LIBERTY GAS MID-STATES MISSOURI
APPENDIX C
ALLIANCE REVISED LIFE PARAMETERS

Based on Staff looking at Missouri-only data to revise parameters (including updating the net salvage analysis to 2017), we have updated the data through 2017 and rerun the life analysis as well. In most cases, we accept Staff's recommendations. For a few accounts, we believe a different life is a better selection. Below are the accounts where we recommend a different life than Staff.

LIBERTY MISSOURI				
Acct	**Description**	**Original Proposed**	**Staff Proposed**	**Company Proposed Revised**
3670	T&D-Mains-STL-PLST-CI-Mixed	25 SQ	75	25 SQ
3671	T&D-Mains-STL	70 R2.5	75	70 R1.5
3672	T&D-Mains-PLST	N/A	75	NA
3760	Mains	25 SQ	71	25 SQ
3761	T&D-Mains-STL	63 R1.5	71	63 R2.5
3762	T&D-Mains-PLST	65 R3	71	65 R2.5
3780	M & R Station Equip	40 R4	58	48 R4
3790	M& R Station Equip-City Gate	45 S2	39	45 S3
3810	Meters	31 L1	39	31 L1
3820	Meters Installations	27 L0.5	34	27 L0
3830	House regulators	27 L0.5	22	27 L0
3840	House Regulatory installations	27 L0.5	30	27 L0
3970	Communications Equipment	11 L2	22	16 L2.5
3971	GEN-Comm Eq. Mob Radios	11 L2	22	16 L2.5
3972	GEN-Comm Eq. Fixed Radios	11 L2	22	16 L2.5
3973	GEN-Comm Eq. Telemetering	11 L2	22	16 L2.5
399.5	Other Tang Prop- PC Software	5 SQ	8	5 SQ

LIBERTY SHARED SERVICES				
Acct	**Description**	**Original Proposed**	**Staff Proposed**	**Company Proposed Revised**
399.5	Other Tang Prop-PC Software	3 SQ	7	3 SQ
399.5	Other Tang Prop-PC Software	5 SQ	7	5 SQ

FERC Account 367.0 Transmission Mains Cathodic Protection (25 SQ)

Company Original	Staff Proposed	Company Proposed Revised
25	75	25 SQ

This account consists of cathodic protection assets for transmission mains such as anodes, ground beds, and rectifiers. There is currently $95 thousand in total plant for Mid-States Gas Missouri. Below is a summary of the assets in this account:

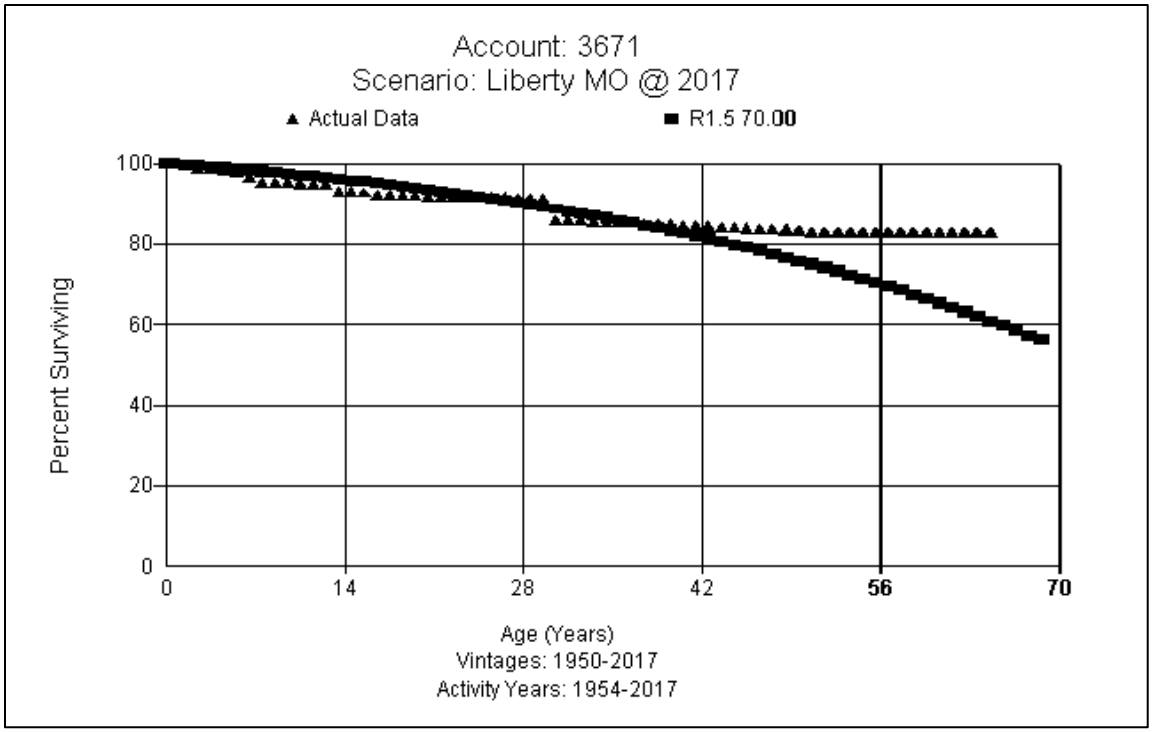
3670	TRN-36700-Anode	21,773.22
3670	TRN-36700-Anode Rectifier Bed	19,830.81
3670	TRN-36700-Cathodic Protection	20,530.43
3670	TRN-36700-Groundbed	4,361.63
3670	TRN-36700-Rectifier	17,992.80
3670	TRN-3670-Cathodic Coating	10,792.98
3670 Total		95,281.87

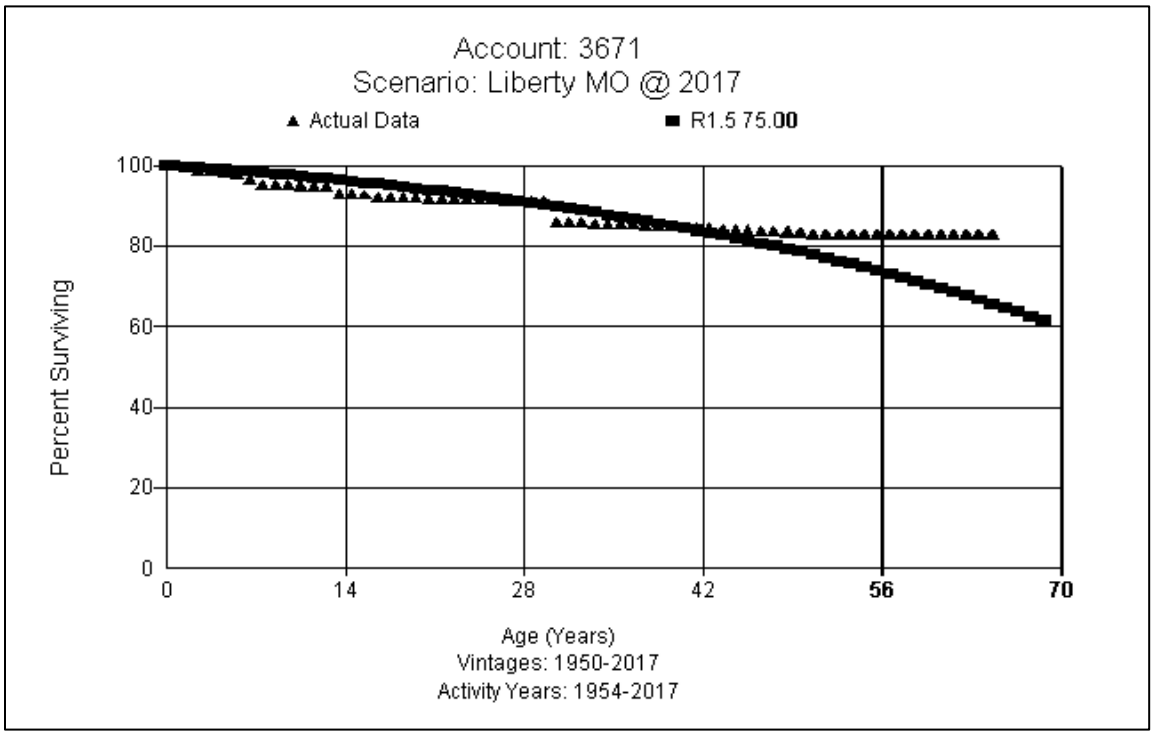
There have been limited retirements, only 1.6% of the current plant balance. That suggests there is too little data to perform life analysis for this account. Staff's approach was to combine account 367.0, 367.1, and 367.2 together and perform life analysis on the combined group. I believe a better approach is to keep the accounts since the life of cathodic protection equipment is quite different from that of mains. Cathodic protection equipment erodes in place and requires periodic replacement. The life characteristics of these assets differ greatly from steel or plastic mains and combining them with pipe will distort the life results for both subaccounts. The life of cathodic protection equipment is generally though to be in the 20 year to 25 year range (consistent with the disappearing of the anode material). Going forward, Liberty will retire cathodic protection assets as they reach the engineering life and will match the operating process of the Company. The proposed 25 years is reasonable from an engineering perspective, aligns with the operational processes of the company, and is our recommendation for this account.

FERC Account 367.1 Transmission Mains Steel (70 R1.5)

Company Original	Staff Proposed	Company Proposed Revised
70 R2.5	75	70 R1.5

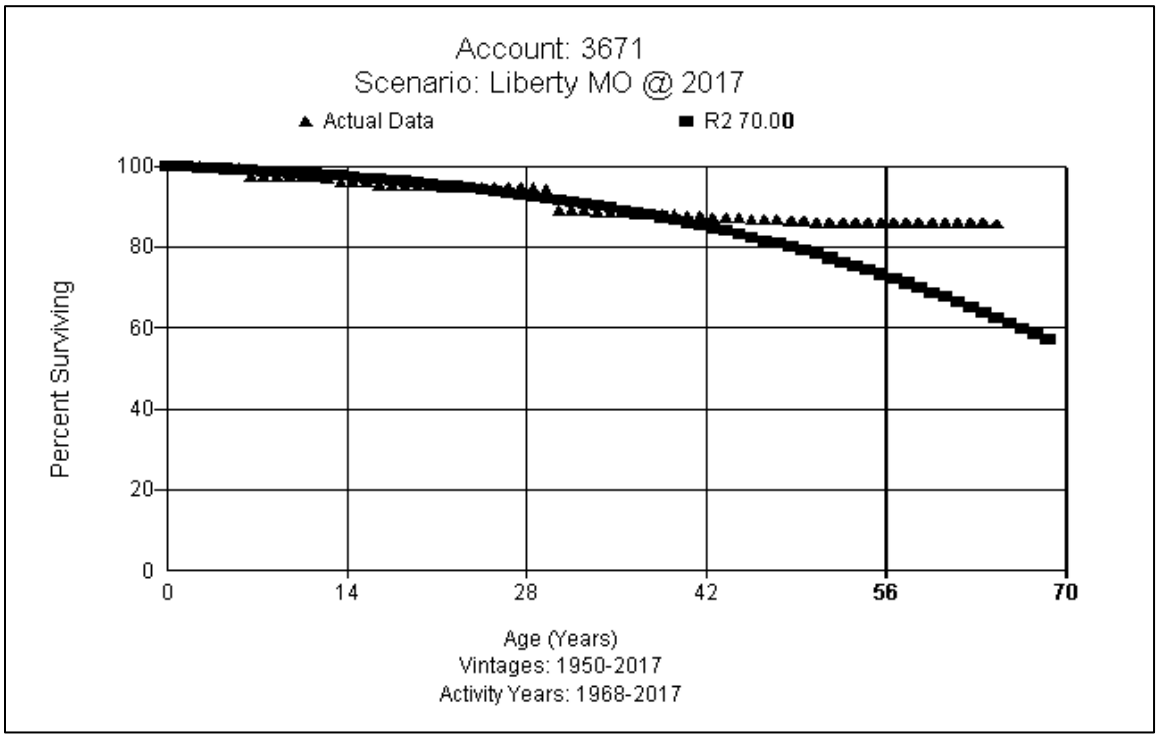
This account consists of steel transmission mains of various diameters and related assets such as clamps, odorant equipment, and vaults. There is currently $9.8 million in total plant for Mid-States Gas Missouri. Of the plant in this account, $9.3 million is various sizes of steel main ranging from 1 inch to 12 inches in diameter. There is very little retirement activity in this account. While performing life analysis, Staff combined all three subaccounts. As I stated above when discussing account 3670, I believe the subaccounts for mains should be analyzed separately. The assets in these subaccounts are not homogeneous (alike) as theory underlying the actuarial analysis process requires. Looking at the graphs below, you can clearly see the life characteristics of the mains is not the same as the shorter lived assets recorded in sub account 3670. Liberty operations personnel report that they see little deterioration in mains, and that most of the transmission mains are from the 1950s and 1960s. The average age of investment in this account is 40.26 years. The retirements that have occurred are approximately 15% of the existing plant balance, but the stub survivor curve barely reaches 80% in the widest band. Having a short stub curve is problematic in performing actuarial analysis. The widest placement and experience band is shown below with an R1.5 dispersion graph. For graphical presentation we used the same Iowa curve selected by the Company since Staff did not include that in its recommendations. The first graph shows the Company proposed life of 70 years and the second graph shows a 75 year life proposed by Staff.

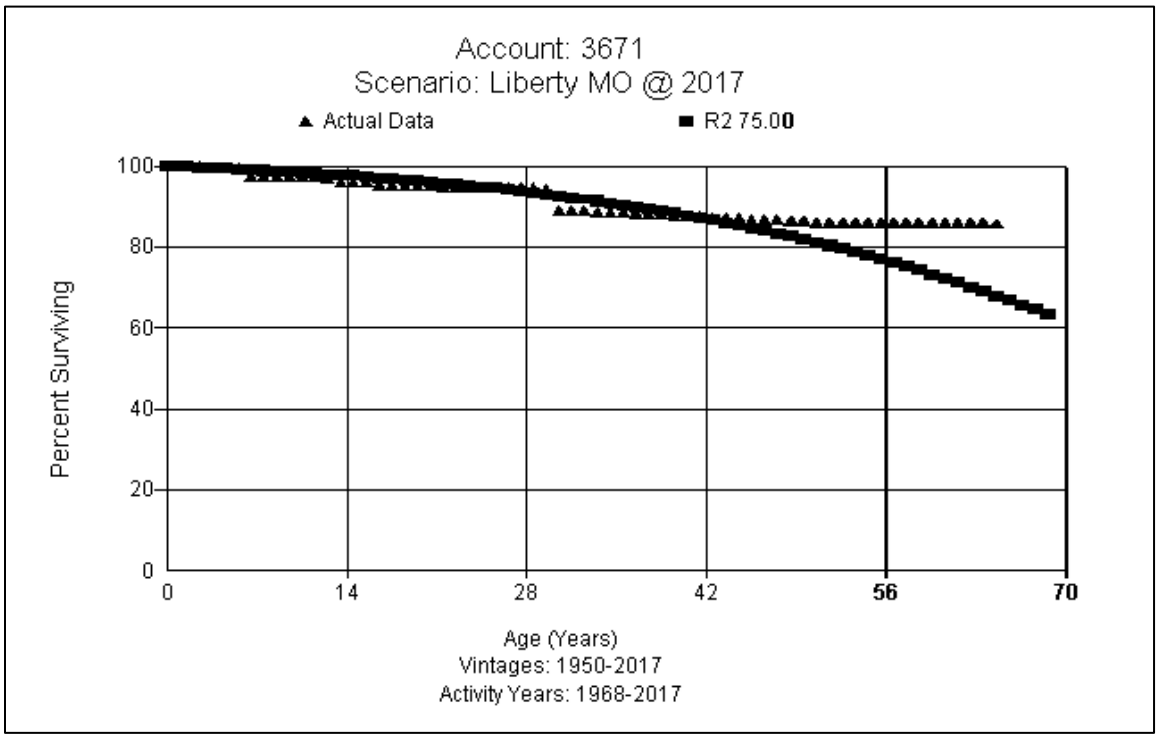




Looking at the graphs above, the R1.5 70 curve is more closely aligned with actual retirement activity at age 30 where the curve starts to move or drop. The R1.5 75 curve rests above the historical experience. Again, when looking at the same placement band with a more recent experience band 1968-2017, the R2 70 curve shows a closer fit to

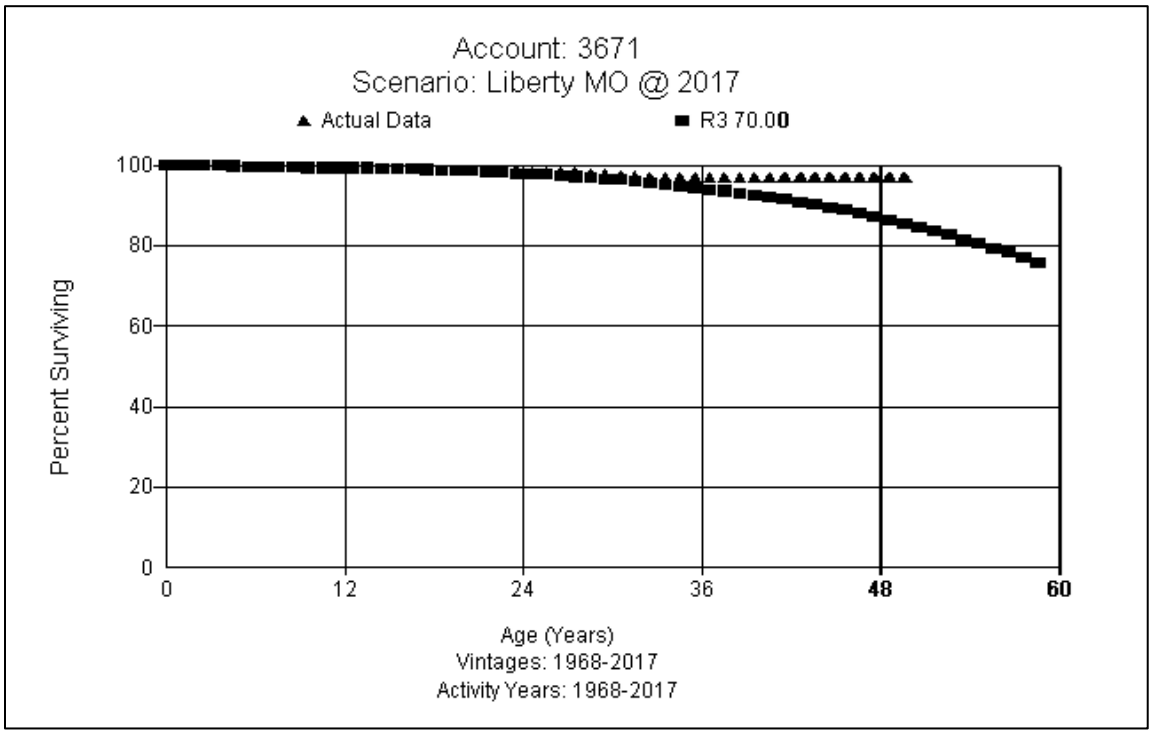
actual experience than the R2 75 curve using the life proposed by Staff.

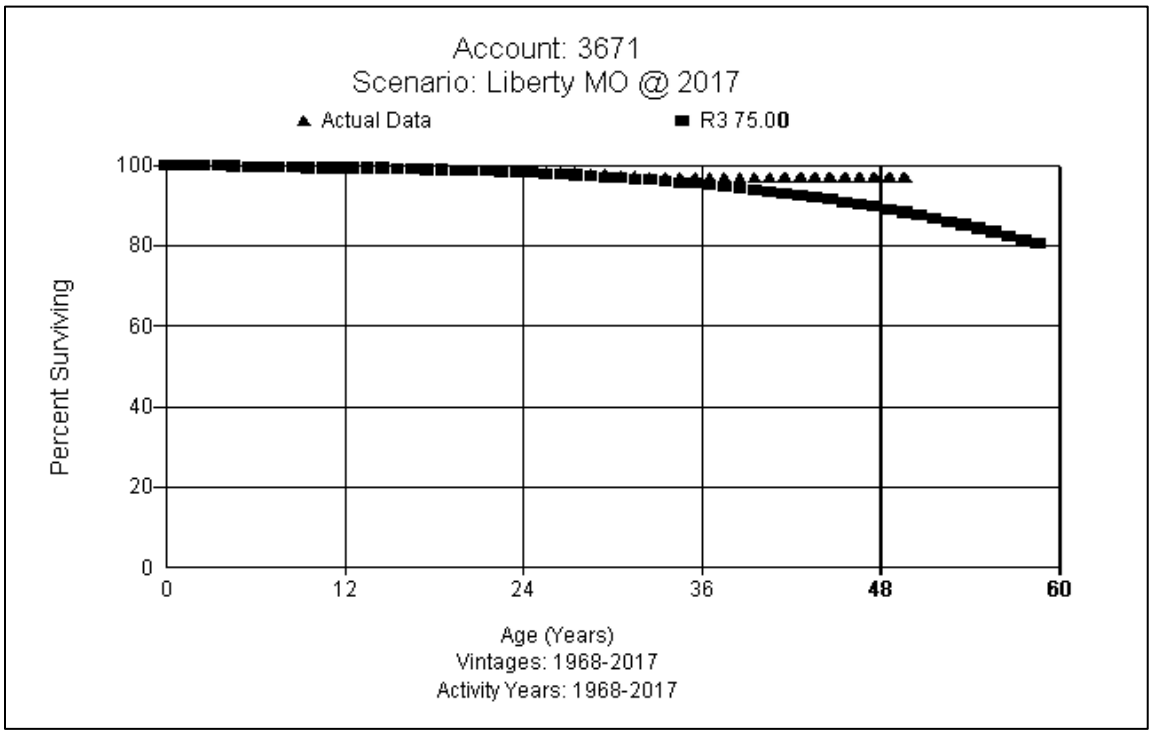




As you analyze more recent placement and experience bands the higher dispersion curves are a better fit, but I've included graphs of various R curves with the Company proposed life of 70 years and the 75 year life proposed by Staff to show that graphically,

the 70 year life is a closer graphical fit.





When the placement and experience bands are changed, the results still support a 70 year life as shown in the graphs below. With the observed life table shows a limited pattern of retirement, actuarial analysis does not really meet the stub curve criteria

recommended by authoritative literature. However, the fact that the R3 dispersion curve and a 70 year life is a good fit across several placement and experience bands illustrates a consistent life trend of the assets in this subaccount. Given the limited historical data and professional judgement, I recommend a 70 R1.5 curve for subaccount 3671.

FERC Account 367.2 Transmission Mains Plastic (see Acct 367.1)

Company Original	Staff Proposed	Company Proposed Revised
No recommendation	75	No Recommendation

This account consists of plastic transmission mains of various diameters. There is approximately $24 thousand in plant in this account. Upon review by Liberty operations personnel, it was determined that the mains should have been booked in account 367.1, Liberty will transfer these assets to account 3671, and no plant is anticipated to be booked in this account in the future. No recommendation is included for this account since the assets will be transferred into 3671.

FERC Account 376.0 Distribution Mains Cathodic Protection (25 SQ)

Company Original	Staff Proposed	Company Proposed Revised
25 SQ	71	25 SQ

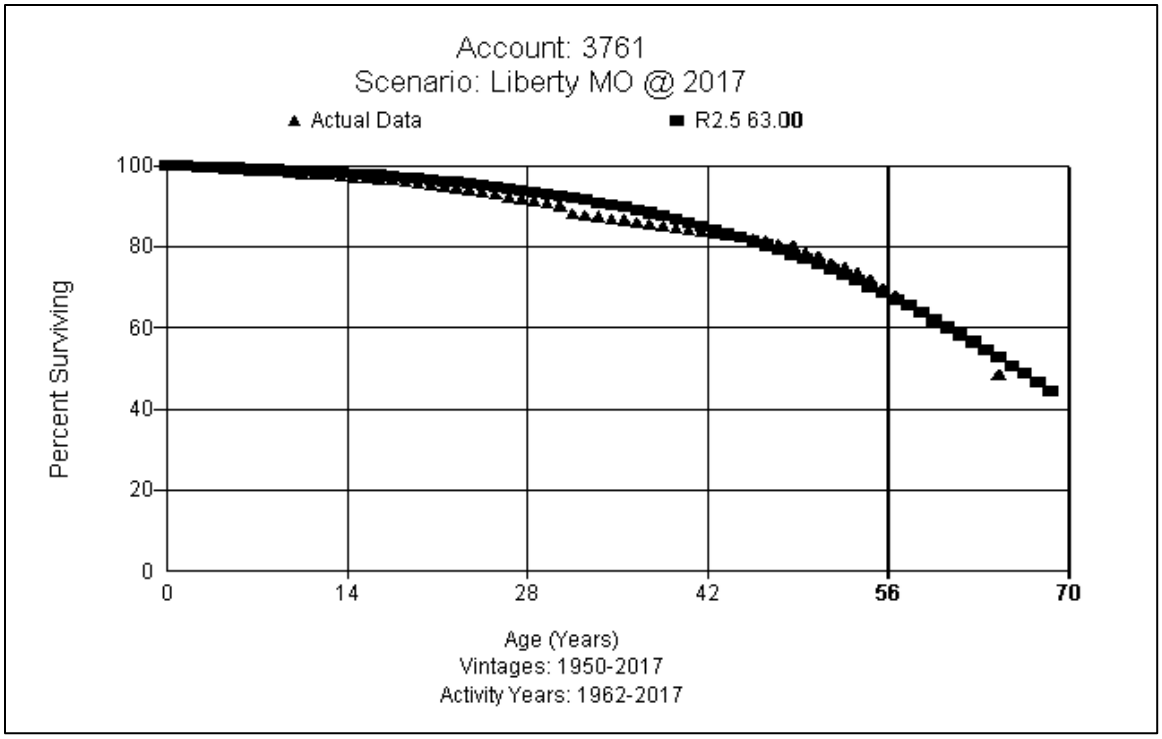
As with transmission, this account consists of cathodic protection equipment, such as anodes, clamps, rectifiers, and ground beds associated with distribution mains. There is currently $2.4 million in total plant for Mid-States Gas Missouri. Of that amount, the plant balance in Missouri is $2.3 million. Operations personnel report that anode beds are designed to last twenty years. They report that rectifiers will last longer

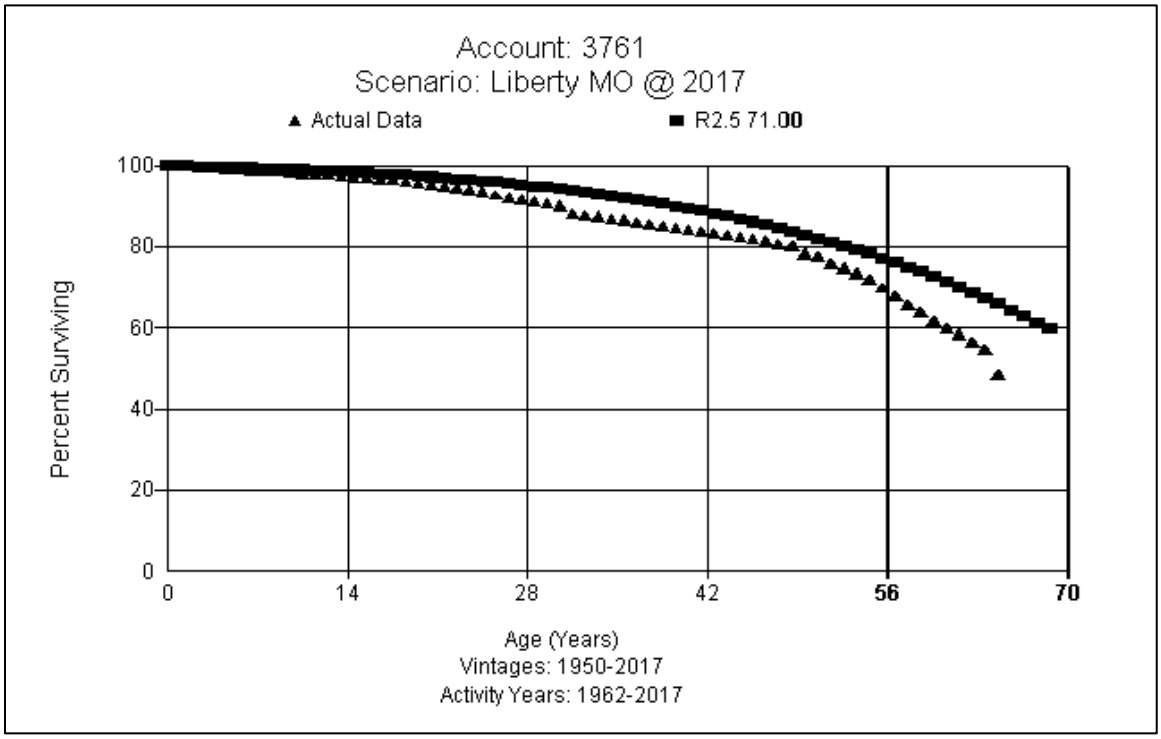
although there have been some replacements. Similar to its approach for account 367, Staff combined the subaccounts while performing life analysis for the subaccounts in 376. The life of the assets in subaccount 3760 is significantly shorter than the life of distribution main. Based on operational input and the life characteristics of the assets, I continue to recommend a 25 SQ curve for this account.

FERC Account 376.1 Distribution Mains Steel (63 R2.5)

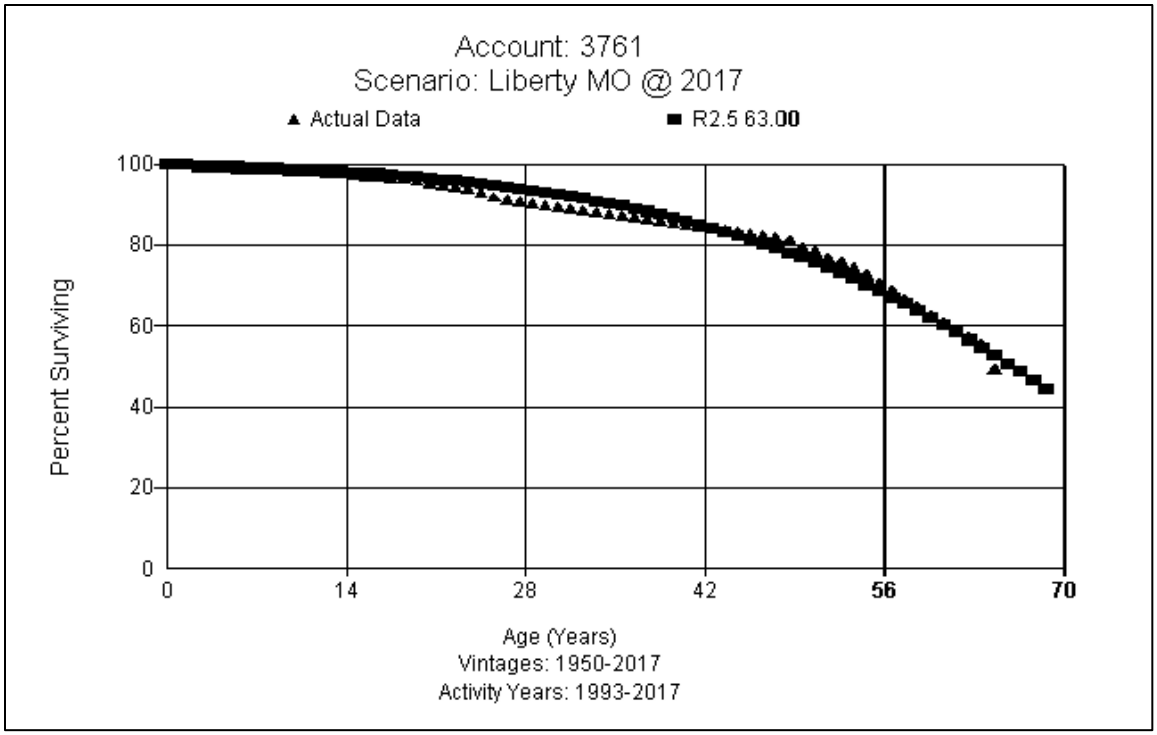
Company Original	Staff Proposed	Company Proposed Revised
63 R1.5	71	63 R2.5

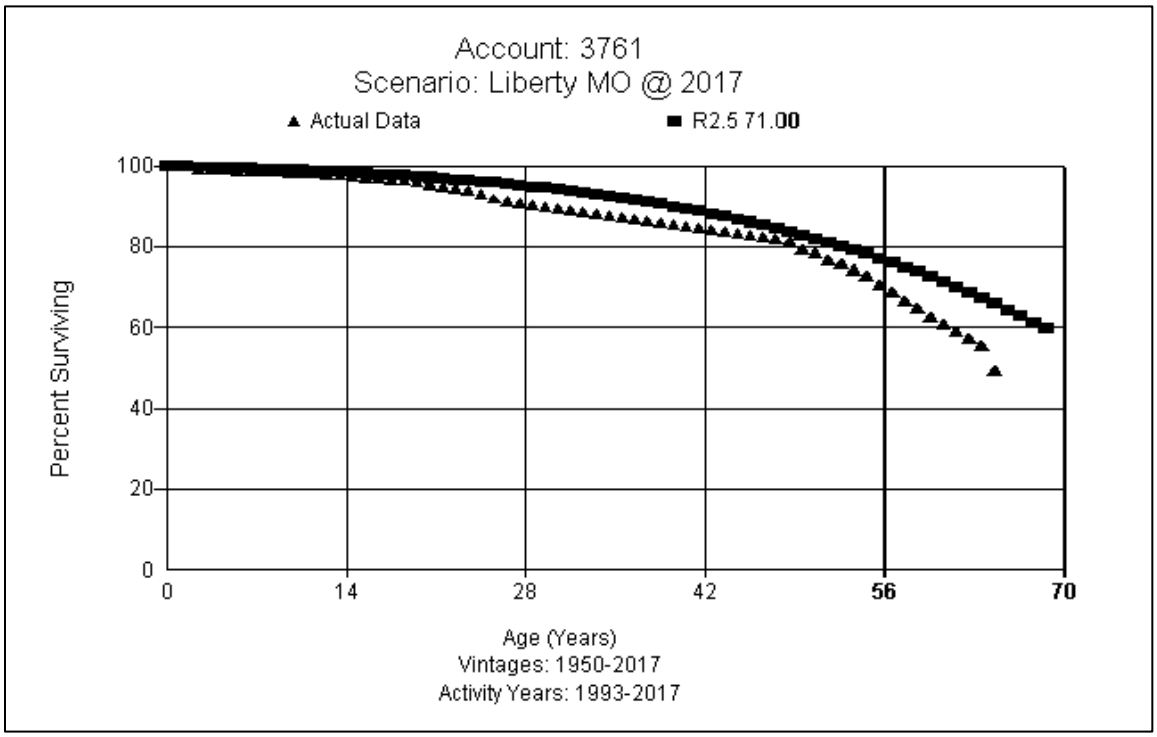
This account consists of distribution mains and associated equipment. There is currently $19.6 million in total plant for Mid-States Gas Missouri. The material types in this account are cast iron, bare steel, bare unprotected steel, PVC, and protected steel. Operations personnel expect the life if this account to be shorter than transmission mains in 3671, because there is more bare steel and the material is not as robust. For protected steel, operations expects a 65 to 70 year life. Since the process of replacing bare steel is underway, the life of steel distribution mains is expected to be shorter than that seen by transmission mains. Based on judgement, history, and input from Company personnel, this study recommends a 63 R2.5 curve for this account. The widest placement and experience band is shown below with the same dispersion curves using my recommended 63 year life and a 71 year life as staff proposes.



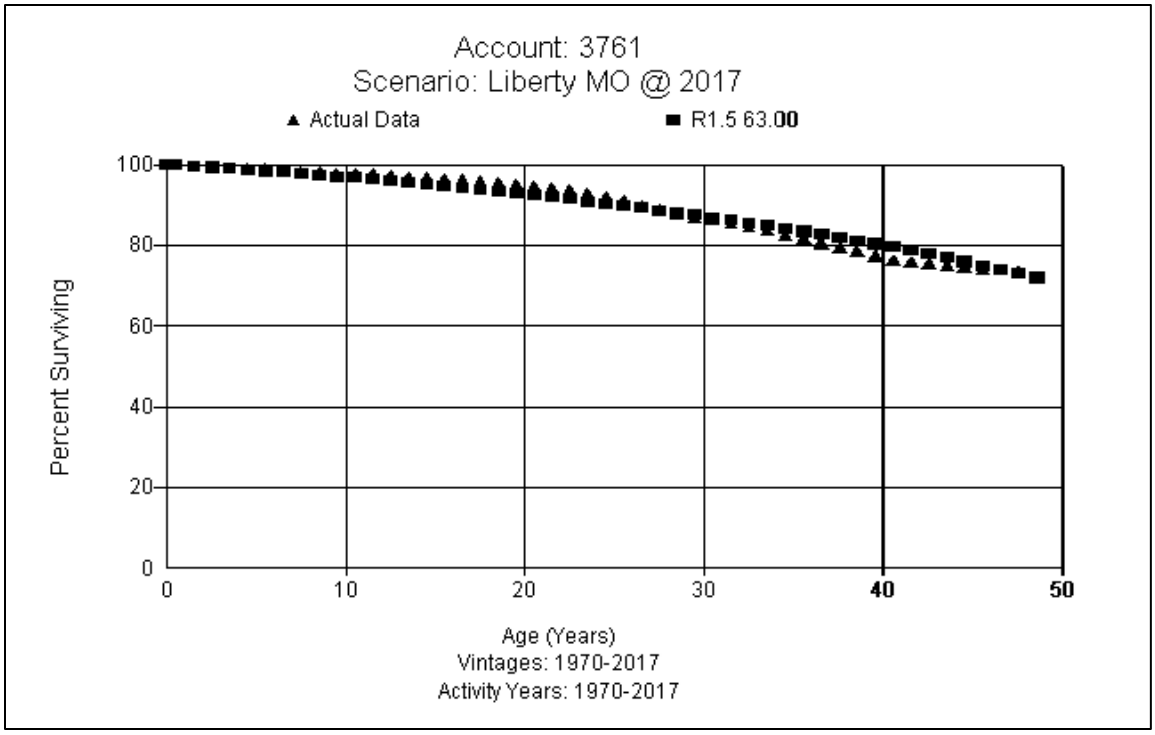


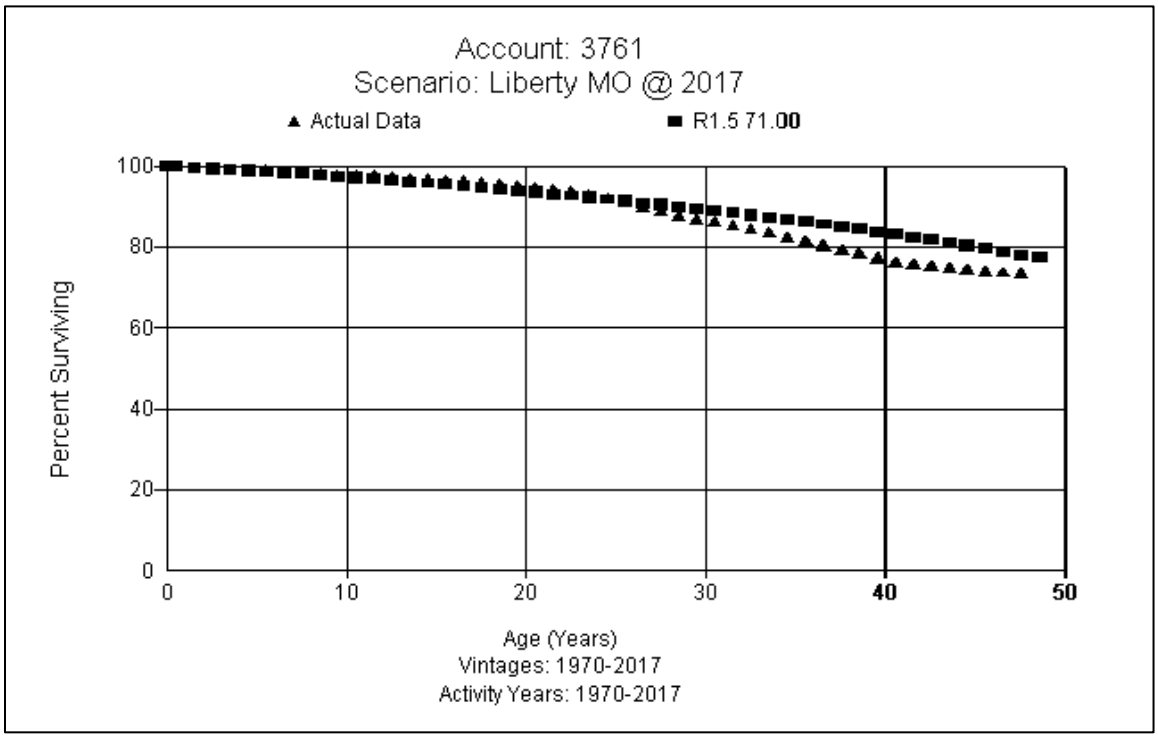
When looking at the graphs above, you can see that the 63 R2.5 curve aligns more closely to the historical retirement experience of the Company. The 71 R2.5 curve is above the curve starting at year 15. Below are more graphs using the full placement band and a more recent experience band of 1993-2017.





As we look at more recent placement and experience bands of 1970-2017, the results still show that the 63 year curve is a closer graphical fit than the 71 year curve. A lower mode dispersion curve with the shorter 63 year life is a better fit consistently.





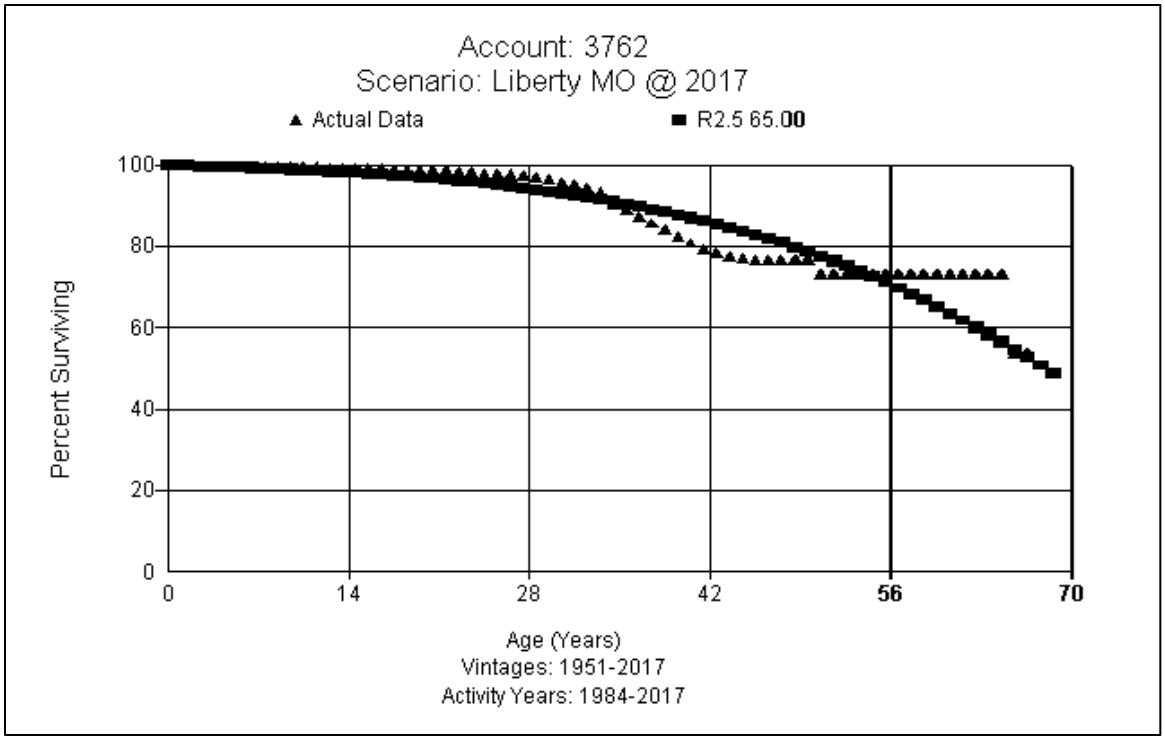
As is the case with the sub accounts of 367, Staff combined all three sub accounts while performing life analysis for this account. The retirement activity, mix of assets, and life characteristics of the assets in each sub account are very different. Given the separate characteristics and separate subaccounts, I do not believe it is as appropriate to blend

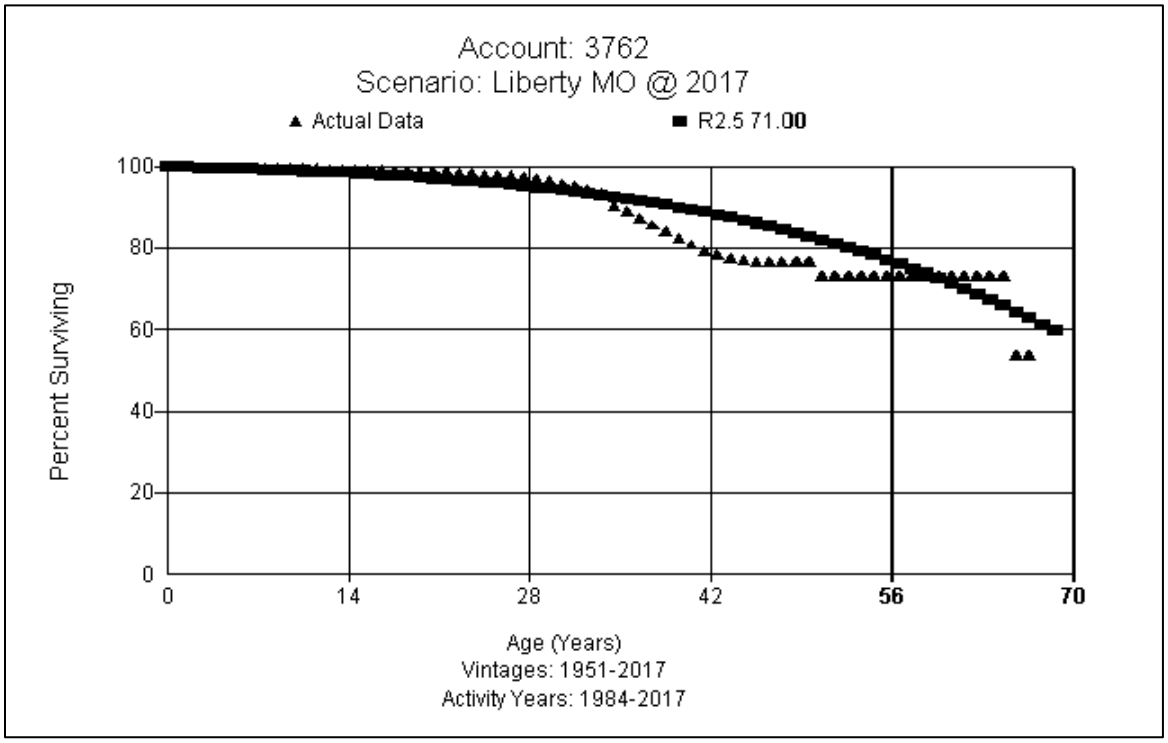
the assets in these subaccounts together to develop a single average service life and dispersion curve as it is to leave separate. Looking at the graphs above, you can clearly see the life characteristics of the mains is not the same as the shorter lived assets recorded in sub account 3760. Additionally, steel and plastic mains have different lives and retirement patterns. After analyzing the updated historical data and considering the information provided by company personnel, I recommend a 63 R2.5 curve for sub account 3761.

FERC Account 376.2 Distribution Mains Plastic (65 R2.5)

Company Original	Staff Proposed	Company Proposed Revised
65 R3	71	65 R2.5

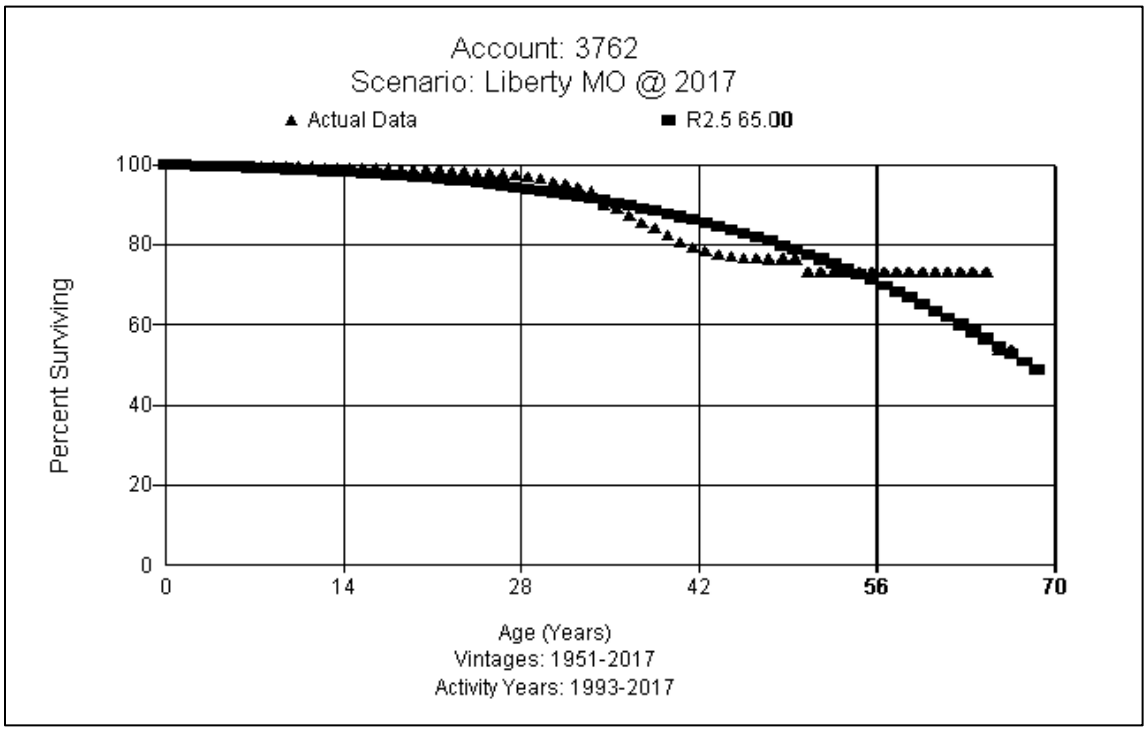
This account consists of plastic distribution mains and associated equipment. There is currently $33.9 million in total plant for Mid-States Gas Missouri. The Company began installed plastic pipe in the 1970s. Some first generation plastic pipe and pre-1983 pipe needs to be replaced. Operations personnel hope that in the future plastic will last as long as steel, but there is no certainty on the life cycle. Historical data is limited since the experience band is only 1984-2017. The widest placement and experience band are shown below with both my recommended life of 65 years and Staff's recommended life of 71 years.

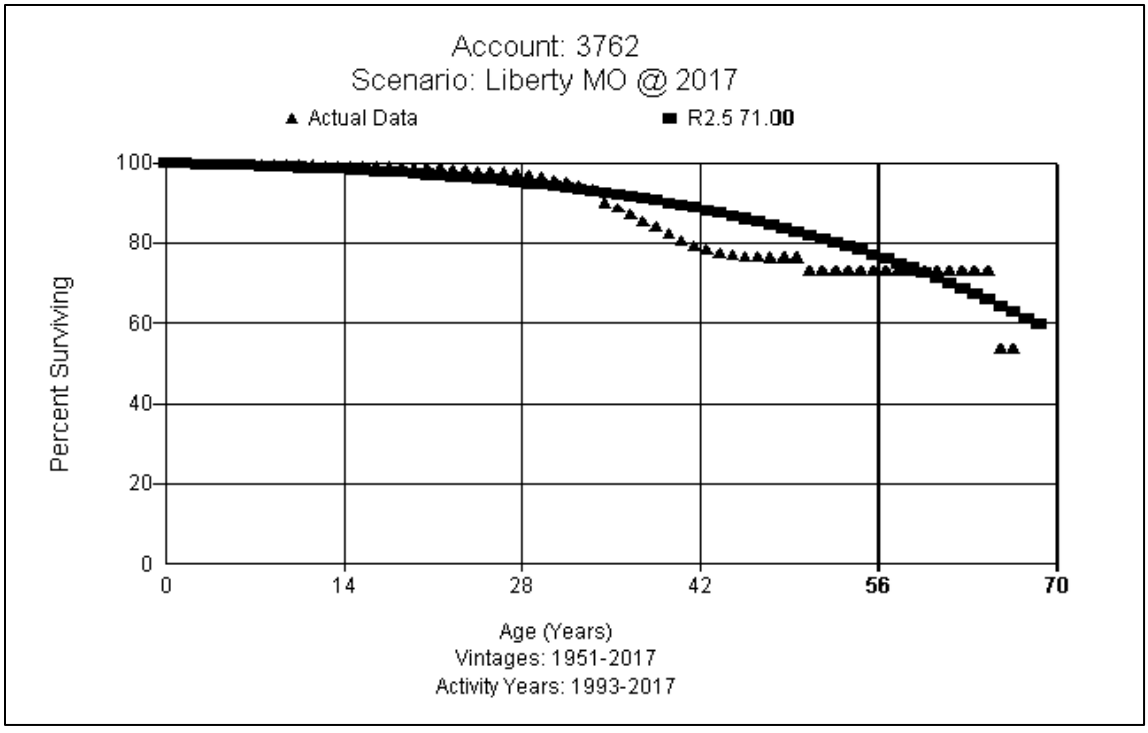




Looking at the graphs above, you can see the 65 R2.5 curve is a closer fit to actual retirement experience, particularly between ages 35-56, than the 71 R2.5 curve; additionally, the slope of the tale is more closely aligned to actual experience.

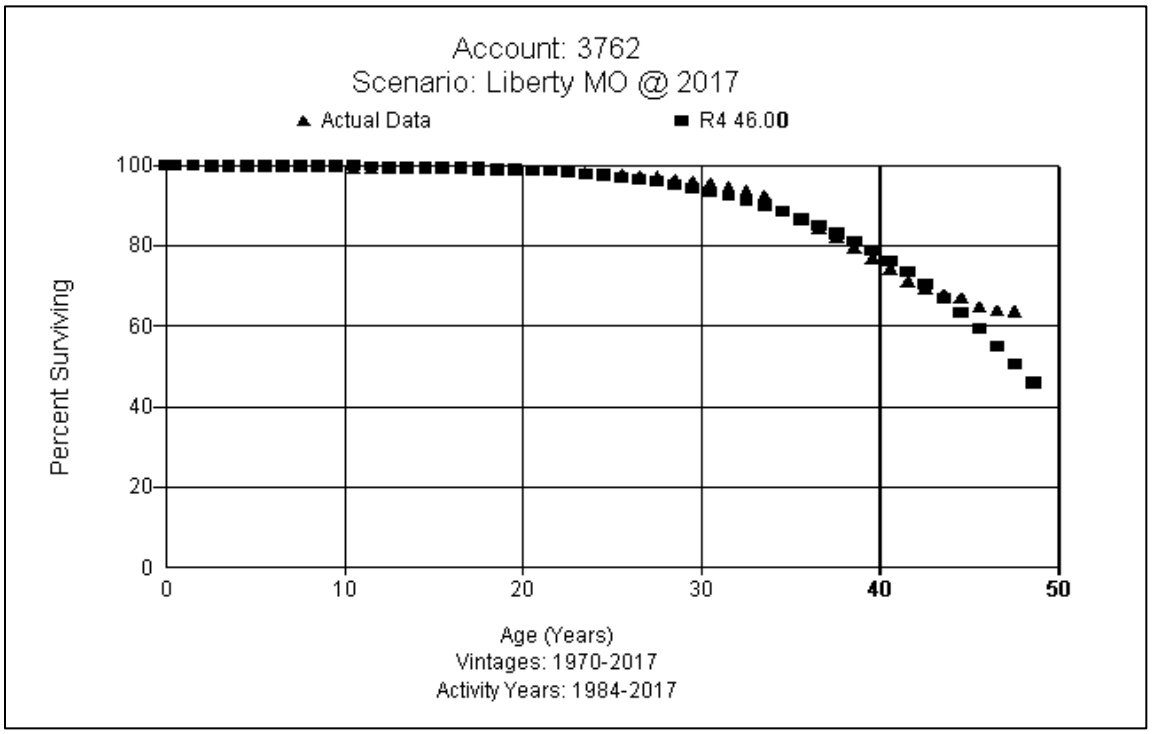
When we further analyze the same placement band with a more recent experience bands, the 65 R2.5 consistently represents a closer graphical fit to historical retirement experience than the 71 R2.5 curve.



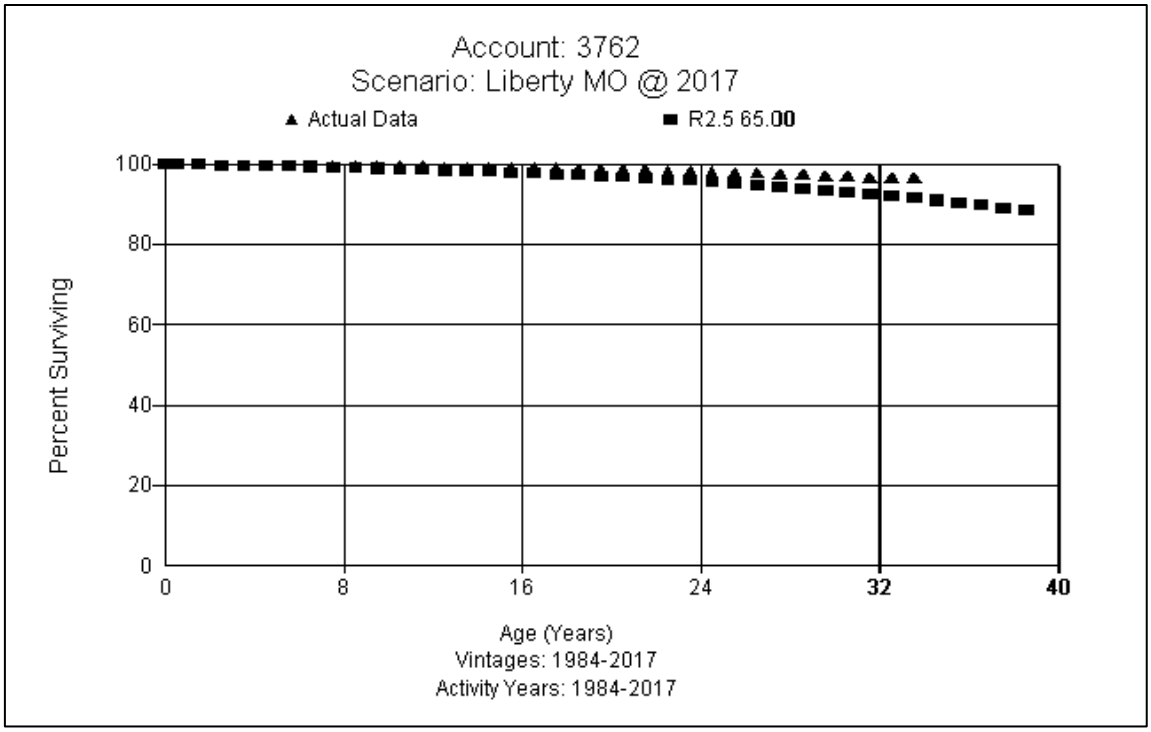


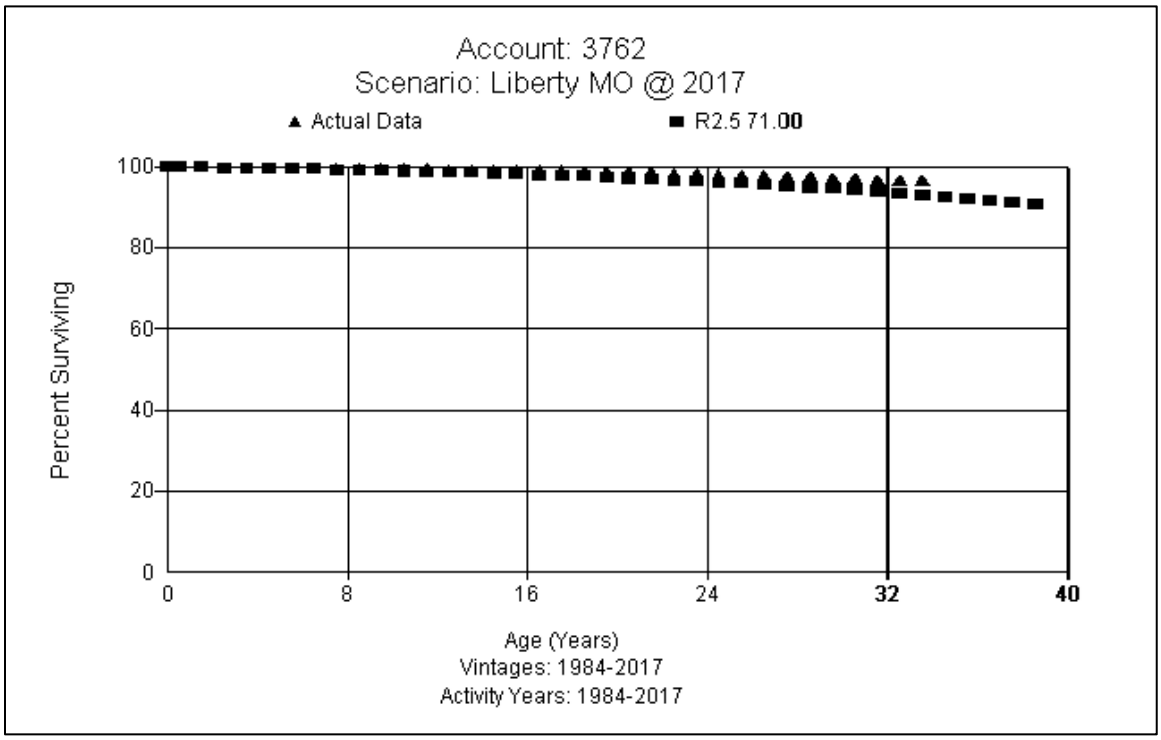
As we continue to look at more recent placement and experience bands, we are seeing

a decreasing life. The graphs below show a close graphical fit is more like a 48 R4, showing a downward trend on the life.



With the decreasing life we are seeing impacting the newer placement and experience bands tends to validate the information we received from operations about needing to replace the plastic mains installed in the 1970s, I don't increasing the life to Staff's recommended longer life is warranted at this time.





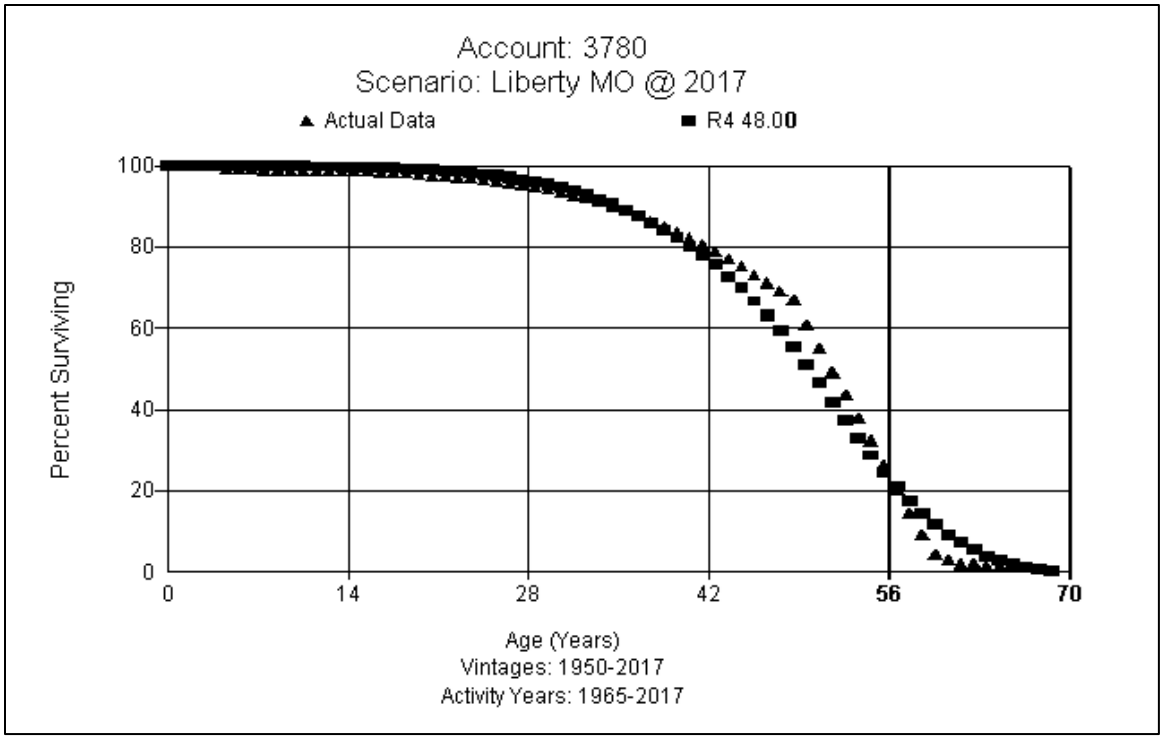
As I have stated previously, I believe analyzing the subaccounts separately more accurately reflects the varying retirement activity, mix of assets, and life characteristics of the assets in each sub account (which are very different). Looking at the graphs above, you can clearly see the life characteristics of the plastic mains is not the same as

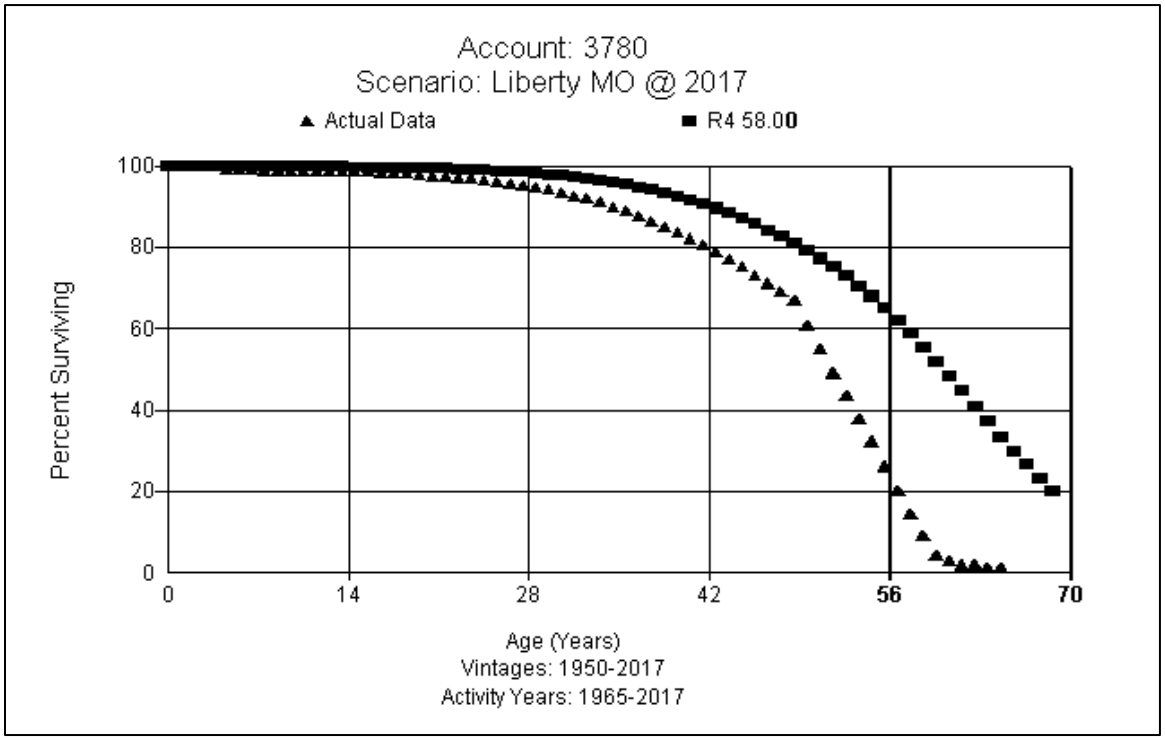
the shorter lived assets recorded in sub account 3760. Additionally, steel and plastic mains have different lives and retirement patterns. After analyzing the historical data and considering the information provided by company personnel, I recommend a 65 R2.5 curve for sub account 3762.

FERC Account 378.0 M&R Station Equipment – General (48 R4)

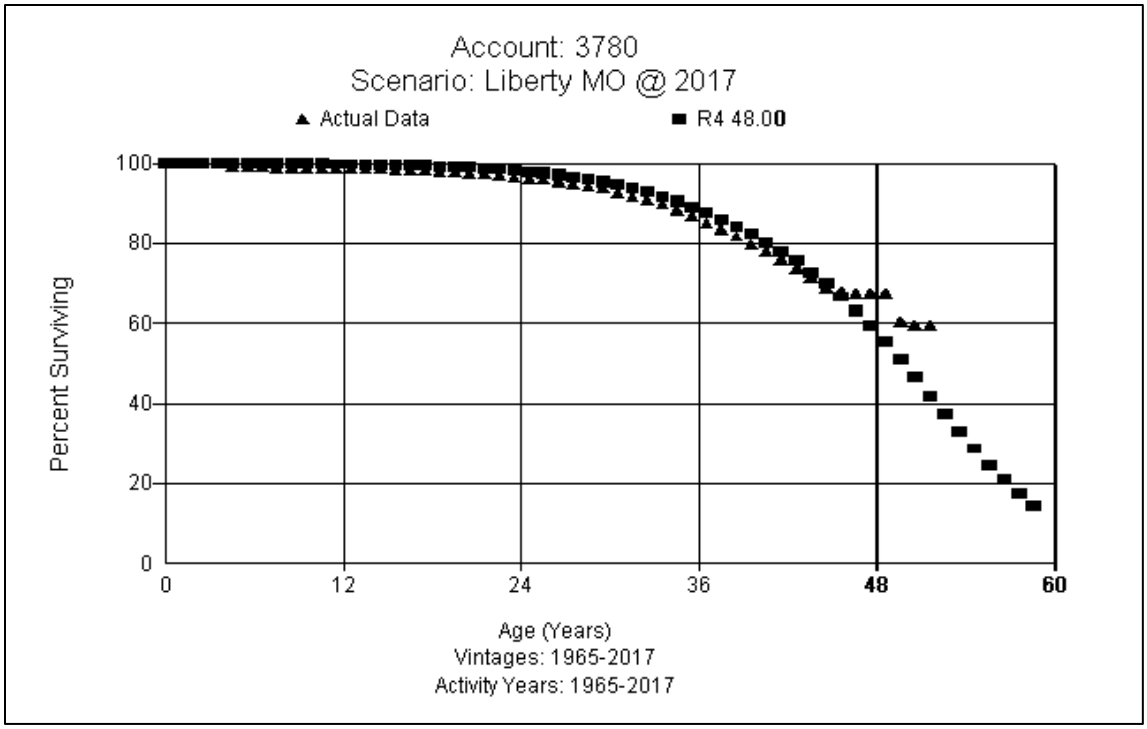
Company Original	Staff Proposed	Company Proposed Revised
40 R4	58	48 R4

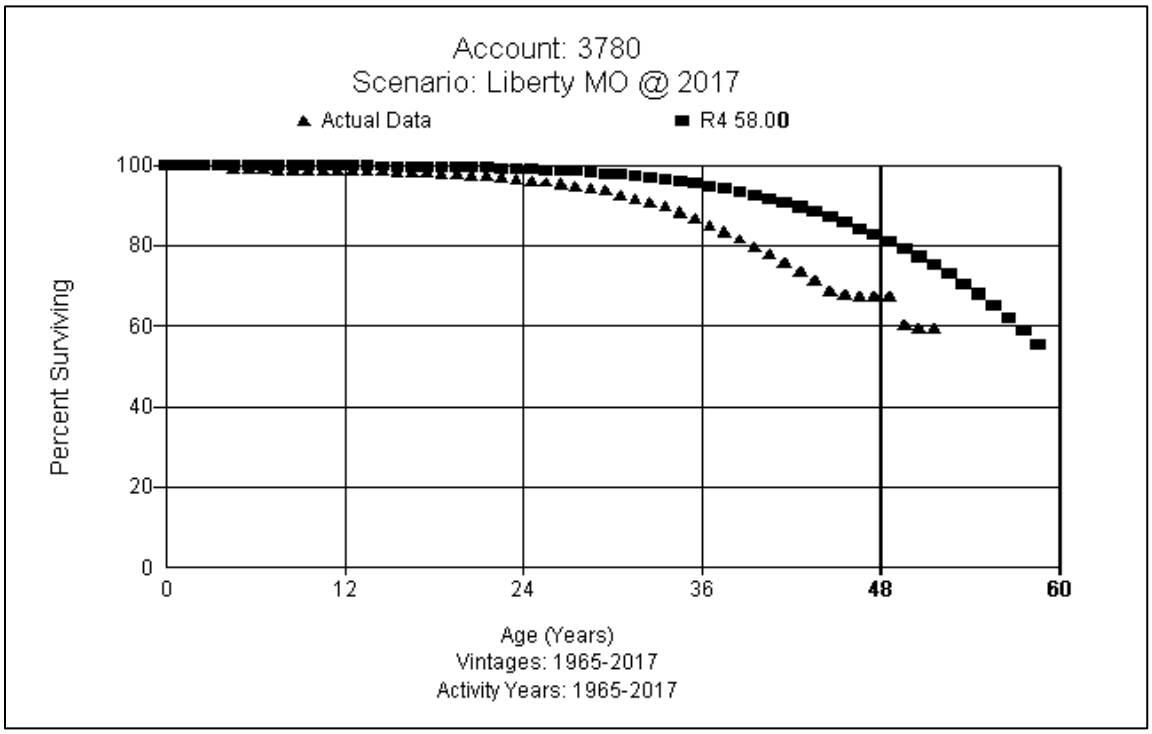
This account consists of M&R station piping, regulators, controls, odorizers and other equipment used in distribution measuring and regulating stations. There is currently $2.5 million in total plant for Mid-States Gas Missouri. Company personnel report that they have replaced hardware in field (SCADA) equipment and a number of relief valves in recent years. The average age of investment of 12.46 years reflects the changes and upgrades that have occurred. Many times, replacement asset in this account have more electronics which will have a shorter life than older equipment that was not as dependent on the forces of technology. The overall band shows a longer life than seen in the original three state study provided in my direct testimony. Also, based on the assets in the account and the similarity to assets in 379, there should be an expectation that the lives of these two accounts are fairly parallel to each other. In the graphs below, the overall placement band of 1950-2017 and experience band of 1965-2017 shows that the 48 R4 curve is consistently a close fit to the historical retirement activity. For a graphical comparison I also included a graph of Staff's proposed life of 58 using the same selected dispersion curve.



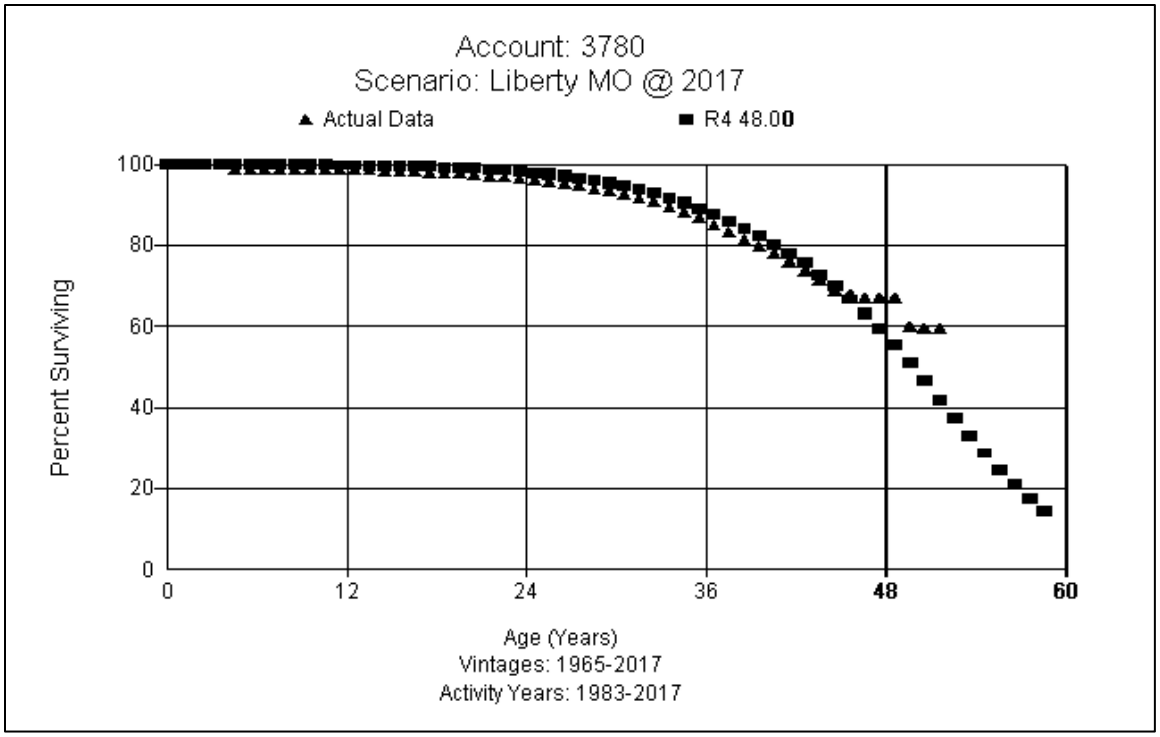


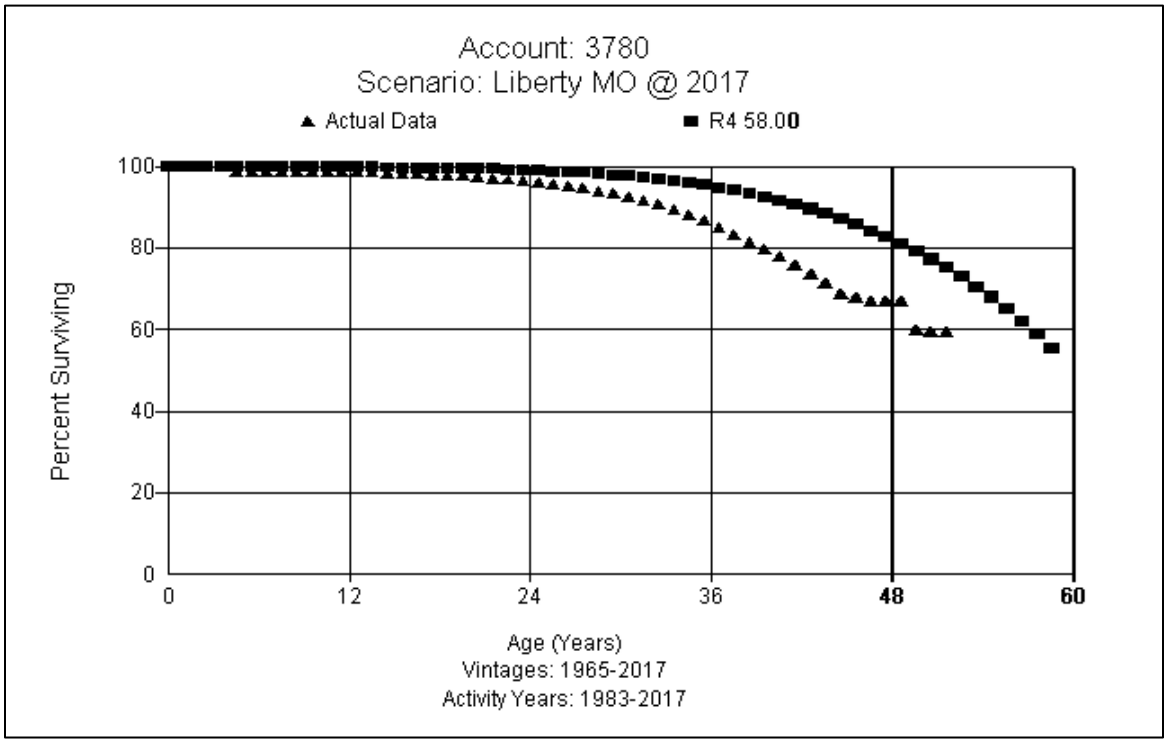
Looking at the graphs above, the 48 R4 is a much closer graphical fit to the historical retirement activity than the 58 year life Staff is recommending.

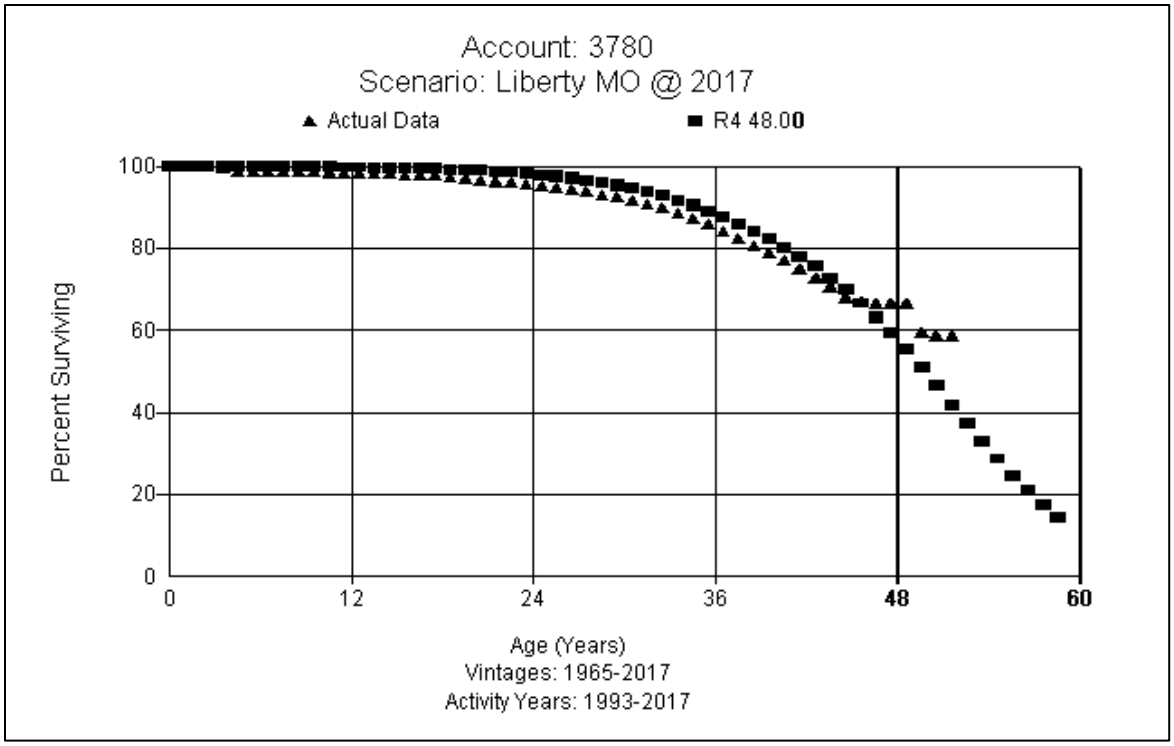


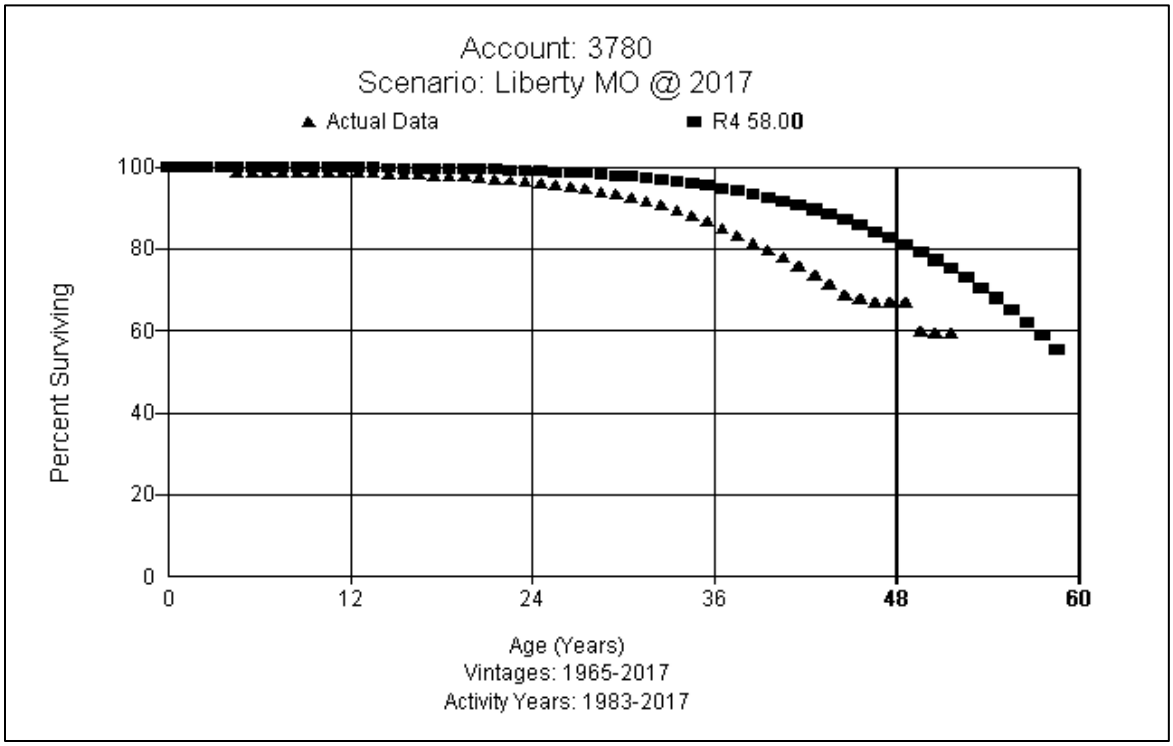


As we continue to analyze more recent placement and experience bands, the 48 R4 curve continues to closely align with the retirement patterns in the historical data.


Account: 3780
Scenario: Liberty MO @ 2017
Actual Data
R4 48.00
Percent Surviving
100
80
60
40
20
0
0
12
24
36
48
60
Age (Years)
Vintages: 1965-2017
Activity Years: 1983-2017


Account: 3780
Scenario: Liberty MO @ 2017
Actual Data
R4 58.00
Percent Surviving
100
80
60
40
20
0
0
12
24
36
48
60
Age (Years)
Vintages: 1965-2017
Activity Years: 1983-2017





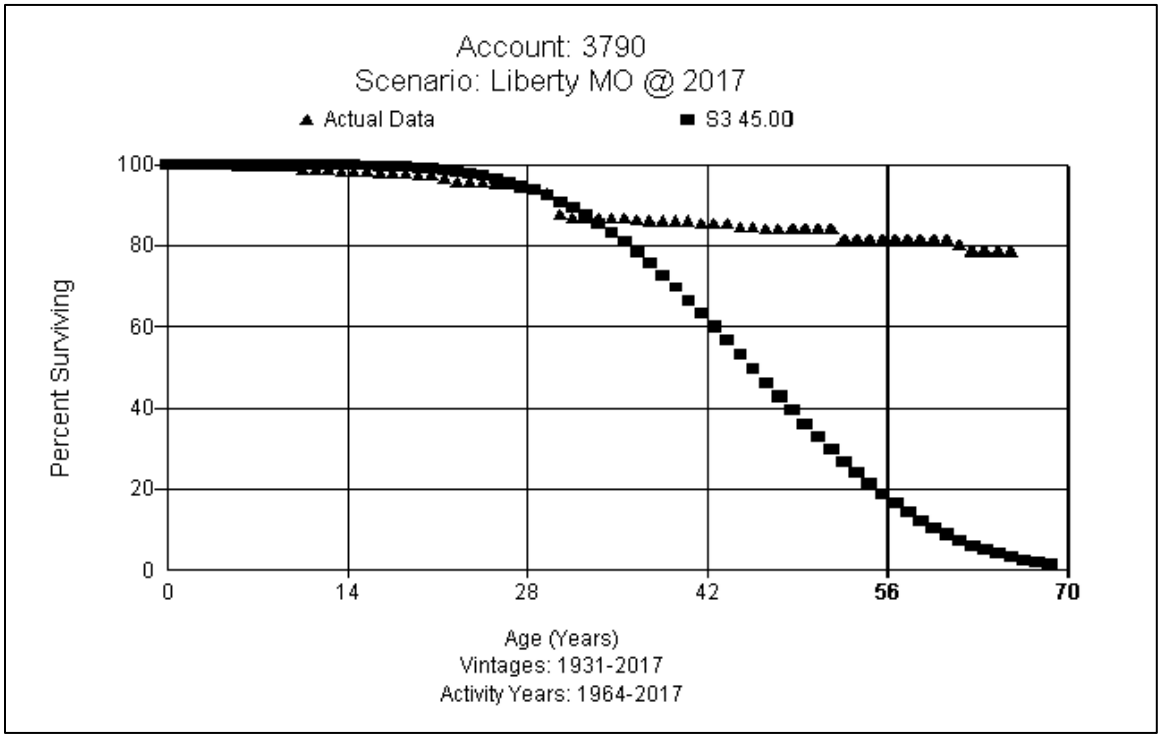
Staff proposes a longer life of 58 years for this account. After performing life analysis using Missouri only retirement data through 2017, seeing how closely the 48 R4 curve is to historical retirement experience, and incorporating information provided by operational personnel and the expectation for a life that is reasonably parallel to that

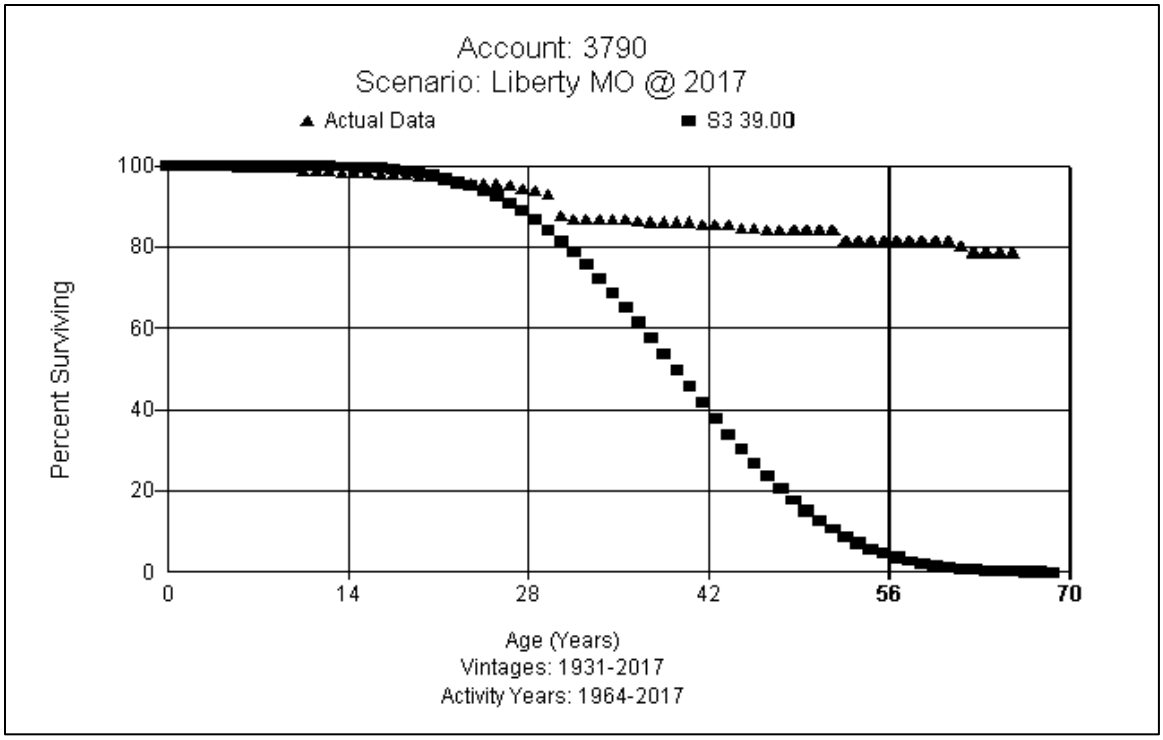
of City Gates, I feel an average life of 48 years with an R4 dispersion strongly supports the future expectations for the life of the assets in this account.

FERC Account 379 M&R Station Equipment-City Gate (45 S3)

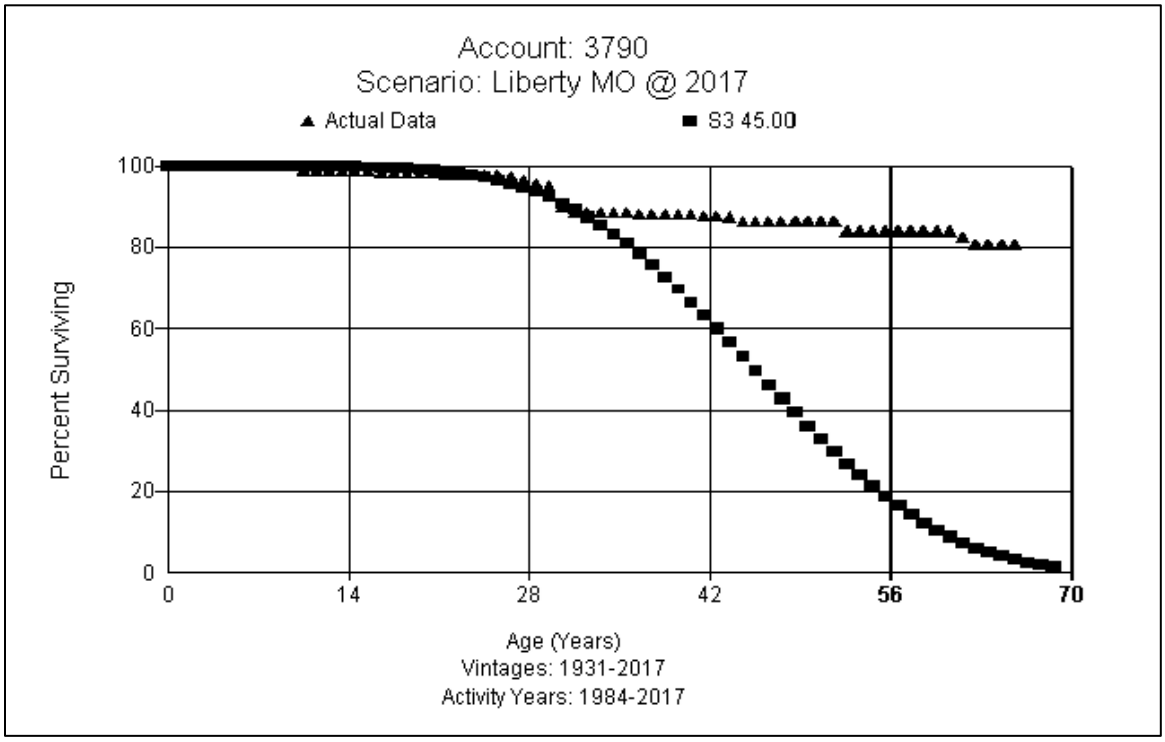
Company Original	Staff Proposed	Company Proposed Revised
45 S2	39	45 S3

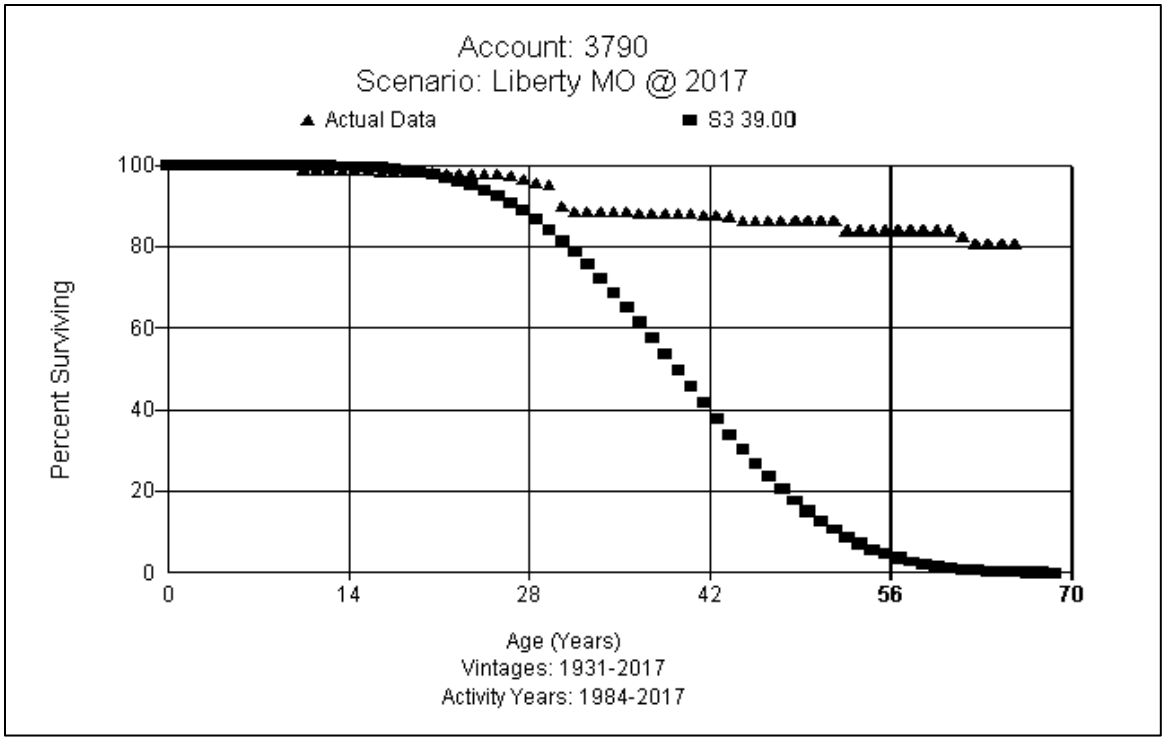
This account consists of M&R station piping, regulators, controls, odorizers, and other equipment used in city gate distribution measuring and regulating stations. There is currently $2.7 million in total plant for Liberty Missouri as of 2017. Company personnel report that they have replaced a number of relief valves in recent years. Below are graphs showing the full placement and experience bands and my recommended 45 S3 curve and a 39 S3 curve based on Staff's proposed life.



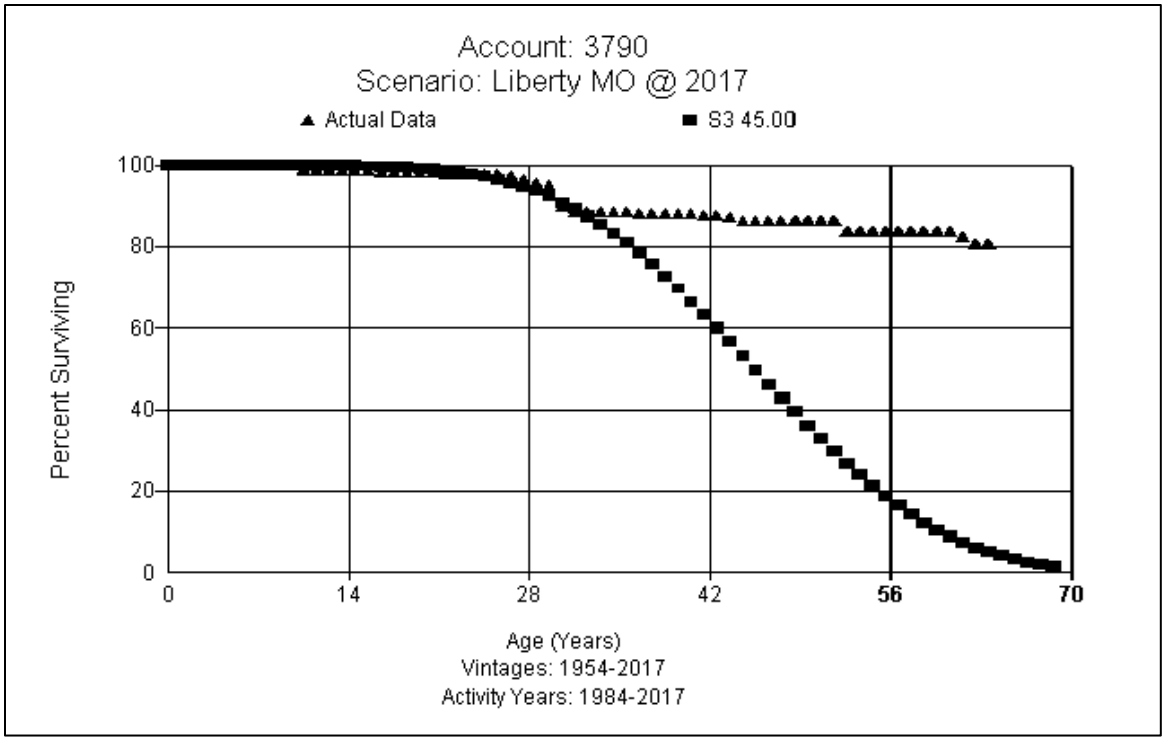


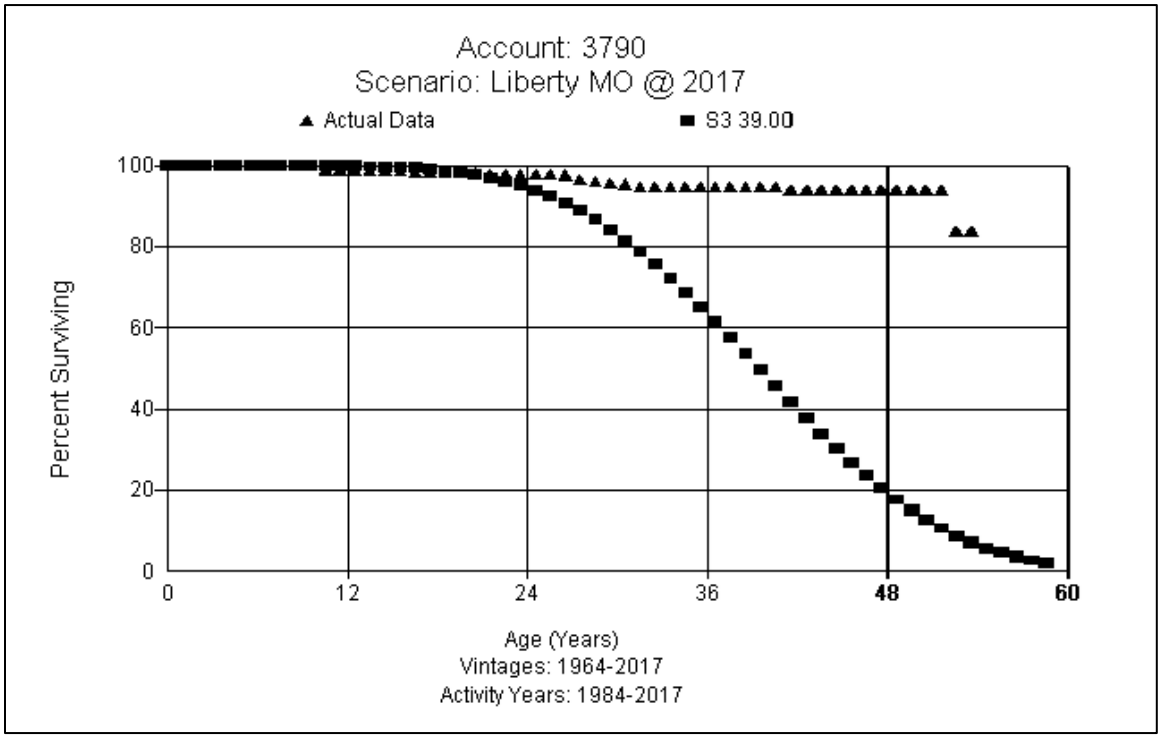
Comparing the graphs above, the S3 45 curve is more closely aligned with actual retirements around ages 25-38 where the actual retirement data slopes downward. The S3 39 curve drops earlier and is not as closely matched.





Analyzing the graphs above, when we use the full placement band combined with a more recent experience band of 1984-2017, the 45 S3 curve again closely aligns with actual experience at age 30 where the actual data slopes down. The S3 39, proposed by staff is even further below the actual data than in the previous graphs.





As we analyze further and look at a more recent placement band of 1964-2017 and an experience band of 1984-2017, shown above, the S3 45 curve consistently aligns better right at the point where the actual data curve starts to slope down around age 30 or so.

While the stub curve is too short to fully understand the characteristic of the assets in the account, given the life set (by Staff and Alliance) for district regulator stations and the partial indications from the analysis, I recommend retaining our recommended 45 year life and an S3 curve for this account.

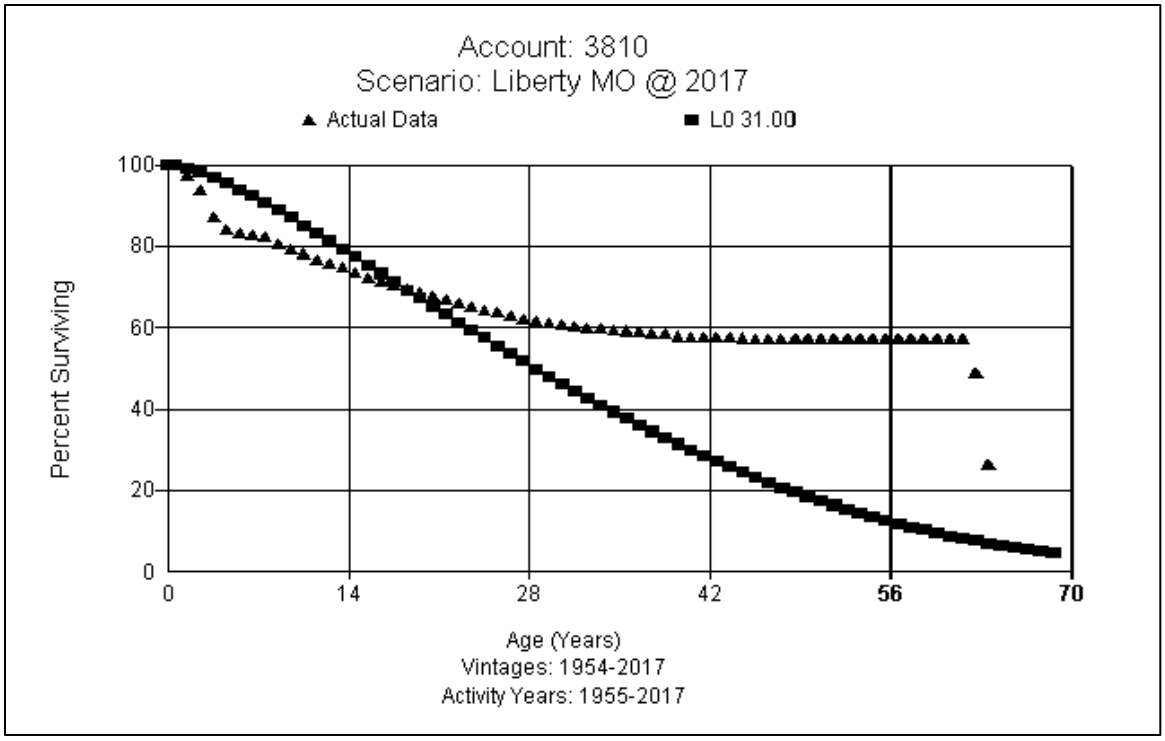
FERC Account 381.0 Meters (31 L1)

Company Original	Staff Proposed	Company Proposed Revised
31 L1	39	31 L1

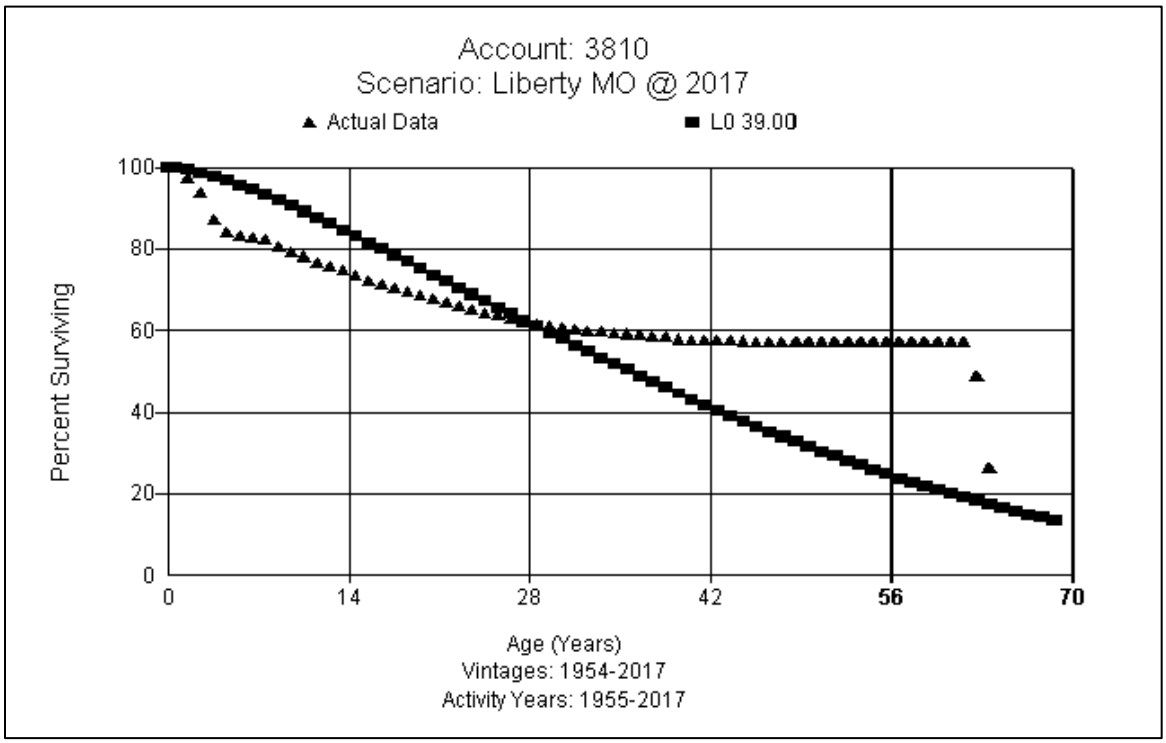
This account consists of meters and meter reading equipment. There is currently $10.6 million in total plant for Mid-States Gas Missouri at December 31, 2017. At September 30, 2015, there was $8.3 million in plant. In Missouri, about 1.5% of the meters were AMR in September 2015. Since that time, the Company has committed to install automated meter readying technology ("AMR") devices for all its Missouri customers as described in DR 0087. Company personnel expect ERT battery life to be 15 to 25 years depending on frequency and overall for meters to last around 30 years. The company that refurbishes meters for Liberty will work on assets up to 30 years old.

There were large retirements that occurred in 2016 and 2017 where the Company retired $3.3 million, nearly 40% of the plant balance in September 2015. The average age of retirements in 2016-2017 was 27.92 years. At year end 2017, the average age of plant in this account shows 10.97 years. Given these indications, newer placement and experience bands will be indicative of the future of this account.

This graph represents the overall placement and experience band for the Company's original pick using data through 2017.



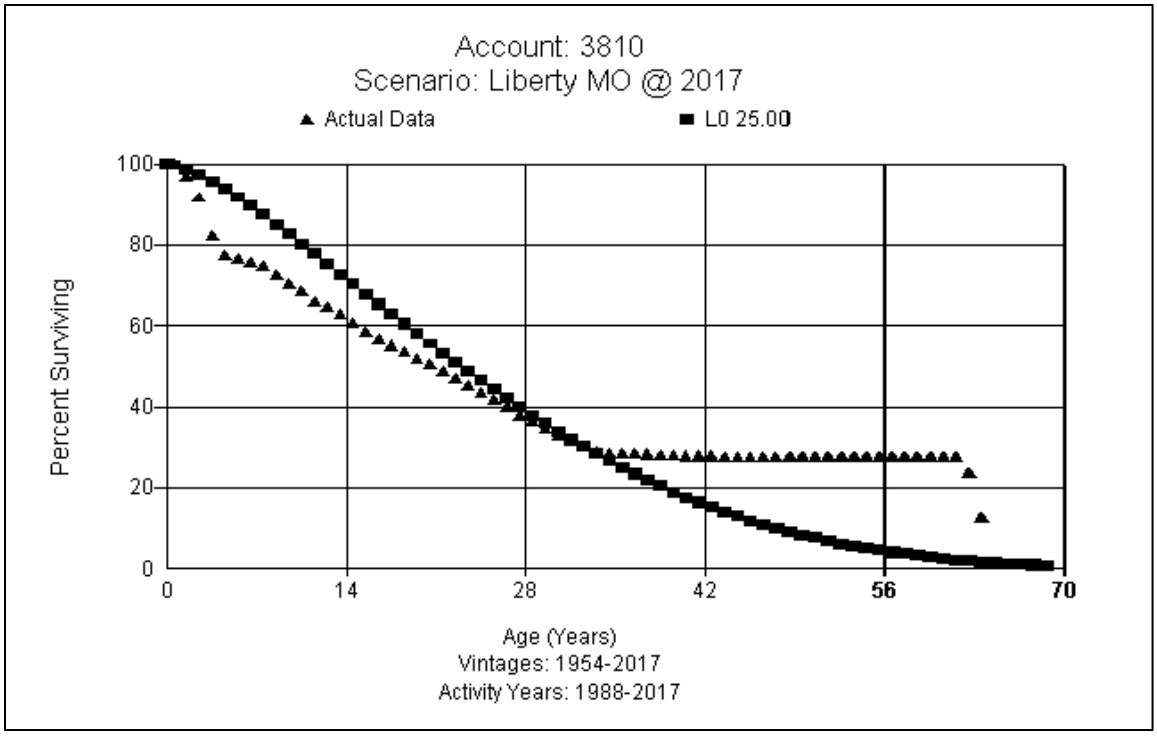
Neither Staff's nor Alliance proposed lives match this pattern well.



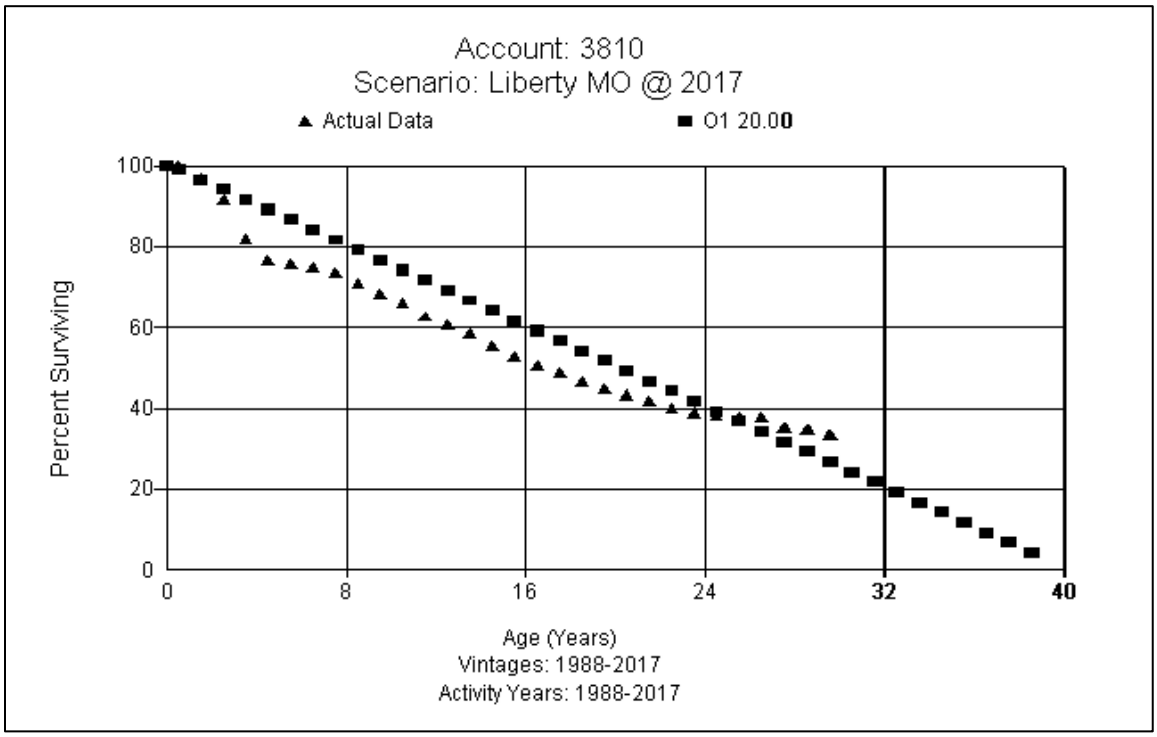
Staff's recommended 39 year life is based on experience through 2015 and comparison with other Missouri gas companies. Given the age of some of the comparable studies (Empire District Gas in 2009 and Ameren in 2010) as well as the

pace of technology in meters, we think it is important to look at experience through the most recent year.

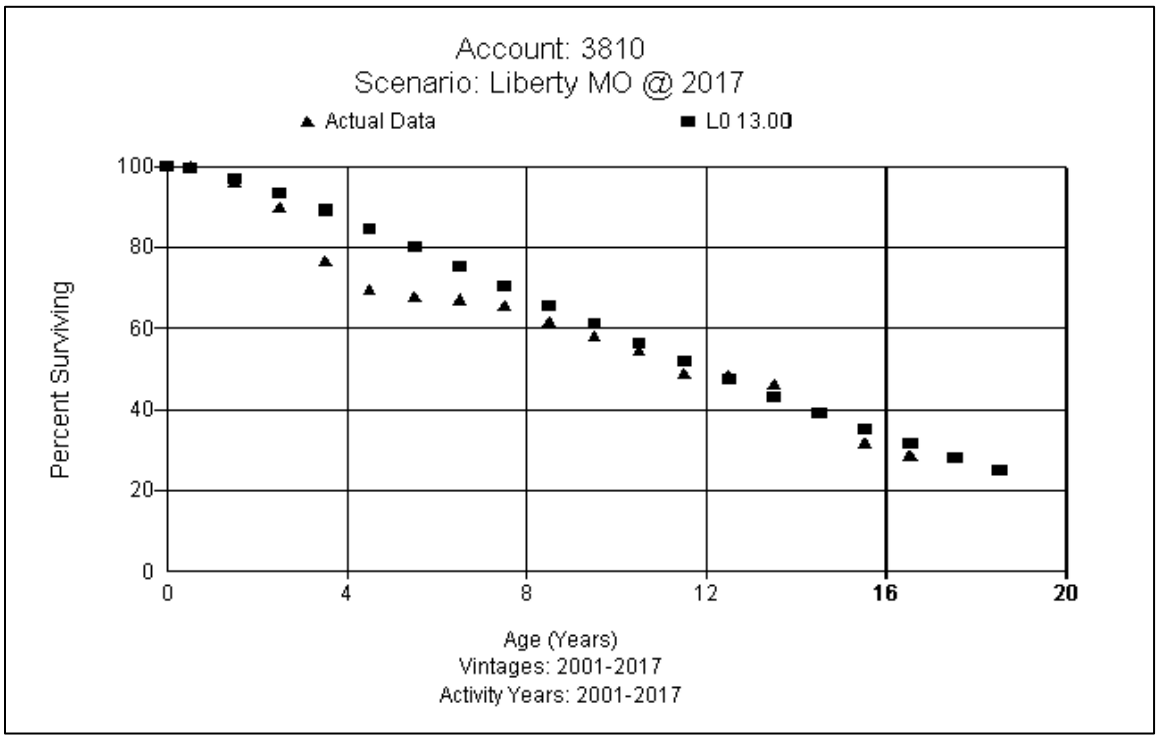
Newer bands show even shorter lives. The graph below shows the overall placement band and an experience band of 1989-2017.



The placement band and experience band of 1988-2017 shows a decreasing life.



For the placement/ experience band of 2001-2017, the life is even shorter.



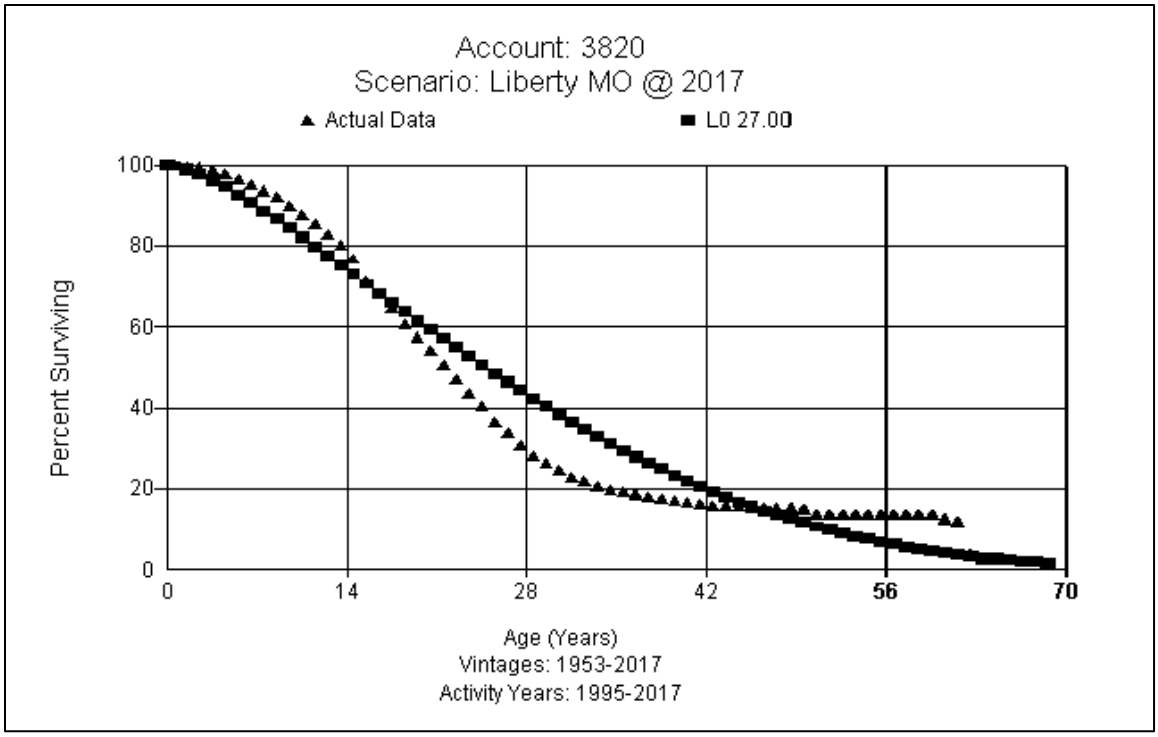
The results showing a rapid decline in life are not to be expected to continue going forward. I see that Staff's proposed 39 year life is as good a fit as Alliance's through

2015 for the full band, but given the significant retirement activity (and the fact that the retirement activity was retiring 40% of the investment at an age in the mid 20's, we believe it is important to look at the most recent activity and the future replacement activity. With our initial recommendation at 31 years, the recent retirements reflecting a shorter life, the more recent life bands also suggesting a decreasing life and the addition of much shorter lived assets to the account, we continue to recommend retaining our original life parameter of 31 L1. Additional years of data in the next study may more fully support adjusting the life downward as the indications are starting to show.

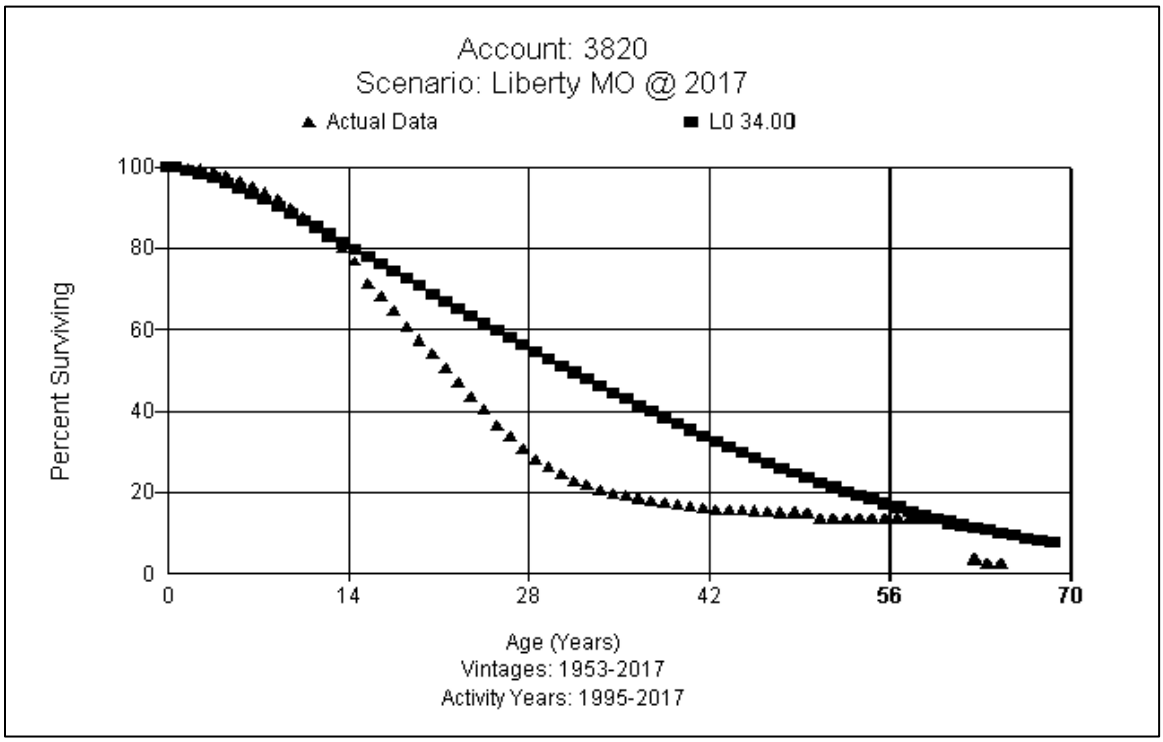
FERC Account 382.0 Meter Installations (27 L0)

Company Original	Staff Proposed	Company Proposed Revised
27 L0.5	34	27 L0

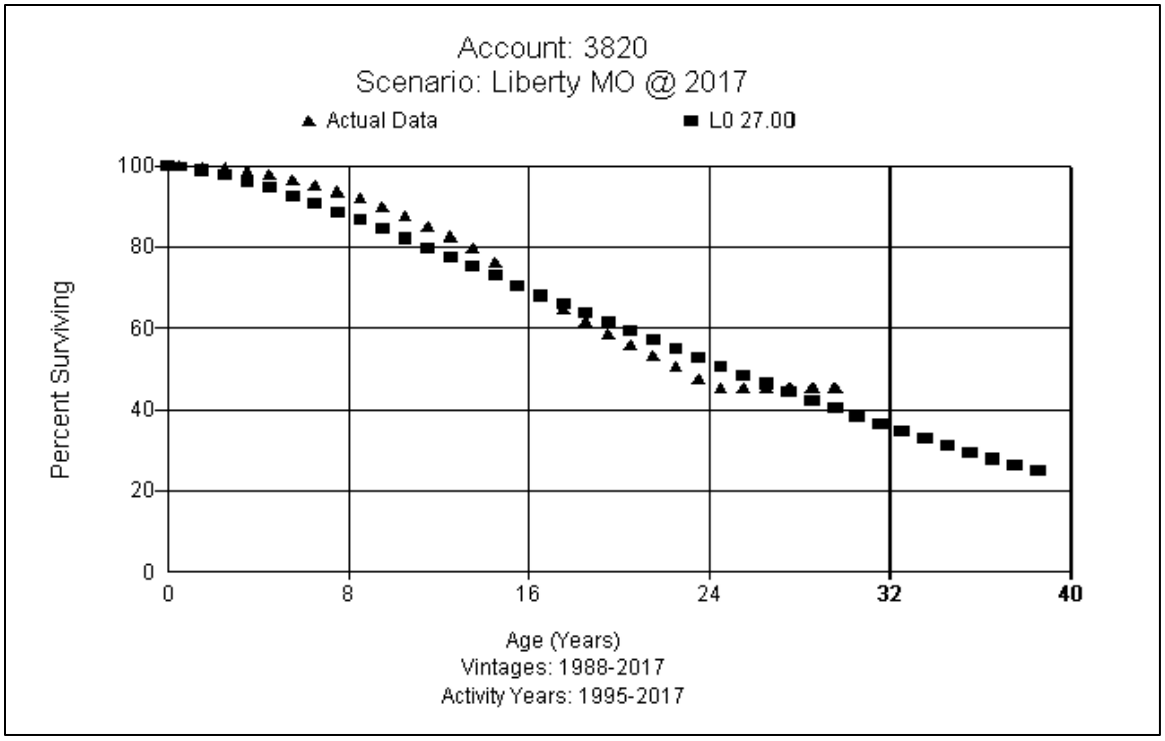
This account consists of meter installation equipment. There is currently $11.3 million in total plant for Mid-States Gas Missouri. Historical data is limited since the experience band is only 1995-2017. There were no retirements during 2012-2015, and retirement activity in 2016-2017. Thus it is important to use the 2017 data to analyze the Company's life characteristics. The graphs below show actual retirement activity and the 27 L0 Iowa curve over different placement bands and the full experience band. The graph below shows the Company's revised proposal for the overall placement and experience band.



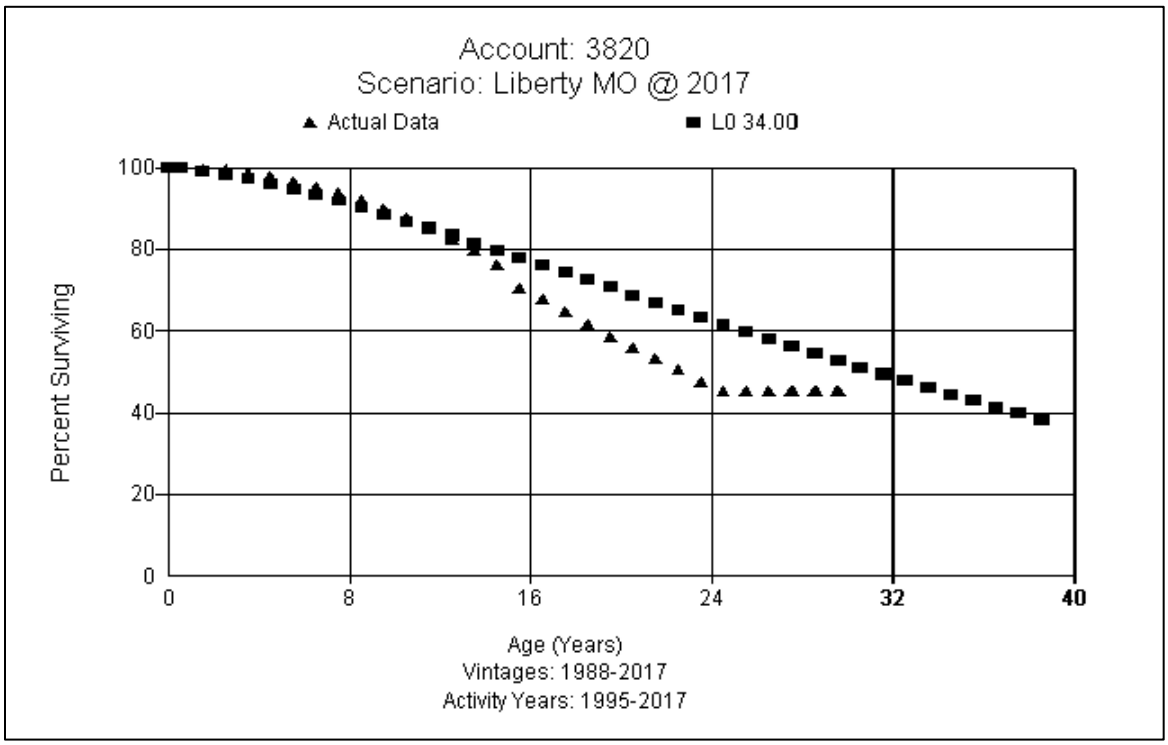
Staff's proposed curve is for the overall band is shown below.



These graphs are a more recent placement /experience band of 1988-2017 and 1995-2017. The graph is the Company's proposal.



Staff's proposed curve for the same band is shown below. The Company proposal is a better visual match over this period.



The two graphs below show a more recent placement and experience bands and two different R curves. The more recent experience band shows the higher dispersion

curve is a closer fit, but the average service life of 27 is still reasonable. Based on the review of the life analysis results and judgment, we revise our proposal to be 27 L0 curve for this account.

FERC Account 383.0 House Regulators (27 L0)

Company Original	Staff Proposed	Company Proposed Revised
27 L0.5	22	27 L0

This account consists of house regulators and equipment. There is currently $2.3 million in total plant for Mid-States Gas Missouri. There is limited history to analyze. Staff proposes a shorter life of 22 for this account. Typically, regulators are replaced when the meter loop is replaced. Based on that understanding, the regulator life and regulator installation life are reasonably set to match the meter installation life (where meter loops are capitalized). Based on judgment, this study recommends a 27 L0 curve for this account, the same as account 382.0. No graph is provided.

FERC Account 384.0 House Regulatory Installations (27 L0)

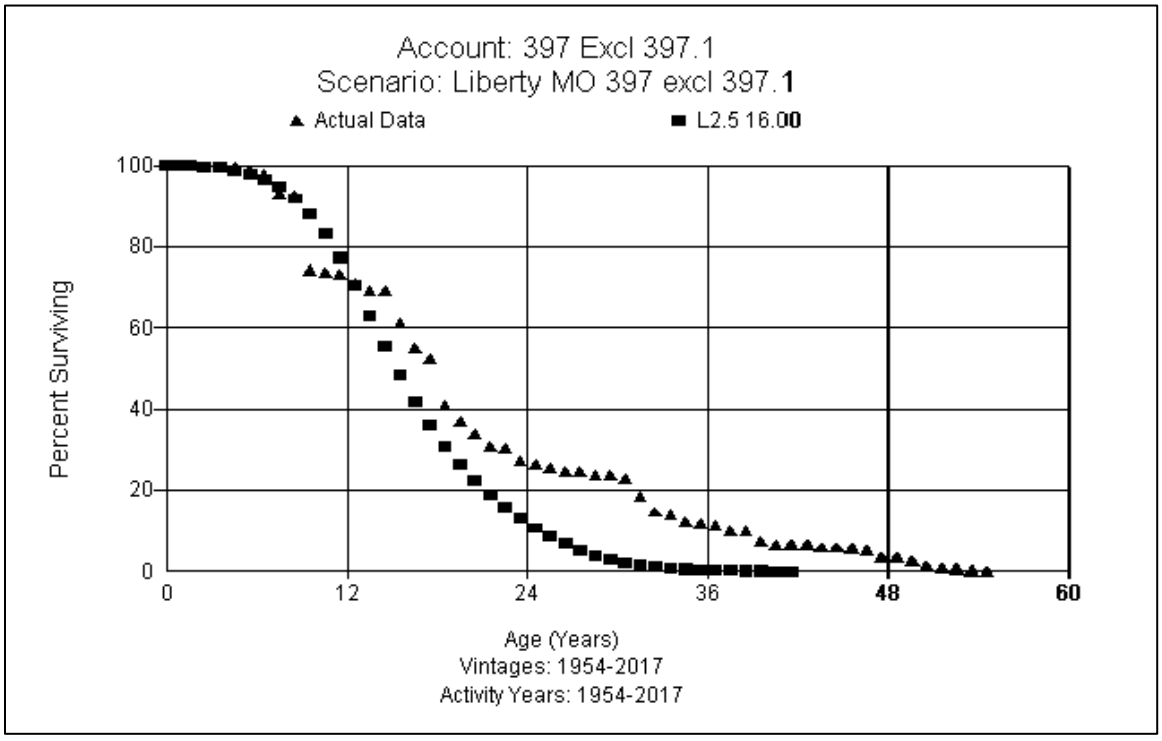
Company Original	Staff Proposed	Company Proposed Revised
27 L0.5	30	27 L0

This account consists of house regulatory installation equipment. There is currently $732 thousand in total plant for Mid States Gas Missouri. There is limited history to analyze. Staff recommends a longer life of 30 for this account. Typically, regulators are replaced when the meter loop is replaced. Based on that understanding, the regulator life and regulator installation life are reasonably set to match the meter installation life (where meter loops are capitalized). Based on judgment, this study recommends a 27 L0.5 curve for this account, the same as account 382.0.

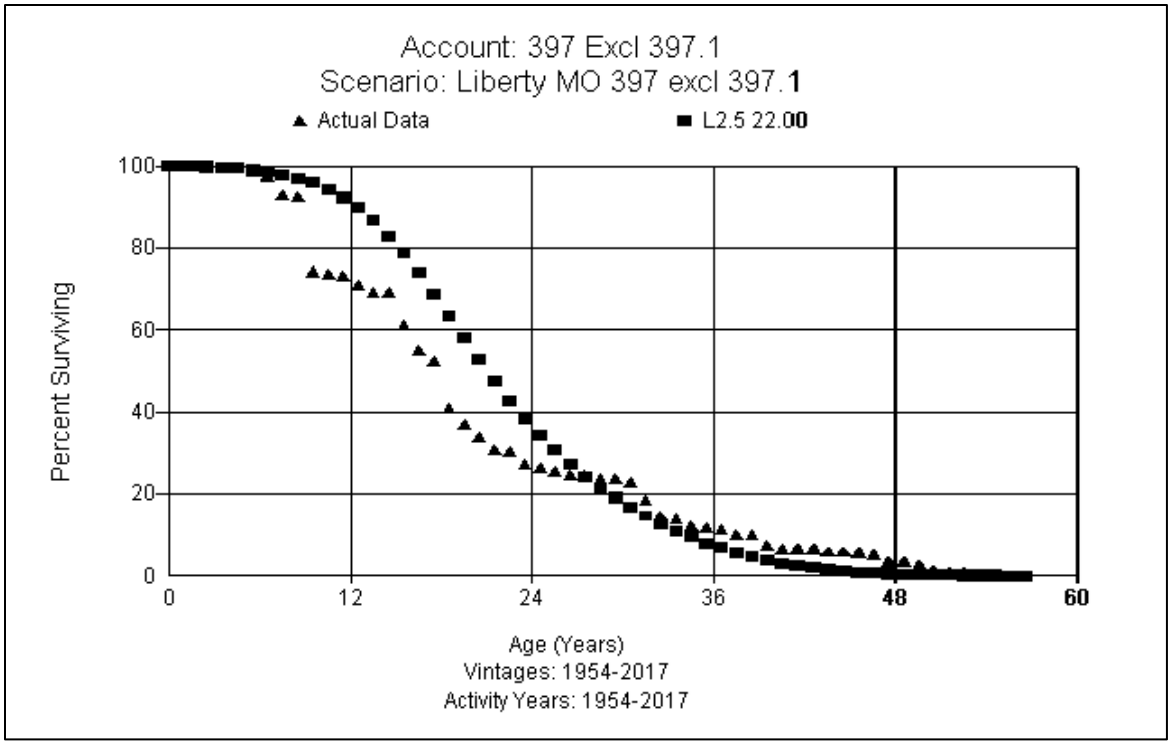
FERC Account 397.0 Communications Equipment (16 L2.5)

Company Original	Staff Proposed	Company Proposed Revised
11 L2	22	16 L2.5

This account consists of general plant communications equipment. There is currently $38 thousand in total plant for Mid-States Gas Missouri. Since there is no plant in Account 397.1, data from Accounts 397.0, 397.2 and 397.3 was combined to analyze this account, because all sub accounts contain homogenous assets with similar life characteristics and forces of retirement, which are primarily changes in technology. The overall band of 1954-2017 does not match the proposed curve well.

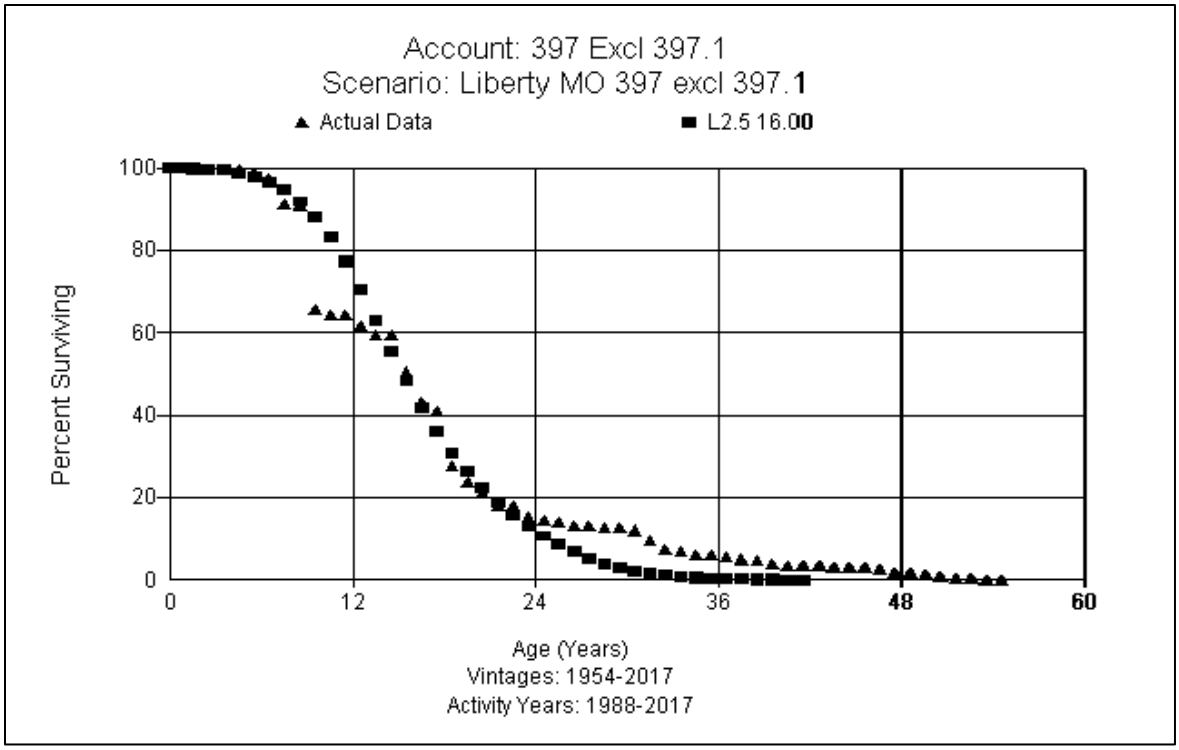


Staff proposes a 22 year life for this account. I do not know which dispersion curve Staff proposes, but the best visual match I see is 22 L1.5 as shown below

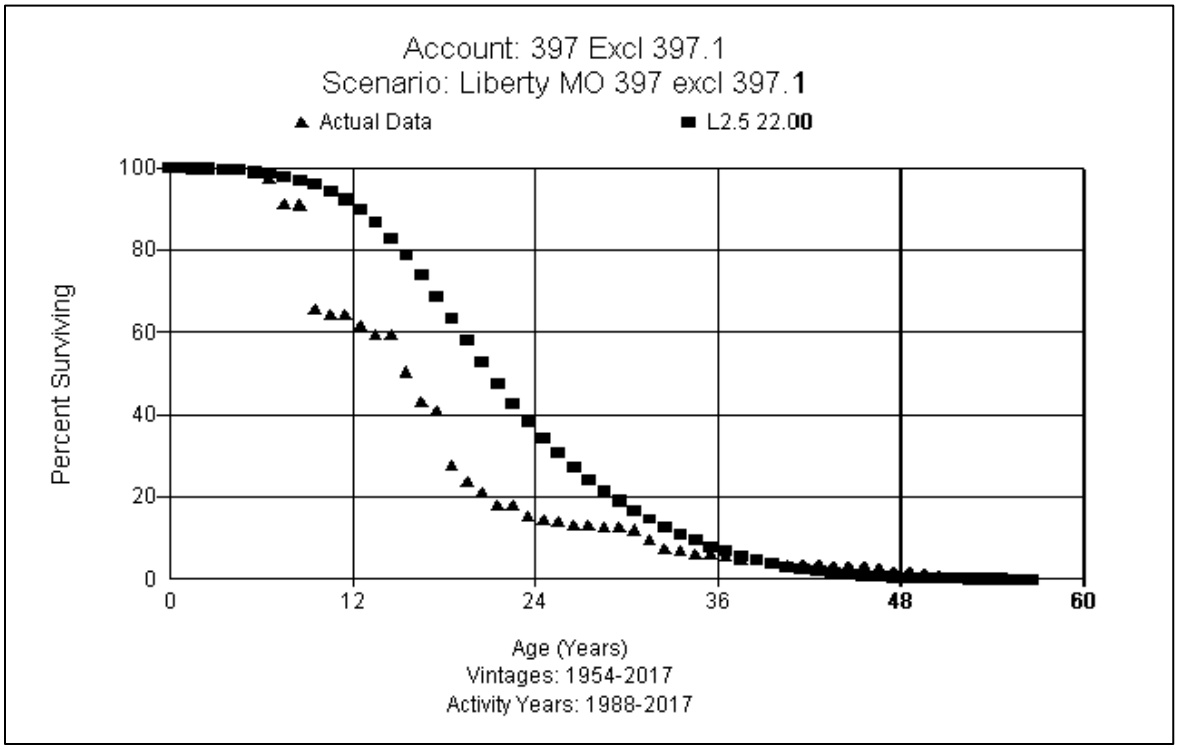


The problem with this fit is that it does not match the drop between 80% surviving and 20% surviving that NARUC mentions. Matching only the tail of the curve is not the matching criteria advocating by NARUC.

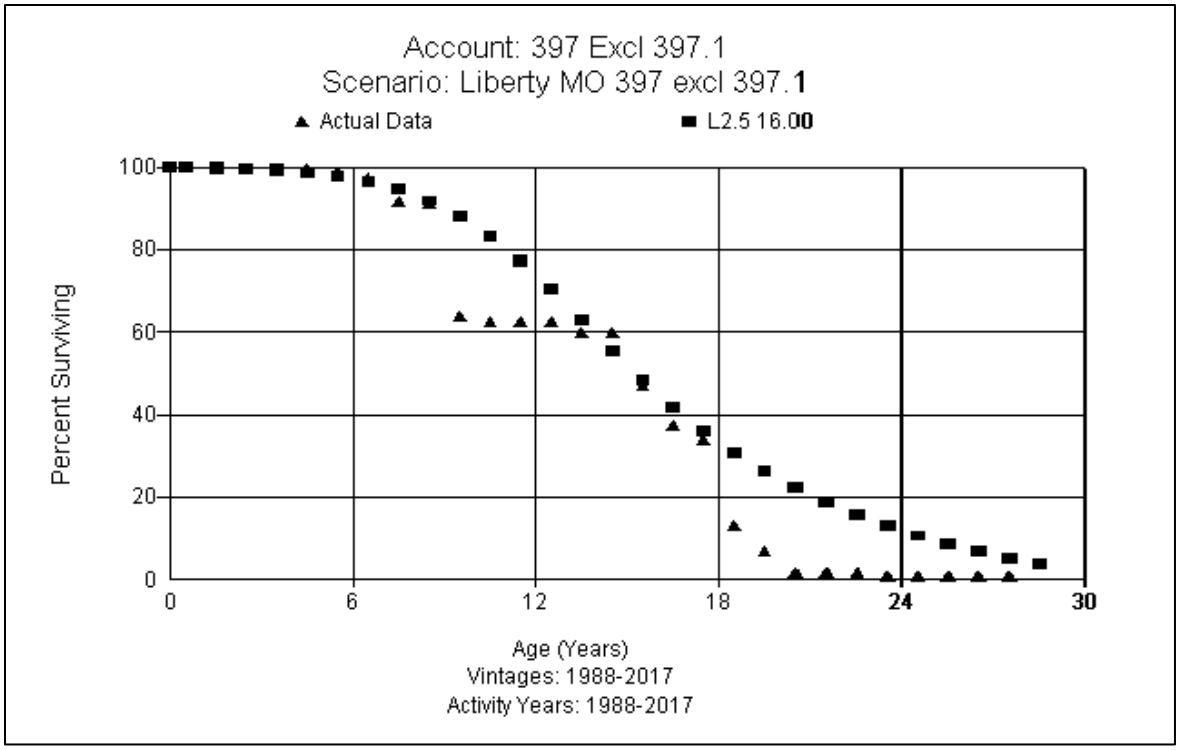
Retaining the overall placement band and moving to a more recent experience band reveals the 16 L2.5 curve provides an excellent visual match.



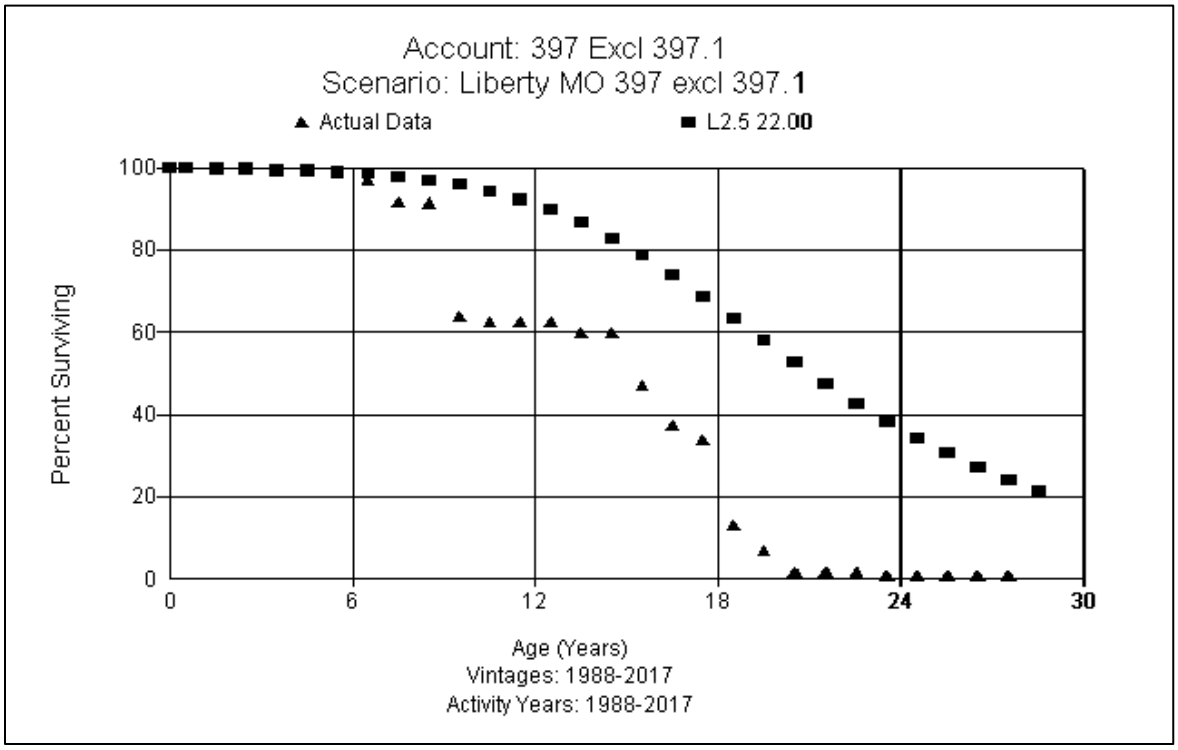
Staff's proposed 22 year life does not match the pattern of retirements in this band.



The placement experience band combination of 1988-2017 shows excellent visual matches with various fits. This band shows that the 16 L2.5 is longer than observed data.



The 22 year life for this band does not match the experience as shown below.



Based on the results of various bands and the technology driven forces of retirement, this study recommends a 16 year life with an L2.5 dispersion.

FERC Account 397.1 General Comm Eq Mob Radios (16 L2.5)

Company Original	Staff Proposed	Company Proposed Revised
11 L2	22	16 L2.5

This account consists of general plant communications equipment – mobile radios. There is currently no plant located in Missouri. Based on results with the combined account, this study recommends a 16 year life with an L2.5 dispersion.

FERC Account 397.2 General Comm Eq Fixed Radios (16 L2.5)

Company Original	Staff Proposed	Company Proposed Revised
11 L2	22	16 L2.5

This account consists of general plant communications equipment – fixed radios. There is currently $13 thousand in total plant for Mid States Gas Missouri. Of that amount, the entire plant balance is in Missouri. Based on results with the combined account, this study recommends a 16 year life with an L2.5 dispersion.

FERC Account 397.3 General Comm Eq Telemetering (16 L2.5)

Company Original	Staff Proposed	Company Proposed Revised
11 L2	22	16 L2.5

This account consists of general plant communications equipment – telemetering. There is currently $3 thousand in total plant for Mid States Gas Missouri. Based on results with the combined account, this study recommends a 16 year life with an L2.5 dispersion.

FERC Account 3995 Other Tangible Property-PC Software (5 SQ)

Company Original	Staff Proposed	Company Proposed Revised
5 SQ	8	5 SQ

This account contains of other tangible property such as PC software. The current balance in this account for Liberty Missouri is $21 thousand. There is limited history to analyze. Staff recommends a longer life of 8 years for this account. The assets in this account are susceptible to frequent changes in technology resulting in shorter useful lives and typically, PC software lives are linked to the underlying PCs. Based on judgement, Alliance continues to recommend a 5 SQ curve for this account.

LIBERTY GAS SHARED SERVICES

The Shared Services Study has been reviewed by Iowa and Illinois, and the proposed parameters and depreciation rates been approved by the Illinois Commerce Commission and Iowa Utilities Board in Dockets GRM #16-208 and RPU-2016-0003, respectively. In Shared Services depreciation parameters, there are only two accounts where I proposed a different life position than Staff. At present, all software is combined into one account with a 7 year life. The Company wishes to subdivide that account into different subaccounts, based on life of the software. In my opinion, this will best satisfy the matching principle and will use the same depreciation groups consistently across multiple jurisdictions. For these reasons, I recommend the following positions:

FERC Account 399.5 Other Tang Prop – PC Software (3 SQ)

Company Original	Staff Proposed	Company Proposed Revised

3 SQ	7	3 SQ

FERC Account 399.5 Other Tang Prop – PC Software (5 SQ)

Company Original	Staff Proposed	Company Proposed Revised
5 SQ	7	5 SQ