%	54,390	0.11%	1,141,194	**2.32%**
	MONTANA POWER STATION COMMON	39,548,415	SQ		-5.0%	41,525,836	941,497	40,584,339	45.3	852,250	2.15%	43,652	0.11%	895,902	**2.27%**
	Total 343.00	243,158,754			-5.0%	255,316,692	5,861,764	249,454,928	44.8	5,295,430	2.18%	271,363	0.11%	5,566,794	**2.29%**
344.00	GENERATORS														
	MONTANA POWER STATION UNIT 1	4,453,465	SQ		-5.0%	4,676,138	16,042	4,660,096	44.2	100,394	2.25%	5,038	0.11%	105,432	**2.37%**
	MONTANA POWER STATION UNIT 2	4,518,954	SQ		-5.0%	4,744,902	18,477	4,726,425	44.2	101,821	2.25%	5,112	0.11%	106,933	**2.37%**
	MONTANA POWER STATION UNIT 3	4,533,708	SQ		-5.0%	4,760,393	42,335	4,718,058	45.3	99,147	2.19%	5,004	0.11%	104,151	**2.30%**
	MONTANA POWER STATION UNIT 4	4,506,950	SQ		-5.0%	4,732,298	4,158	4,728,140	45.3	99,399	2.21%	4,975	0.11%	104,374	**2.32%**
	MONTANA POWER STATION COMMON	3,083,993	SQ		-5.0%	3,238,193	114,795	3,123,398	45.2	65,690	2.13%	3,411	0.11%	69,102	**2.24%**
	Total 344.00	21,097,070			-5.0%	22,151,924	195,807	21,956,117	44.8	466,452	2.21%	23,540	0.11%	489,992	**2.32%**
345.00	ACCESSORY ELECTRIC EQUIPMENT														
	MONTANA POWER STATION UNIT 1	2,304,518	SQ		-5.0%	2,419,744	85,415	2,334,329	44.3	50,093	2.17%	2,601	0.11%	52,694	**2.29%**
	MONTANA POWER STATION UNIT 2	2,319,983	SQ		-5.0%	2,435,982	86,376	2,349,606	44.2	50,534	2.18%	2,624	0.11%	53,159	**2.29%**
	MONTANA POWER STATION UNIT 3	2,305,511	SQ		-5.0%	2,420,787	21,524	2,399,263	45.3	50,419	2.19%	2,545	0.11%	52,964	**2.30%**
	MONTANA POWER STATION UNIT 4	1,807,757	SQ		-5.0%	1,898,145	1,669	1,896,476	45.3	39,869	2.21%	1,995	0.11%	41,865	**2.32%**
	MONTANA POWER STATION COMMON	10,031,597	SQ		-5.0%	10,533,177	293,350	10,239,827	45.3	214,972	2.14%	11,072	0.11%	226,045	**2.25%**
	Total 345.00	18,769,366			-5.0%	19,707,834	488,334	19,219,500	45.0	405,888	2.16%	20,838	0.11%	426,726	**2.27%**
346.00	MISCELLANEOUS POWER PLANT EQUIPMENT														
	MONTANA POWER STATION UNIT 1	278,999	SQ		-5.0%	292,949	9,689	283,260	44.3	6,079	2.18%	315	0.11%	6,394	**2.29%**
	MONTANA POWER STATION UNIT 2	286,229	SQ		-5.0%	300,540	9,381	291,159	44.3	6,249	2.18%	323	0.11%	6,572	**2.30%**
	MONTANA POWER STATION UNIT 3	245,496	SQ		-5.0%	257,771	2,254	255,517	45.3	5,370	2.19%	271	0.11%	5,641	**2.30%**
	MONTANA POWER STATION UNIT 4	242,926	SQ		-5.0%	255,072	224	254,848	45.2	5,370	2.21%	269	0.11%	5,638	**2.32%**
	MONTANA POWER STATION COMMON	1,261,756	SQ		-5.0%	1,324,844	37,157	1,287,687	45.2	27,093	2.15%	1,396	0.11%	28,489	**2.26%**
	Total 346.00	2,315,406			-5.0%	2,431,176	58,705	2,372,471	45.0	50,161	2.17%	2,573	0.11%	52,734	**2.28%**
	Total Gas Turbine Plant	377,464,676			-5.0%	396,337,910	8,545,401	387,792,509	44.8	8,226,729	2.18%	420,928	0.11%	8,647,656	**2.29%**
	General Plant														
390.00	STRUCTURES AND IMPROVEMENTS														
	SYSTEMS OPERATIONS BUILDING	11,067,334	R2.5	- 80	0.0%	11,067,334	2,613,866	8,453,468	33.5	252,342	2.28%	-	0.00%	252,342	**2.28%**
	STATION TOWER	35,112,758	R2.5	- 80	0.0%	35,112,758	3,770,523	31,342,235	48.6	644,902	1.84%	-	0.00%	644,902	**1.84%**
	EASTSIDE OPERATIONS CENTER	40,665,138	R2.5	- 80	0.0%	40,665,138	759,598	39,905,540	55.3	721,619	1.77%	-	0.00%	721,619	**1.77%**
	OTHER STRUCTURES	15,589,931	R2.5	- 80	0.0%	15,589,931	2,835,611	12,754,320	28.0	455,511	2.92%	-	0.00%	455,511	**2.92%**
	Total 390.00	102,435,161			0.0%	102,435,161	9,979,598	92,455,563	44.6	2,074,375	2.03%	-	0.00%	2,074,375	**2.03%**
	TOTAL PLANT STUDIED	**$ 479,899,837**				**$ 498,773,071**	**$ 18,524,999**	**$ 480,248,072**		**$ 10,301,103**	**2.15%**	**$ 420,928**	**0.09%**	**$ 10,722,031**	**2.23%**

Depreciation Rate Development

(SL-AL-RL-BG System)

Exhibit DJG-5

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

[1] From depreciation study
[2] Average life and Iowa curve shape developed through actuarial analysis and professional judgment. "SQ" = square curve, or no interim retirements; interim retirements excluded per Commission precedent
[3] Weighted net salvage for life span accounts from weighted net salvage exhibit
[4] = [1]*(1-[3])
[5] From depreciation study
[6] = [4] - [5]
[7] Composite remaining life based on Iowa cuve in [2]
[8] = ([1] - [5]) / [7]
[9] = [8] / [1]
[10] = [12] - [8]
[11] = [13] - [9]
[12] = [6] / [7]
[13] = [12] / [1]. Any negative rates adjusted up to zero.
* N/D = Nondepreciable

Weighted Net Salvage

		[1]	[2]	[3]	[4]	[5]
Account		Terminal Retirements		Interim Retirements		Weighted
No.	Description	Retirements	Net Salvage	Retirements	Net Salvage	Net Salvage
	GAS TURBINE PLANT					
341.00	STRUCTURES AND IMPROVEMENTS					
	MONTANA POWER STATION UNIT 1	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 2	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 3	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 4	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION COMMON	100%	-5.0%	0%	-5%	-5.0%
342.00	FUEL HOLDERS					
	MONTANA POWER STATION UNIT 1	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 2	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION COMMON	100%	-5.0%	0%	-5%	-5.0%
343.00	PRIME MOVERS					
	MONTANA POWER STATION UNIT 1	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 2	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 3	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 4	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION COMMON	100%	-5.0%	0%	-5%	-5.0%
344.00	GENERATORS					
	MONTANA POWER STATION UNIT 1	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 2	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 3	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION UNIT 4	100%	-5.0%	0%	-5%	-5.0%
	MONTANA POWER STATION COMMON	100%	-5.0%	0%	-5%	-5.0%
345.00	ACCESSORY ELECTRIC EQUIPMENT					
	MONTANA POWER STATION UNIT 1	100%	-5.0%	0%	0%	-5.0%
	MONTANA POWER STATION UNIT 2	100%	-5.0%	0%	0%	-5.0%
	MONTANA POWER STATION UNIT 3	100%	-5.0%	0%	0%	-5.0%
	MONTANA POWER STATION UNIT 4	100%	-5.0%	0%	0%	-5.0%
	MONTANA POWER STATION COMMON	100%	-5.0%	0%	0%	-5.0%
346.00	MISCELLANEOUS POWER PLANT EQUIPMENT					
	MONTANA POWER STATION UNIT 1	100%	-5.0%	0%	0%	-5.0%
	MONTANA POWER STATION UNIT 2	100%	-5.0%	0%	0%	-5.0%
	MONTANA POWER STATION UNIT 3	100%	-5.0%	0%	0%	-5.0%
	MONTANA POWER STATION UNIT 4	100%	-5.0%	0%	0%	-5.0%
	MONTANA POWER STATION COMMON	100%	-5.0%	0%	0%	-5.0%

[1] From Depreciation Study
[2] Removed 100% of OG&E's proposed terminal net salvage due to lack of support (see responsive testimony)
[3] From Depreciation Study
[4] From Depreciation Study
[5] = [1]*[2] + [3]*[4]

Exhibit DJG-7

EL PASO ELECTRIC NYSE-EE

RECENT PRICE 51.45 | P/E RATIO 22.5 (Trailing: 21.5, Median: 15.0) | RELATIVE P/E RATIO 1.15 | DIV'D YLD 2.6% | VALUE LINE

TIMELINESS 2 Raised 4/14/17

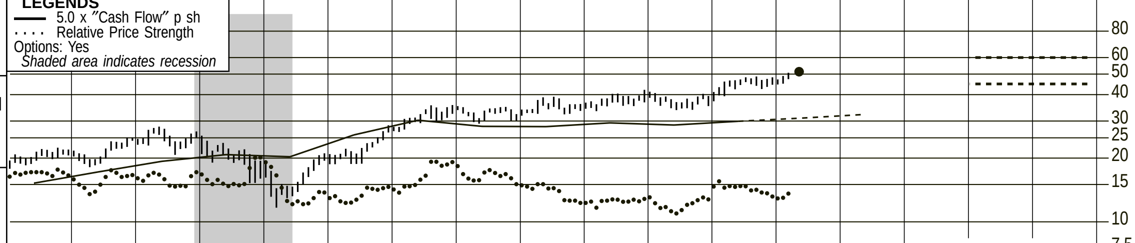
SAFETY 2 Raised 5/11/07

TECHNICAL 4 Lowered 3/31/17

BETA .75 (1.00 = Market)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
High:	25.0	28.2	25.5	21.1	28.7	35.7	35.3	39.1	42.2	41.3	48.8	51.7
Low:	18.2	20.8	15.2	11.6	18.7	26.7	29.2	31.8	33.4	33.8	37.2	44.7

LEGENDS
— 5.0 x "Cash Flow" p sh
.... Relative Price Strength
Options: Yes
Shaded area indicates recession



Target Price Range 2020 2021 2022

2020-22 PROJECTIONS

	Price	Gain	Ann'l Total Return
High	60	(+15%)	7%
Low	40	(-20%)	-2%

Insider Decisions

	J	J	A	S	O	N	D	J	F
to Buy	0	0	0	0	0	0	0	0	0
Options	0	4	0	0	4	0	0	3	0
to Sell	0	0	0	0	0	0	1	0	0

Institutional Decisions

	2Q2016	3Q2016	4Q2016
to Buy	90	72	104
to Sell	75	90	75
Hld's(000)	38927	39276	39292

Percent shares traded 21 14 7

% TOT. RETURN 3/17

	THIS STOCK	VL ARITH.* INDEX
1 yr.	13.0	20.2
3 yr.	54.4	22.0
5 yr.	80.6	78.0

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	© VALUE LINE PUB. LLC	20-22
15.40	13.91	13.97	14.95	16.70	17.75	19.43	23.15	18.85	20.61	22.97	21.26	22.11	22.74	21.01	21.89	***22.15***	***22.75***	Revenues per sh	***24.50***
3.43	2.99	3.00	3.27	3.05	3.44	3.86	4.16	4.07	5.15	6.05	5.66	5.65	5.87	5.75	5.98	***6.20***	***6.45***	"Cash Flow" per sh	***7.25***
1.27	.57	.64	.69	.76	1.27	1.63	1.73	1.50	2.07	2.48	2.26	2.20	2.27	2.03	2.39	***2.45***	***2.60***	Earnings per sh A	***3.00***
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	.66	.97	1.05	1.11	1.17	1.23	***1.30***	***1.40***	Div'd Decl'd per sh B	***1.75***
1.85	1.75	2.03	1.94	2.28	2.73	4.63	5.36	5.95	5.27	5.90	6.70	7.18	8.50	8.55	7.03	***6.35***	***5.65***	Cap'l Spending per sh	***7.00***
9.01	9.20	10.51	11.23	11.56	12.60	14.76	15.47	16.45	19.04	19.03	20.57	23.44	24.39	25.13	26.52	***27.65***	***28.80***	Book Value per sh C	***32.25***
49.99	49.61	47.56	47.40	48.14	46.00	45.15	44.88	43.92	42.57	39.96	40.11	40.27	40.36	40.44	40.52	***40.60***	***40.70***	Common Shs Outst'g D	***41.00***
11.0	23.0	18.3	22.0	26.7	16.9	15.3	11.9	10.8	10.7	12.6	14.5	15.9	16.4	18.3	18.7	*Bold figures are*		Avg Ann'l P/E Ratio	***16.5***
.56	1.26	1.04	1.16	1.42	.91	.81	.72	.72	.68	.79	.92	.89	.86	.92	.98	*Value Line*		Relative P/E Ratio	***1.05***
- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	2.1%	3.0%	3.0%	3.0%	3.1%	2.7%	*estimates*		Avg Ann'l Div'd Yield	***3.5%***

CAPITAL STRUCTURE as of 12/31/16
Total Debt $1360.2 mill. **Due in 5 Yrs** $209.7 mill.
LT Debt $1195.5 mill. **LT Interest** $72.3 mill.
(LT interest earned: 2.9x)

Pension Assets-12/16 $269.8 mill. **Oblig** $337.8 mill.

Pfd Stock None

Common Stock 40,557,679 shs. **as of 1/31/17**

MARKET CAP: $2.1 billion (Mid Cap)

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		20-22
877.4	1038.9	828.0	877.3	918.0	852.9	890.4	917.5	849.9	886.9	***900***	***925***	Revenues ($mill)	***1000***
74.8	77.6	66.9	90.3	103.5	90.8	88.6	91.4	81.9	96.8	***100***	***105***	Net Profit ($mill)	***125***
31.6%	32.8%	33.1%	36.1%	34.2%	34.1%	33.0%	31.0%	29.9%	35.8%	***36.0%***	***36.0%***	Income Tax Rate	***36.0%***
15.9%	20.4%	24.3%	22.1%	17.6%	22.4%	24.1%	30.8%	27.5%	17.6%	***10.0%***	***11.0%***	AFUDC % to Net Profit	***15.0%***
49.6%	53.8%	52.7%	51.2%	51.8%	54.8%	51.4%	53.5%	52.7%	52.7%	***51.5%***	***52.5%***	Long-Term Debt Ratio	***51.5%***
50.4%	46.2%	47.3%	48.8%	48.2%	45.2%	48.6%	46.5%	47.3%	47.3%	***48.5%***	***47.5%***	Common Equity Ratio	***48.5%***
1321.6	1503.9	1527.7	1660.1	1576.7	1824.5	1943.5	2118.4	2150.8	2269.9	***2320***	***2470***	Total Capital ($mill)	***2725***
1450.6	1595.6	1756.0	1865.8	1947.1	2102.3	2257.5	2488.4	2695.5	2821.2	***2930***	***3005***	Net Plant ($mill)	***3325***
7.1%	6.7%	6.0%	7.0%	8.3%	6.5%	6.1%	5.7%	5.3%	5.8%	***6.0%***	***6.0%***	Return on Total Cap'l	***6.0%***
11.2%	11.2%	9.3%	11.1%	13.6%	11.0%	9.4%	9.3%	8.1%	9.0%	***9.0%***	***9.0%***	Return on Shr. Equity	***9.5%***
11.2%	11.2%	9.3%	11.1%	13.6%	11.0%	9.4%	9.3%	8.1%	9.0%	***9.0%***	***9.0%***	Return on Com Equity E	***9.5%***
11.2%	11.2%	9.3%	11.1%	10.0%	6.3%	4.9%	4.8%	3.4%	4.4%	***4.5%***	***4.5%***	Retained to Com Eq	***4.0%***
- -	- -	- -	- -	26%	43%	47%	49%	57%	51%	***52%***	***53%***	All Div'ds to Net Prof	***58%***

ELECTRIC OPERATING STATISTICS

	2014	2015	2016
% Change Retail Sales (KWH)	-1.6	+2.3	+.1
Avg. Indust. Use (MWH)	21505	21687	21036
Avg. Indust. Revs. per KWH (¢)	NA	NA	NA
Capacity at Peak (Mw)	1879	2055	2080
Peak Load, Summer (Mw)	1766	1794	1892
Annual Load Factor (%)	NA	NA	NA
% Change Customers (yr-end)	+1.3	+1.4	+1.6
Fixed Charge Cov. (%)	251	218	267

ANNUAL RATES of change (per sh)	Past 10 Yrs.	Past 5 Yrs.	Est'd '14-'16 to '20-'22
Revenues	3.0%	1.0%	*2.0%*
"Cash Flow"	6.0%	3.0%	*3.5%*
Earnings	9.5%	2.0%	*5.0%*
Dividends	- -	- -	*7.0%*
Book Value	8.0%	7.0%	*4.0%*

Cal-endar	QUARTERLY REVENUES ($ mill.) Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2014	185.5	251.8	283.6	196.6	917.5
2015	163.8	219.5	289.7	176.9	849.9
2016	157.8	217.9	323.2	188.0	886.9
2017	***170***	***230***	***295***	***205***	***900***
2018	***175***	***235***	***315***	***200***	***925***

Cal-endar	EARNINGS PER SHARE A Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2014	.11	.75	1.30	.11	2.27
2015	.09	.52	1.40	.02	2.03
2016	d.14	.55	1.84	.14	2.39
2017	***d.10***	***.65***	***1.60***	***.30***	***2.45***
2018	***d.10***	***.70***	***1.80***	***.20***	***2.60***

Cal-endar	QUARTERLY DIVIDENDS PAID B Mar.31	Jun.30	Sep.30	Dec.31	Full Year
2013	.25	.265	.265	.265	1.05
2014	.265	.28	.28	.28	1.11
2015	.28	.295	.295	.295	1.17
2016	.295	.31	.31	.31	1.23
2017	.31				

BUSINESS: El Paso Electric Company (EPE) provides electric service to 411,000 customers in an area of approximately 10,000 square miles in the Rio Grande valley in western Texas (68% of revenues) and southern New Mexico (19% of revenues), including El Paso, Texas and Las Cruces, New Mexico. Wholesale is 13% of revenues. Electric revenue breakdown by customer class not available. Generating sources: nuclear, 49%; gas, 34%; coal, 2%; purchased & other, 15%. Fuel costs: 26% of revenues. '16 reported depreciation rate: 2.3%. Has about 1,100 employees. Chairman: Charles A. Yamarone. President & CEO: Mary Kipp. Incorporated: Texas. Address: Stanton Tower, 100 North Stanton, El Paso, Texas 79901. Tel.: 915-543-5711. Internet: www.epelectric.com.

El Paso Electric has filed a general rate case in Texas. The utility is seeking an increase of $217 million, based on a return of 10.5% on a common-equity ratio of 48.35%. The application is intended to place Units 3 and 4 of a gas-fired generating station in the rate base, among other things. EPE is also asking for changes in rate design so that tariffs for each customer class reflect (or come very close to reflecting) the cost of service. In particular, residential solar customers would pay considerably more than they are now paying because other users have been subsidizing them. A ruling from the Texas regulators is due in the fourth quarter, but will be retroactive to July 18, 2017. Thus, the portion of EPE's revenues that would have been recorded in the third quarter will be booked in the fourth period instead. Accordingly, the December quarter, which is normally seasonally weak, will be stronger than usual this year. Note that because of the uncertainty surrounding this rate case, management has not provided earnings guidance for 2017.

The utility has postponed its plan to file a rate application in New Mexico. EPE determined that it did not need rate relief in the state right away. Thus, the utility will still have some effects of regulatory lag in 2018, but these will be limited because the Texas portion of EPE's business (at more than 80%) is far greater than the New Mexico portion.

We estimate earnings growth in 2017 and 2018. We assume reasonable regulatory treatment in the Texas rate case. The utility is also benefiting from strong customer growth, which is a byproduct of the healthy economy in El Paso and environs.

The company expects to raise the dividend growth rate at its board meeting in late May. EPE's goal is a payout ratio in a range of 55%-65% by 2020. Dividend hikes in recent years have amounted to $0.06 a share annually, but we estimate an increase of $0.08 a share (6.5%) next month.

The dividend yield of this timely stock is low for a utility. This reflects EPE's good dividend growth potential. Like most utility issues, the recent quotation is within our 2020-2022 Target Price Range, so total return potential is unspectacular.

Paul E. Debbas, CFA *April 28, 2017*

(A) Diluted earnings. Excl. nonrecurring gains (losses): '01, (4¢); '03, 81¢; '04, 4¢; '05, (2¢); '06, 13¢; '10, 24¢. '14 earnings don't add to full-year total due to rounding. Next earnings report due early May. (B) Initial dividend declared 4/11; payment dates in late March, June, Sept., and Dec. (C) Incl. deferred charges. In '16: $118.9 mill., $2.93/sh. (D) In millions. (E) Rate allowed on common equity in TX in '12: none specified; in NM in '16: 9.48%; earned on avg. com. eq., '16: 9.3%. Regulatory Climate: TX, Average; NM, Below Average.

Company's Financial Strength	B++
Stock's Price Stability	90
Price Growth Persistence	70
Earnings Predictability	80