Docket No. RP16-___-000
Exhibit No. ANR-057

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

ANR Pipeline Company) Docket No. RP16 -___-000

Summary of Prepared Direct Testimony of Patrick R. Crowley

Mr. Crowley is employed by Brown, Williams, Moorhead and Quinn, Inc., a nationally recognized energy consulting firm, as a depreciation expert in regulated oil and natural gas pipelines. He provides Prepared Direct Testimony in this proceeding on behalf of ANR Pipeline Company ("ANR") regarding the proper and adequate depreciation rates for ANR's facilities based on reasonable remaining life estimates and a broad group straight line average remaining life depreciation methodology.

Mr. Crowley explains the concepts behind depreciation analysis and survivor curve theory, which establish the average service lives of the assets of the utility, the retirement decline curve, and the interim retirements that set the average remaining life for each account. Mr. Crowley then factors in the truncating factors that further limit the average remaining lives of ANR facilities and then calculates the depreciation rate. Mr. Crowley also calculates negative salvage rates for ANR's assets. Using the retirements forecast from the survivor curves and the terminal retirement engineering study performed by ANR witness Taylor, Mr. Crowley calculates a negative salvage rate that composites near-term and long-term negative salvage.

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PREPARED DIRECT TESTIMONY OF PATRICK R. CROWLEY ON BEHALF OF ANR PIPELINE COMPANY

January 29, 2016

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Glossary of Terms

ALJ	Administrative Law Judge
ANR	ANR Pipeline Company
ARL	Average Remaining Life
ASL	Average Service Life
BLS	Bureau of Labor Statistics
BWMQ	Brown Williams Moorhead & Quinn, Inc.
CI	Conformance Index
DEPR	Depreciation
FASB	Financial Accounting Standards Board
FERC	Federal Energy Regulatory Commission
INS	Interim Negative Salvage
L Curve	Left Modal Iowa Survivor Curve
NBV	Net Book Value
NGA	Natural Gas Act
NS	Negative Salvage
PHMSA	Pipeline & Hazardous Materials Safety Administration
PPI	Producer Price Index
R Curve	Right Modal Iowa Survivor Curve
S Curve	Symmetrical Modal Iowa Survivor Curve
SPR	Simulated Plant Record
TNS	Terminal Negative Salvage

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ANR Pipeline Company) Docket No. RP16 -___-000

Prepared Direct Testimony of Patrick R. Crowley

I. INTRODUCTION

Q. Please state your name, occupation and business address.

A. My name is Patrick R. Crowley and my business address is 1155 15th Street, NW, Suite 1004 Washington, DC 20005. I am Vice President of Brown Williams Moorhead & Quinn, Inc. ("BWMQ"), an energy consulting firm in Washington DC.

Q. On whose behalf are you submitting testimony in this proceeding?

A. I am submitting testimony on behalf of ANR Pipeline Company ("ANR").

Q. What is the purpose of your direct testimony?

A. The purpose of this Prepared Direct Testimony is to present my recommendation regarding the proper and adequate depreciation rates based on appropriate remaining life factors applicable to the ANR natural gas pipeline system. I am also recommending negative salvage rates for ANR's storage and transmission functions that are a composite of the short and long-term negative salvage expectations.

Q. Please state your professional experience and qualifications.

A. I graduated from DePaul University in Chicago, Illinois with a Bachelor of Arts degree in economics in 1976 and a Master of Arts degree in economics in 1978, with a concentration in mathematical economics. Upon graduation from DePaul University in 1978, I joined the Chicago, Rock Island & Pacific Railroad Company for a short time working in the general manager's office before I joined the Federal Energy Regulatory Commission ("FERC" or "Commission") in 1979. I was employed at FERC for 28 years. For 24 of those 28 years, I was employed in the litigation division of the Office of Pipeline and Producer Regulation and its successor offices. I retired to form my own consulting firm, Crowley Energy Consulting, in February 2007, where I provided energy litigation support for clients in the natural gas and oil pipeline industries. I joined BWMQ in 2013.

My work as an Industry Economist in the Depreciation Branch of the Pipeline Rates Division of the Office of Pipeline and Producer Regulation at the FERC was mainly as an expert witness with the Trial Staff gas and oil litigation team from 1979 to 1992. I prepared pipeline depreciation studies, long-term forecasts of crude oil and natural gas reserves and production, mortality studies of plant retirements, and cost behavior studies for pipeline facilities. From 1992 through 1994, I worked on the operational aspects of the Order No. 636 service restructuring of Texas Eastern Transmission, LP and was the FERC Staff team leader for the restructuring of Tennessee Gas Pipeline Company. From 1994 through 1998, I worked on the advisory side of the Commission where I prepared reports for Commission orders regarding proposals for revised tariff terms, new services, rate designs, and tariff rates, as well as a wide variety of utility reports and cost studies. In 1998, I returned to the litigation side of the Commission where I worked on electric utility, natural gas, and oil pipeline rate cases, complaint cases, and show cause orders until I retired.

Q. Have you testified before the Federal Energy Regulatory Commission?

A. I filed testimony before FERC in numerous dockets, as reflected on Exhibit No. ANR-058.

Q. Have you provided testimony specifically on depreciation?

A. Yes I have, as reflected in the list of cases in Exhibit No. ANR-058.

Q. Have you provided any exhibits with your testimony?

A. Yes. I have included the following exhibits with my testimony:

Exhibit No. ANR-058	*Curriculum Vitae* of Patrick R. Crowley
Exhibit No. ANR-059	Depreciation Workpapers
Exhibit No. ANR-060	Storage Survivor Curve Analysis
Exhibit No. ANR-061	Transmission Survivor Curves Analysis

Q. What materials are included in your Exhibit No. ANR-059?

A. Exhibit No. ANR-059 is made up of the workpapers supporting my depreciation and negative salvage rate recommendations for the ANR pipeline system. The schedules present each step of the process of developing the proper and adequate depreciation rates given ANR's current operations and the recovery of its investment in plant over the remaining useful life of those assets. The following schedules are included in Exhibit No. ANR-059:

Schedule No. 1	Current & Recommended Depreciation Rates
Schedule No. 2	Depreciation Overview
Schedule No. 2A	Composite Plant Balances
Schedule No. 3	Model Parameters
Schedule No. 4	Maintenance & Capacity Plant Additions
Schedule No. 5	Depreciation Expense & Rate Derivation
Schedule No. 6	Storage Negative Salvage Rate
Schedule No. 7	Transmission Negative Salvage Rate

Schedule No. 8	Intangible Plant Composite Rate
Schedule No. 9	Turbine Compressors Life Expectancy

Q. What materials are included in your Exhibit Nos. ANR-060 and ANR-061?

A. Exhibit Nos. ANR-060 and ANR-061 are made up of the survivor curve analysis workpapers for each of the major property accounts. Exhibit No. ANR-060 consists of Schedule Nos. A-1 through A-7 which include the storage function accounts. Exhibit No. ANR-061 consists of Schedule Nos. B-1 through B-5 which include the transmission function accounts.

Q. Will you summarize your recommendation in this case?

A. Yes. Provided below is a summary of ANR's current depreciation rates along with the rates I support in this testimony:

	Current Rates	**Proposed Rates**
Depreciation Rates		
Intangible Plant	various	10.78%
Production & Gathering	0.00%	0.49%
Underground Storage	2.30%	1.91%
Transmission Plant	1.30%	3.18%
Acct 370 Comm Eq	8.50%	10.00%
General Plant	various	
Acct. 390 Structures & Improvements		5.5%
Acct. 391 Office Furniture & Equipment		16.2%
Acct. 392 Transportation Equipment		9.8%
Acct. 394 Tools, Shop & Garage Equipment		10.8%
Acct. 396 Power Operated Equipment		3.8%

Negative Salvage

Underground Storage	0.00%	0.70%
Transmission	0.00%	1.46%

Q. How were ANR’s current depreciation rates developed?

A. ANR’s current depreciation rates are the result of a settlement of ANR’s last rate case in Docket No. RP94-43-000 – which occurred 20 years ago.

II. DEPRECIATION THEORY

Q. Please describe depreciation theory.

A. Depreciation is a term used in accounting, economics, and finance to convey the concept of the inherent loss of value in an entity’s capital assets over time and the associated allocation of that loss in capital value over some defined period. Capital costs are those costs incurred to acquire plant and equipment that will be used over several accounting periods to facilitate the provision of an entity’s goods and services. The anticipated longevity of the asset is, in a sense, the purchase of future services from the asset; depreciation is the expensing of those future services. When investors purchase assets they expect to get their money back and earn a profit on that investment: the return ***of*** investment as well as return ***on*** the investment. In order to get an accurate assessment of their economic activities, entities need to accurately match expenses with the revenue generated. Deducting the costs of operations and the capital investment costs from the revenue stream helps reveal the profitability of the enterprise. Depreciation and amortization are the means by which capital costs are allocated over time to reflect the concept that capital costs contribute to profitability in all periods. This concept is simply that capital costs are recovered over the economic life span of the assets. The Maximum physical life of the asset is expected to be in general 200% of the average service life, but the economic life can be substantially shorter than the physical life. The recovery of the capital costs must occur within the economic lifespan of the asset. The tools used in depreciation analysis are the foundation for allocating capital costs over the useful life of a depreciable asset to provide investors the opportunity to recoup their investment in a reasonable and consistent manner during the expected service life of the asset.

Q. How does the Commission define depreciation?

A. The Commission defines depreciation as:

> [T]he loss in service value not restored by current maintenance, incurred in connection with the consumption or prospective retirement of gas plant in the course of service from causes which are known to be in current operation and against which the utility is not protected by insurance. Among the causes to be given consideration are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in the art, changes in the demand and requirements of public authorities, and in the case of natural gas companies, the exhaustion of natural resources.
> 18 C.F.R. Part 201, Definitions, 12.B (2015).

Q. What does "loss in service value" mean?

A. Loss in service value is the diminishment of the ability of an asset to provide useful service to the utility. Loss in service value occurs broadly from two sources: physical causes such as wear and tear, decay, and action of the elements, and, second, what can be classified as economic causes (inadequacy, technological or economic obsolescence, changes in the art, changes in demand, requirements of public authorities, and the exhaustion of natural resources).

Q. How has FERC historically viewed the supply-side economic life of natural gas pipelines?

A. The primary factor that FERC historically relied upon in determining a pipeline's economic life in NGA section 4 and 7 proceedings is the potential exhaustion of natural gas resources. In 1990, FERC stated it "normally based the depreciation rates of major interstate pipelines on economic, or useful, lives that are between 20 and 25 years." *Iroquois Gas Transmission System, L.P.*, 52 FERC ¶ 61,091 at 61,392-93 (1990). FERC extended the economic life to 35 years in 1998 in *Iroquois Gas Transmission System, L.P.*, 84 FERC ¶ 61,086 (1998) ("*Iroquois*"). In *Iroquois,* FERC explained:

> The economic factors the Commission's regulations require relate to “changes in demand,” “exhaustion of the supply of natural resources” and, to some extent, “requirements of public authorities.” The Commission finds that the ALJ has adequately addressed these factors. As discussed below, the ALJ relied on evidence presented by Joint Parties, Staff, and the Public Service Commission of New York which showed that demand for gas is increasing in the Northeast, the market served by Iroquois, and that the natural gas supply, which the ALJ found is the single most important factor in determining a pipeline's remaining useful life, is over 35 years.
>
> *Iroquois* at p. 61,438.

It is important to note that the FERC acknowledged in *Iroquois* that while natural gas supply may exist for “over 35 years” the remaining economic life actually adopted by the Commission was, in fact, 35 years. Since *Iroquois*, the FERC has not approved an economic life over 35 years in a litigated proceeding.

The Commission in *Portland Natural Gas Transmission Sys*., 134 FERC ¶ 61,129 (2011) at P 127 noted:

> The ALJ rejected [Portland Shippers Group’s] recommended end-life of 40 years for Portland’s System, finding it extended beyond the Commission’s standard of 35 years, and is inconsistent with Commission precedent indicating that reserve estimate projected beyond 35 years are speculative.

The Commission affirmed the Administrative Law Judge’s (“ALJ”) rejection of the Portland Shippers Group’s and Staff’s recommended economic end-life beyond 35 years.

Q. How has the demand-side economic life for pipelines generally been determined?

A. In the past, Commission’s primary focus for determining a pipeline’s depreciable life, as noted above, was the estimated gas reserves at the upstream end of its system. Demand for the pipeline’s services at the other end of the system was assumed to be endless. However, a pipeline with abundant gas supplies available at its upstream end but no demand at the other end will not be transporting any gas. The upheaval in the pipeline industry over the last few years has led me to conclude that long-term demand stability is less certain than once thought.

Q. What causes long-term demand to be less certain than in the past?

A. For almost 70 years the pipeline industry has, in general, built larger and safer pipeline systems to bring natural gas and oil products from the Louisiana, Texas, and Gulf Coast production areas to the Midwest and northeast United States consuming areas. More recently, developments in drilling technology have made natural gas supplies trapped in shale formations economically feasible to produce. The traditional resource basins have been overshadowed by newly accessible resource basins that are closer to consuming areas, such as the Marcellus and Utica shales. While the demand for natural gas in general has grown substantially, the demand for transportation service from any one pipeline in particular can no longer be assumed to be endless. Customers are avoiding long-term contracting in order to take advantage of alternative market opportunities.

Q. Is pipeline infrastructure changing in response to demand conditions?

A. Yes. There are a number of pipelines connected to traditional supply basins that have seen demand for transportation of supplies from their traditional supply basins fall off in response to the availability of competitively-priced shale resources in the eastern United States or the abundance of liquids produced from shale deposits. One fallout of the decrease in demand for supplies from traditional supply basins is a decrease in utilization of the pipeline facilities that access those basins. Another consequence has been, as an example, for pipelines to reverse the flow of certain segments of pipe so that supplies from the Marcellus and Utica shales physically can reach markets that, prior to these recent developments, were served by natural gas from the traditional supply basins.

Q. How do physical conditions affect depreciation rates?

A. Oil and gas pipeline systems are built to safely transport hydrocarbons for many years. Properly maintained, all pipeline assets have very long life expectancies. However, what goes into the ground as a state-of-the-art industrial asset will, one day, run up against various factors that will cause the asset to be retired. First, simple usage takes its toll on any asset. Under normal usage, every asset has a range of service life expectancy that will define its maximum depreciable life. But various factors can shorten that expectation, such as extreme weather-related damage, third-party damage, or governmental regulations. These often bring an immediate end to the facilities' useful life. Other factors, as indicated by the FERC definition above, can shorten a life expectation not because the asset itself fails but because changes in technology, methodology, or regulations render the asset obsolete. Improvements in safety, efficiency, or usefulness can lead to the retirement/replacement of assets that might otherwise have remained in service for many years. Both FERC policy and depreciation theory allow for the truncation of the useful life of facilities based on these considerations.

Q. How do the requirements of public authorities affect depreciation rates?

A. The requirements of public authorities can have a significant impact on the depreciable life of facilities. A common example is the encroachment of human population upon previously remote areas, which may trigger a requirement to relocate a pipeline. Public authorities may require physical removal, replacement, or upgrade of plant or equipment. Public authorities may also establish operational criteria that impact the usefulness of some assets and may alter the useful life expectancy of those assets. The cost of complying with the requirements of public authorities can cause the cost of using the facilities to become prohibitive and thus render the facilities economically obsolete. Such actions must be taken into consideration in setting depreciation rates when those requirements cause the truncation of the useful life of pipeline assets.

Q. How does the natural resource base affect depreciation rates?

A. The determination of the useful life of industrial property is often dependent upon an underlying non-renewable natural resource base, the exhaustion of which sets the outer limits of the assets' depreciable lives. In the case of oil and natural gas properties, the useful life of some assets is limited to the economic life of the oil or natural gas anticipated to flow through the assets, including "proved reserves" known to be accessible at any given time, plus the "future reserves" that can be reasonably expected to become proved reserves at some point. On the other hand, evolving market forces can make gas supplies that were previously economic no longer economic in a relatively short time period. For example, the rapid development of shale gas resources in the Marcellus, Utica, Bakken, and Eagle Ford shale plays have radically altered the status quo of conventional U.S. natural gas production and even other dry shale gas plays, such as the Haynesville. The impact of these changes can also dramatically change gas flows across the U.S. natural gas pipeline infrastructure. Competition among suppliers, transporters, and marketers has placed new and powerful business risk burdens on many players in the industry. Depreciation analysis must take into consideration these economic forces that threaten the longevity of the useful life of existing infrastructure assets.

Q. What are interim retirements and how do they affect depreciation rates?

A. Interim retirements are the routine retirements of plant and equipment that will occur each year between the study date and the terminal closing of the pipeline system. The importance of interim retirements, for depreciation study purposes, is that such retirements shorten the *average* depreciable life of the assets. If some units are retired prior to the end of the planned service life, the associated depreciation accruals will not have fully recovered the invested cost in the assets. Depreciation rates must capture the average life expectancy of the assets in the accounts, which is estimated through the survivor curve analysis of interim retirements. This is more fully explained in the survivor curve discussion later in this testimony.

Q. Based on the factors you have discussed, what economic life have you selected for ANR's facilities?

A. While strong-supply side arguments can be made for expanded economic life spans, equally strong demand-side arguments can support significantly shorter economic life spans for specific pipeline systems. Long-term forecasting becomes more and more speculative the further out the forecast. As discussed in the testimony of ANR witness Kirk, it is reasonable to assume natural gas will be available for at least 35 years, the timeframe traditionally used by FERC to assess natural gas supply. In the absence of a strong indicator for some other economic life, I have elected to maintain the Commission's traditional 35-year life estimate for ANR's facilities.

Q. Do you believe that using an economic life greater than 35 years is speculative?

A. Yes, I do. Although national natural gas supplies are abundant, the response of the natural gas industry has demonstrated that the demand for the services of any given pipeline is not secured merely by the regional gas supplies to which it is physically connected. Competition from even distant natural gas supply basins can bring about quick and powerful shifts in demand. In just the last five years many south-to-north pipelines connected to long-term gas supplies on their south ends have sought to change the direction of their systems in response to the newly discovered abundant and less expensive resources in the north. Where "long-term" was once thought of as over 30 years, it would now appear that in some circumstances "long-term" is about five years – the time it takes for infrastructure to respond to changes in demand.

Q. Have you relied on any other witnesses for your recommendation of a 35-year economic life for ANR?

A. Yes. ANR witness Kirk has conducted and is sponsoring a study of the natural gas reserves available to the ANR system. I have relied on his analysis and study in formulating my recommendation.

Q. What depreciation methodology did you use for ANR?

A. I used the broad group, straight line, average remaining life method of depreciation. Under this method, which is the standard method for FERC-regulated pipelines, all of the assets within a group are considered to be homogeneous units of plant used and treated alike across the system regardless of the vintage, construction techniques, or retirement rate. In practice, there are two levels of grouping – by FERC account and by function. Generally all assets within a FERC account are considered as one group and a depreciation *expense* is derived. Then the FERC accounts are combined into a larger functional group, such as storage or transmission, with one depreciation *rate* for the whole function. Where operational considerations warrant, assets within a given FERC account are grouped in a different function, such as offshore transmission versus onshore transmission, to reflect the distinctive use and depreciable life expectations for those assets. I also used a whole life rate for general plant, which I will explain later in this testimony.

Q. What are the different concepts regarding life expectations for industrial property?

A. The depreciable lives of a gas pipeline entity's assets are bound by three life expectancy estimates: 1) the average physical <u>service life</u> expectancy of the various classes of property; 2) the estimated <u>remaining life of the natural gas reserves</u> supporting the need for the assets; and 3) the estimated <u>remaining economic life</u> of the demand for services provided by the capital assets. These three factors set the stage for calculating the average remaining depreciable life, which also takes into account the truncation date and interim retirements. The service life measures the physical life expectancy of the plant in service, absent specific economic or resource limitations. The remaining life of the resource base measures the expectations for the exhaustion of natural resources and its impact of the assets in question. The remaining economic life is the life expectancy as impacted by economic forces such as changes in regulations, alternative transportation routes, or alternative energy sources. The average remaining depreciable life takes all these factors into consideration to select a life span for use in the depreciation calculations.

Q. Does the age of the assets make a difference?

A. Yes, it does. The estimation of future retirements is accomplished by multiplying the decline curve ratios found in the survivor curve times the plant balance. But recall that the survivor curve reflects the survivorship ratio for each age interval so that determining the retirement curve would require a matrix of multiplications to calculate the survivorship of each age interval dollar for each transaction year out into the future until the plant is exhausted, which could be two or three hundred years of calculations for each vintage.

Alternatively, the stream of retirements can be approximated by calculating the average age of the plant and multiplying the total plant installations by the survivor curve surviving percentage at the average age and each successive year for the time period selected for the study (truncation date). The sum of the surviving plant balances divided by the full installations reveals the average remaining life. For example, if the average age (as a percent of average service life) is 10 years old, the chances are that the survivorship percentage is still in the 97+% range. In other words, the plant is young and few retirements will be forecast for many years to come because the decline curve is still rather flat for the relevant period. On the other hand, if the average age is older, say 50 years (as a percent of the ASL), the plant is much further along the survivor curve trajectory and the forecast for retirements would be much higher because the decline curve is much steeper for the relevant period. These survivorship forecasts determine the surviving plant balances for the future, and in turn, the average remaining life of the surviving dollars. Consequently, the average age of the plant is critical to setting the depreciation rate.

Q. How is the average age determined?

A. Traditionally, the average age is determined by multiplying the surviving dollars invested per year by the age of those dollars, and then dividing by the total dollar amount invested. The result is the average age of the dollars in the account.

Q. Is there an inherent problem measuring the average age in dollars rather than physical plant?

A. Yes, there can be. Survivor curve methodology analyzes the age of retirements not the value of the retirements and relies on the assumption that the units of measurements it uses are comparable. The wear and tear experienced by a 15-year-old pipe in the 1960s should be the same as wear and tear experienced by a 15-year-old pipe in the 1990s, given the same quality of material, throughput, maintenance, and other externals. The cost of the pipe should have no effect on the wear and tear of the assets. But because the data used for survivor curve analysis is dollars rather than physical measurements, the units of retirement can become un-comparable. For example, $1,000,000 of 1960s-era line pipe would represent approximately 10 miles of pipe, whereas $1,000,000 of 2015 line pipe would barely cover half-a-mile. Consequently, a forecast of future retirements/survivorship based on the average age of inflation impacted dollars will skew toward a much higher survivorship position on the survivor curve and underestimate the retirement rate going forward – and in turn overestimate the average remaining life and underestimate the appropriate depreciation rate.

Q. How can you correct for the distortion?

A. The distortion in the value of the assets over time caused by inflation can be corrected by applying a deflator index to the time series in developing the average age. By applying the Bureau of Labor Statistics (“BLS”) Producer Price Index (“PPI”) for steel mill products to the original cost plant activity data, the dollars from all vintages are put on the same playing field. Now we have 1960 dollars that are comparable to 1990 dollars, and so on. The physical plant represented by $1,000,000 should be roughly the same for all vintages. Yet because the age of the dollars has not changed, the survivor curve results are the same as before the indexing. The difference is that the average age of the plant is calculated based on indexed values rather than inflation impacted dollars. The indexed average age can then be used for the survivor curve application, resulting in a retirements forecast more in line with the actual experience of the plant.

Q. **Describe the concept of truncation.**

A. Most pipelines incorporate a truncation date in their derivations of depreciation rates to reflect the fact that the average actual useful lifespan of the assets is often significantly shorter than the physical average service life. The incorporation of a truncation date is often unrelated to the physical characteristics of the asset itself but due to reasons such as the loss of reserves supporting its use, technical obsolescence bringing about replacement, or the requirements of public authorities that may lead to economic obsolescence of certain facilities. The truncation may cause the remaining life of the assets to be less than the average physical life.

Q. **Describe the methodological steps you took to develop the depreciation rates for ANR.**

A. The calculation of depreciation rates involves several steps that focus on the actual life expectancy of the plant in service and derive an accrual rate that should match the return of investment capital with the actual useful lives of the property. These steps are to:

1. determine the depreciable plant to be recovered;
2. estimate near-term plant additions;
3. examine retirement patterns by account;
4. use a survivor curve model to estimate average service lives;
5. estimate the remaining useful life of natural resources;
6. assess the long-term demand for the pipeline services;
7. set the truncation date;
8. calculate the average remaining lives by account; and
9. calculate the depreciation rates.

Q. **Your Schedule No. 4 of Depreciation Workpapers Exhibit No. ANR-059 indicates the addition of both near-term maintenance capital and capacity capital in deriving**

the depreciation base. What do these groupings mean and why have you added near-term additions to the depreciable rate base?

A. The depreciation rates are likely to be in effect for some time before the next rate case and the plant will grow somewhat during that period. Just as future plant retirements are taken into consideration in developing the depreciation rates, so too should plant additions be forecast so that the depreciation rates can recover the investment over its useful life span. I separated maintenance capital from capacity capital to reflect the inherent difference between additions needed to continue providing the current level of service and the additions needed to expand services to new customers or new contracts.

ANR witness Hampton discusses the need and planning for capital additions to upgrade ANR's aging system over the next three years. Specifically, he notes the need to upgrade ANR's compressor units, associated compressor station, system communications and control equipment, and metering and regulation equipment. His discussions regarding the age of ANR's system are echoed in the graphs of plant growth in my Exhibit No. ANR-061 at pages 3, 9, 15, 21, and 27. These graphs show the annual plant additions and retirements for each transmission property account in original cost dollars and inflation adjusted dollars. As discussed further elsewhere, the inflationary impact on time series data tends to minimize past period amounts when, in fact, after adjusting for inflation, the past period investments carry much greater weight. Adjusting the investment time series for inflation illustrates that a large proportion of ANR's physical system is over 50-years old. As ANR witness Hampton notes, ensuring the safety and reliability of the system dictates that replacing much of this aging plant is a prudent action that should begin over the next few years. But for every million dollars in 1950s-era plant retired, the replacement cost will be almost $10 million. Those replacement investments cannot begin recovery unless they are incorporated into the depreciation rate. Hence, I have incorporated near-term plant additions into the development of the depreciation rates to recover the investment that will be in place during the pendency of the rates developed in this rate case.

The forecast amounts for near-term plant additions were provided by ANR. The anticipated additions are shown on Schedule No. 4 of Exhibit No. ANR-059.

Q. Some would argue that your use of near-term plant additions is speculative and should not be included in the derivation of depreciation rates. Do you agree?

A. No, I do not agree. ANR has a history of transmission function plant additions in all major accounts going back 64 years. It is not speculative to assume the pipeline will continue to engage in capital maintenance replacements, install upgraded equipment, expand service capacity, and respond to safety improvements. These near-term additions can be estimated by looking to current capital budget forecasts or looking back to recent actual plant activity. In either case the estimate of near-term additions reflects the actual needs of the pipeline system and is the best estimate of plant balances most likely to be in place during the pendency of the tariff rates being developed. It is known that there will be plant additions and those additions are measurable.

Q. In 1992, the Commission rejected the use of plant additions in developing depreciation rates in a specific rate filing. How is this case different?

A. The Commission's decision in *Indiana & Michigan Municipal Distributors Ass'n v Indiana Michigan Power Co.*, 59 FERC ¶ 61,260 at 61,968, addressed a proposal that incorporated 17 years of plant additions (1992 through 2009). I too would question 17 years of plant additions. My testimony, to the contrary, deals with very near-term plant additions with an eye toward estimating the average plant balance that will be in effect while the depreciation rates and tariff rates are in effect. The near-term additions are easily estimated and therefore are a readily known number.

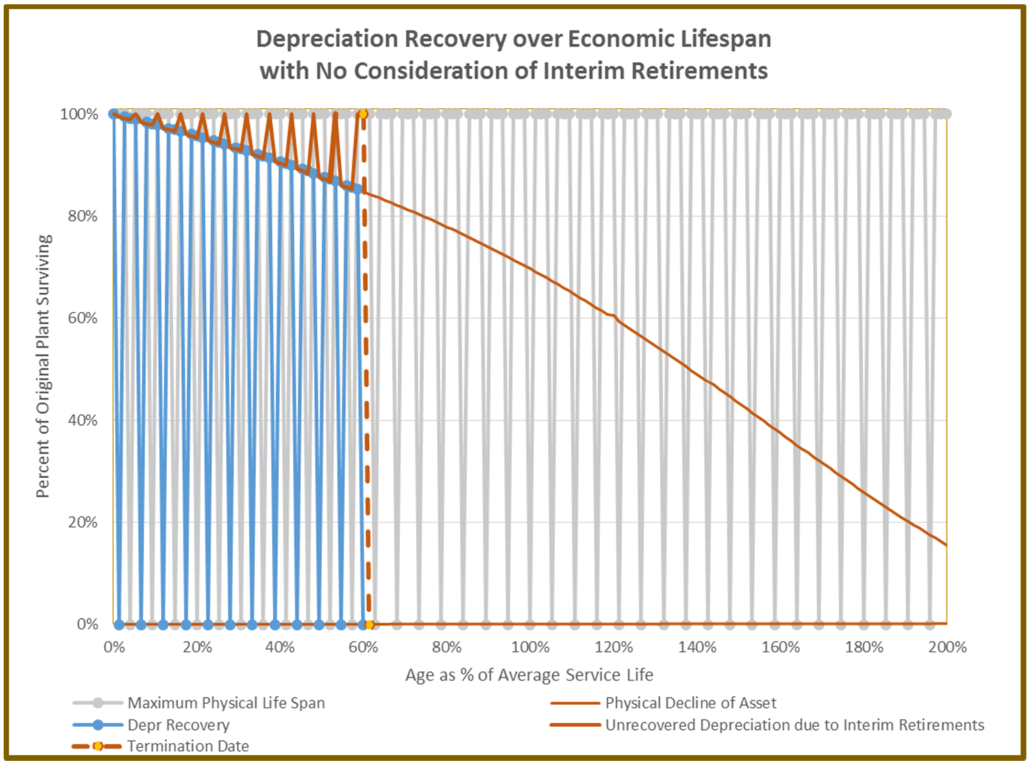
Q. The Code of Federal Regulations does not mention future plant in defining depreciation practices. Why should near-term additions be included in the depreciation rate derivation?

A. Depreciation rate development is often seen as a snapshot of plant in service at the end of the test period. My approach is more holistic in that I developed depreciation rates that cover the reasonable range of time over which the tariff rates and embedded depreciation rates will be in effect. The plant in service will continuously expand and contract as upgrades replace old technology, larger facilities replace smaller, exhausted plant is retired and new customers are connected to the system. Plant in service should be seen in the context of the evolution of the pipeline's attempts to respond to market needs, new technology, and operational efficiencies. The average plant in service over the period that the rates will be in effect should be the guiding figure in developing the depreciation rates.

Q. Is the concept of near-term plant balances alien to current depreciation theory and practice?

A. No, it is not. The concept of using the average plant balance is inherent in the use of survivor curves to develop the average remaining life. It is a long-accepted depreciation concept that the depreciation rate must be calculated on the basis of the average plant balance over the remaining life of the assets to ensure the proper rate of recovery of the plant investment. The decline curve derived via the survivor curve analysis generates an average plant balance for each year of the interim period between the study date and the termination date. As illustrated in Graph No. 1, the decline in the average plant balance results in the under-recovery of depreciation, shown as an orange line/area above the decline curve, if the average plant balance is not incorporated into the depreciation rate calculation. The composite of the average balances weighted by the years that plant will be in use produces the average remaining life and in turn the depreciation rate. So the concept of incorporating changes in the near-term average plant balance is not alien to standard depreciation accounting, it is indeed central to depreciation theory.

Graph No. 1 – Average Plant Balance & Depreciation Recovery



Q. How have you organized the near-term additions?

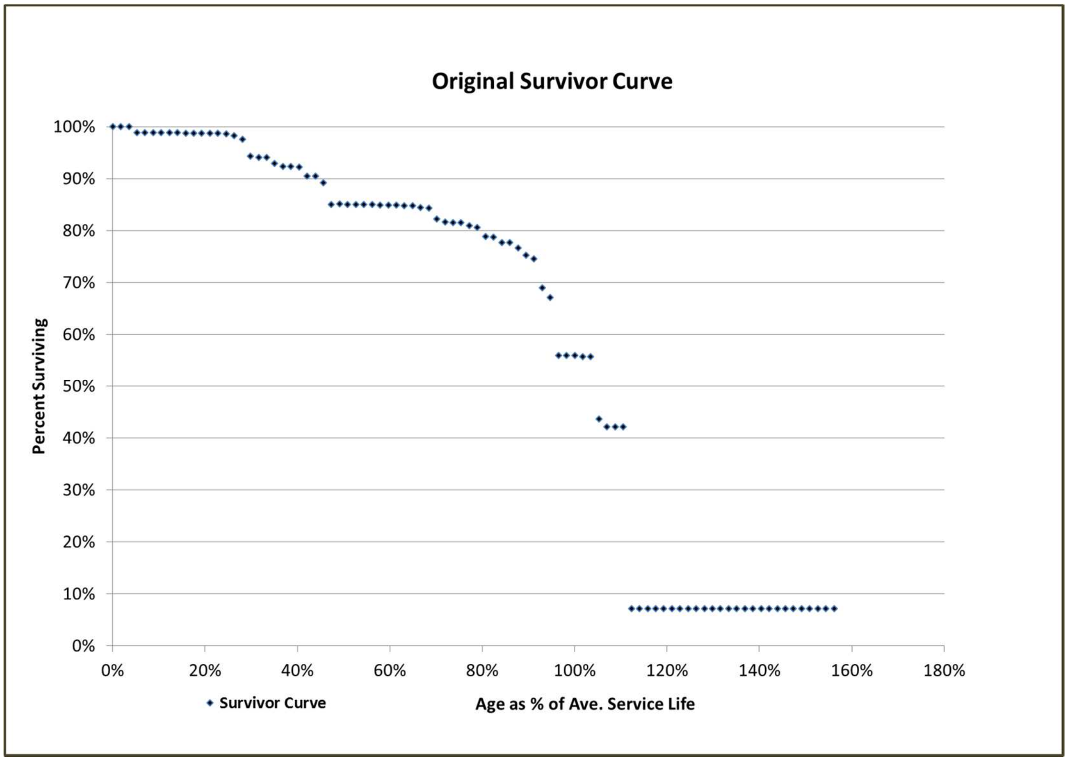
A. Plant additions are necessary to maintain the pipeline system's safety and integrity, and to capture efficiencies in updated technology and performance. Additions are also often needed to expand capacity to serve new customers. For an older system like ANR, capital additions undertaken for system maintenance become more important as the older plant reaches its average service life and gets retired. As noted in the discussions on Accounts 367 Mains and 368 Compressor Station Equipment below, ANR has a significant level of pipe and compression equipment that is 50 years old or older and facing retirement in the near future. While the dollar value of the older plant is far below today's inflated cost for similar plant and equipment, the older plant represents a large proportion of the actual physical plant. As noted earlier, a mile of line pipe in the 1950s cost just a tenth of what that same mile might cost today. The forecasts of near-term retirements indicated by the survivor curve analysis assume an average age for the plant. Because actual retirements are likely to be older plant and thus less valuable dollars, an inflation adjusted retirement forecast will correctly include significantly more of the older physical plant than if a standard non-inflation adjusted dollar average age is used. Replacing that older, lower cost, plant will burden ANR with much higher replacement costs to maintain the system at its current capacity. Consequently, I have differentiated near-term additions between maintenance capital and capital projections that are aimed at system expansion.

III. SURVIVOR CURVE THEORY

Q. What is a survivor curve?

A. A survivor curve is the pictorial end result of an actuarial analysis of hundreds of thousands of transactions that make up the 'life story' of industrial property accounts. With each passing year the retirements of property, if any, leave a smaller percentage of the original installation in place. If retirements were uniform in size and regularity, a simple straight line projection would provide an adequate forecast of future retirements, and, in turn, allow the calculation of the average remaining life of the assets. But the retirement patterns of industrial property do not follow a straight line. The retirement patterns of industrial property are characterized by a complex life trajectory which includes a transition point where survivorship takes a dramatic downward turn. The retirement rate and survivorship rate are inversely related phenomena. The upside down bell curve shape of retirement frequency distribution creates the ski-slope shape survivorship curve. After a period of substantial retirements, the retirement pattern passes through another transition point where retirements fall off, leaving a long tail of lingering survivorship. The overall lifespan survivorship trajectory for most industrial property follows this ski-slope pattern seen in Graph No. 2 that, despite an appearance of simplicity, requires complex mathematical formulae to replicate. Adding to the complexity, additions to plant, transfers between accounts, and various adjustments to plant accounts over time, can obscure the patterns of retirements, making it difficult to discern the physical life expectancy of plant and equipment. Survivor curve analysis translates the hundreds of thousands of data points into recognizable patterns, enabling an analysis and forecast of future life expectancies.

Graph No. 2 – Survivor Curve of Original Data



Q. How does survivor curve theory work?

A. The survivor curve analysis primarily deals with two survivor curves: one being a curve that traces the actual surviving dollars from each vintage of plant addition and the other a prototypical Iowa Curve selected to carry the trend of the actual data out into the future for forecasting purposes. Once the original data is synthesized into an original experience survival curve (see Graph No. 2 above), the curve is compared to hundreds of prototypical curves (see Graph Nos. 3 and 4 below) to find one that will best forecast the most likely experience of future interim retirements. With the retirement forecast in hand, the average remaining life can be calculated.

Q. Is survivor curve theory accepted by the Commission?

A. Yes, the Commission has approved depreciation rates based on survivor curve theory for over 40 years.

Q. How do these retirement characteristics convert into survivor curves?

A. While the retirements of property are the drivers of actuarial studies, it is the surviving dollars that are of concern. For each installation year investment, the percent of that year's plant still surviving in each subsequent year is calculated. The same exercise is performed for every year's installation dollars. Once the string of aged retirements is assembled, summation of surviving aged plant and aged retirements reveals the actual experienced survival for the account, which when plotted becomes the survivor curve for that specific account as illustrated in Graph No. 2.

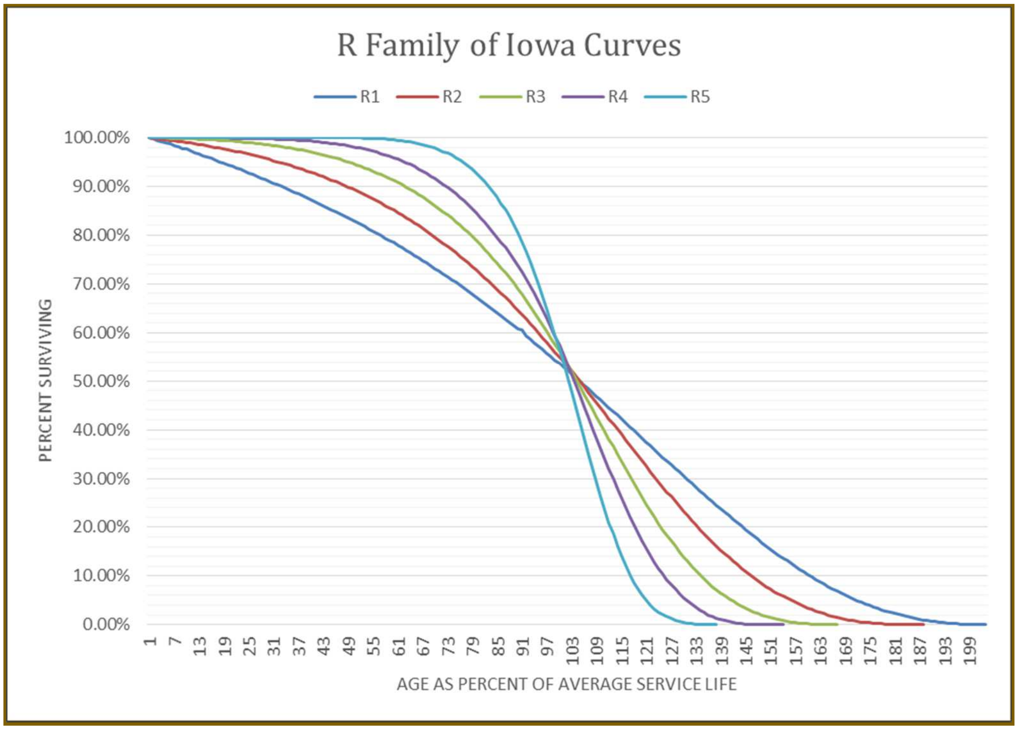
Q. How does the survivor curve of the actual data support forecasts of future retirements?

A. Once the original survivor curve is obtained, the question turns to what should be expected of that account in terms of future retirements. For this aspect of the study we look to prototype curves that mimic the pattern of our original account activity. The retirement ratios that characterize the curves are applied to the surviving plant in service to generate interim retirement dollars. While there are a few options for typical curve patterns, the Iowa Type Survivor curves are the most commonly used for depreciation purposes and are the curves used for this study.

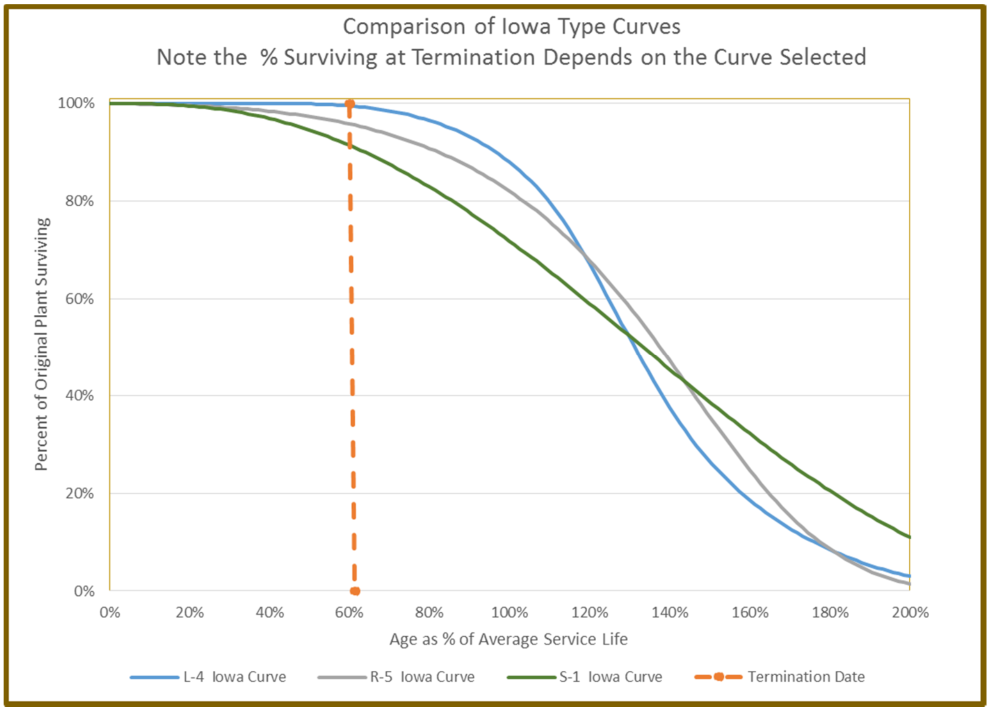
Q. What are Iowa Curves?

A. Iowa Curves represent standardized retirement patterns of industrial property developed from actuarial studies conducted in the 1930s. The Iowa Curves consist of families of curves that reflect left-modal, symmetrical-modal, and right-modal frequency distributions, called simply L, S, and R curves. Each family of curves includes four to five curve sets within the family, labeled R_1, R_2, $R_{3,}$ and so on, each with slightly different slope configurations (see Graph No. 3 below). Further, each curve has representatives from each average service life age group from 5 years to 120 years. The modality of the curves simply reflect whether the most frequently occurring retirement age is younger than the average retirement age – an L Curve (i.e., to the left of the average service life on a graph) or older than the average retirement age – an R Curve (i.e., to the right of the average service life), or equal to the average retirement age – an S Curve (i.e., symmetrical to the average service life). Graph No. 3 also illustrates the wide variety of retirement patterns that can occur within each family of curves, from plant that experiences retirements almost immediately after installation (as in the R_1 type curve) to plant that may go a very long time before any significant retirements take place (as in the R_5 type curve). Graph No. 4 illustrates the impact of different curves on the percent surviving at the termination date, which affects the derivation of the average remaining life, which in turn sets the depreciation rate.

Graph No. 3 – R Family of Iowa Curves



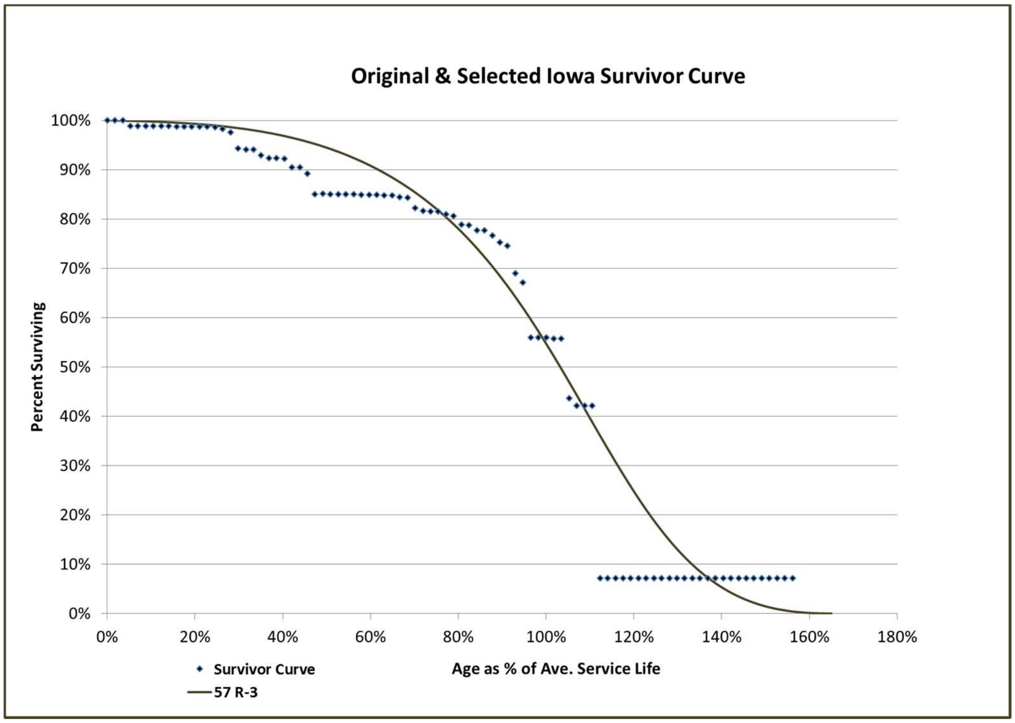
Graph No. 4 – Comparison of Curves



Q. How does the model select the "best fit" curve?

A. The selection of a curve is done by a combination of statistical comparison and informed knowledge of the nature of the assets. The statistical assessment is a simple calculation of the differences between the original data and the selected Iowa Curve. The differences are squared to eliminate positive and negative differences from cancelling each other out as well as to accentuate deviations. The curve with the least sum of squared difference between the actual book value of the account and the predicted value of the account is generally the best fitting curve and, unless some other factor weighs heavily in the analysis, that curve will be used to forecast future retirements. This concept is illustrated in Graph No. 5.

Graph No. 5 – Iowa Curves Represent the Original Data



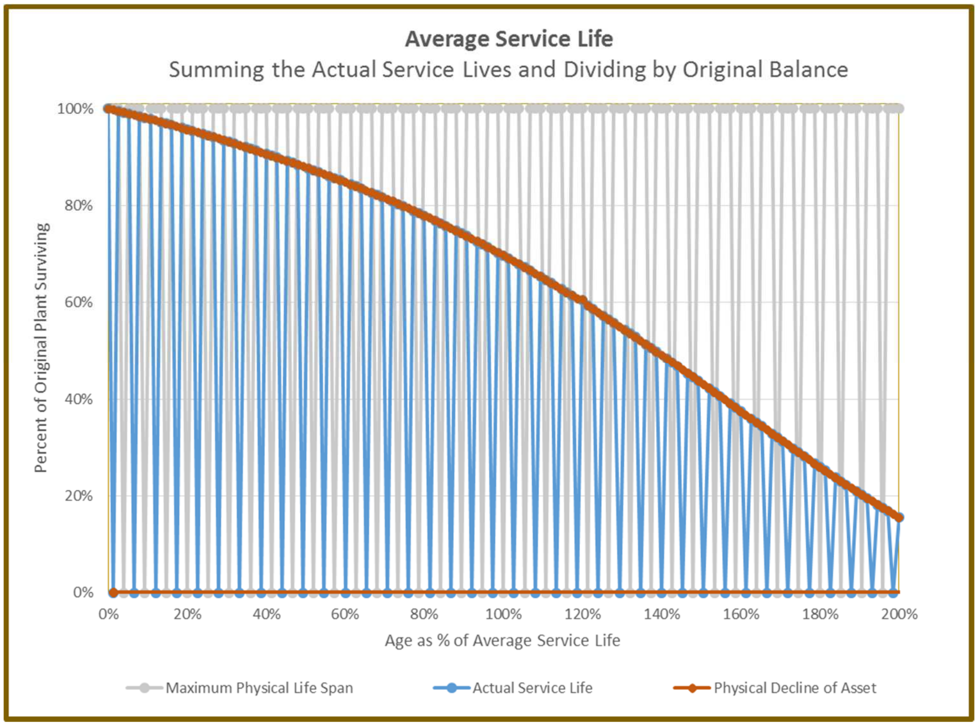
Q. Why would you not use the curve identified by the model as the “best fit” curve?

A. The Iowa Curve with the least sum of squared differences may fit the overall pattern of the original survivor curve but may not fit the portion of the original life curve representing the interim period. For depreciation purposes, the interim period between the study date and the termination date defines the period over which the remaining undepreciated plant investment must be recovered. To determine the average remaining life of the assets over that period, we take the average age of the plant in service, converting it to age as a percent of average service life to determine where along the Iowa survivor curve it sits. The retirement rate from that point on is the most likely retirement pattern that will define the average remaining life of the asset. The survivor curve model calculates the least squares statistical test for each of several hundred curves. However, of equal weight is the analyst's assessment of the individual property type and patterns of retirements.

Q. Describe the concept of the average service life.

A. The physical plant of large industrial entities like pipelines is made up of thousands of units of property. For example, the pipeline itself is not one long pipe. Rather, it consists of thousands of sections of pipe of various lengths installed over decades as the system expanded, or as portions of the system were replaced due to damage or wear and tear. While the usefulness and longevity of each section of pipe depends on the conditions associated with its use, eventually the retirement experience begins to reveal how long an average section of pipe can be expected to remain in service, as illustrated in Graph No. 6 below.

Graph No. 6 - Average Service Life Derivation



At some point assets begin to drop out of service so that some plant has shorter lives than others. The average is derived by calculating the percent surviving at each age interval, summing the surviving dollars, and dividing by the original balance. See Graph No. 6. For our purposes, knowing the average service life ("ASL") of plant and equipment allows for an accommodation in the depreciation rate derivation to reflect that some plant retires over the years, causing a decline in the depreciation base and a possible shortfall in capital recovery as illustrated in Graph No. 1 earlier. Once a prototypical curve is selected to represent the anticipated retirement patterns, an ASL can be calculated for the property account.

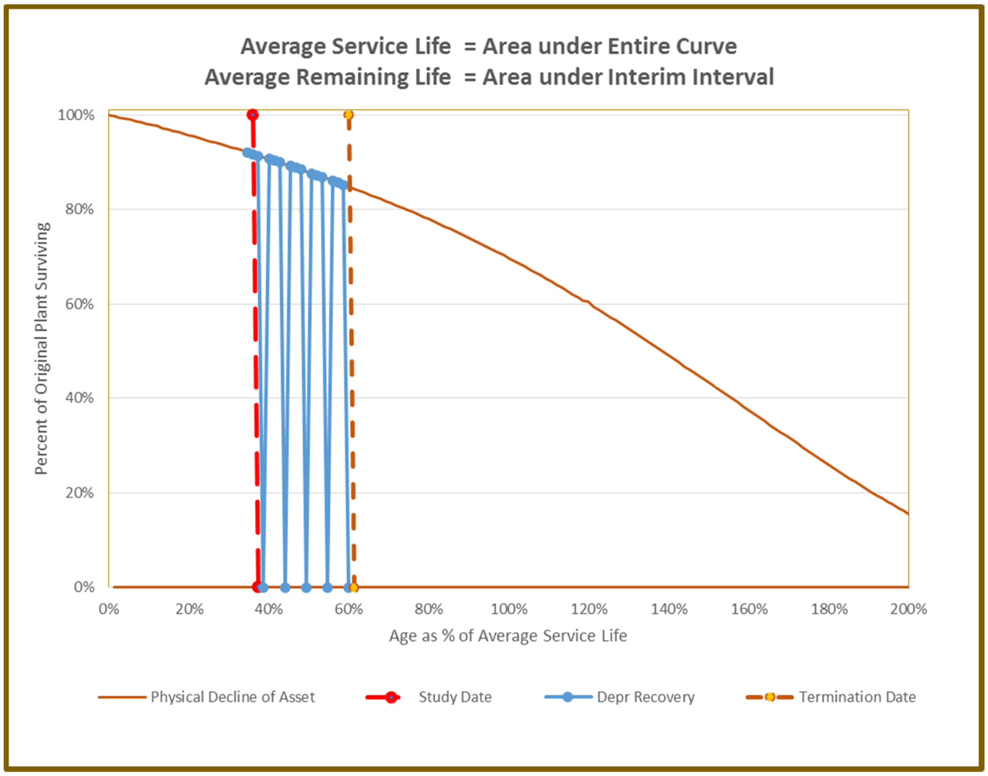
Q. Why is the ASL important?

A. In general, depreciation rates recover the cost of the plant over its life expectancy. The application of a straight line depreciation rate to the annual rate base builds the depreciation reserves through annual accruals in equal installments, as shown in the vertical bars above. By the truncation date the plant should be fully depreciated. However, if the rate base is declining because of interim retirements, the annual accruals will not add up to the full amount needed for recovery by the truncation date, leaving a shortfall. The importance of using survivor curves is that by using them, we can avoid under-recovery of depreciation due to interim retirements between the study date and the termination date. Interim retirements are considered fully recovered and the full original cost of the unit of property is deducted from the accumulated reserve for depreciation. If interim retirements are not taken into consideration in deriving the average remaining life of plant, the depreciation rate will have under-recovered the plant at the truncation date, as illustrated by Graph No. 1 earlier.

Q. Describe the concept of the average remaining life.

A. The average remaining life ("ARL") calculation is restricted to the time between the study date and the termination date. The ARL, commonly known as the "area under the curve" as illustrated in Graph No. 7 below, represents the time period over which the company's remaining net plant will be depreciated. Dividing the sum of the surviving balances as calculated by the survivor curve by the starting balance provides the ARL, which is used in the depreciation calculations.

Graph No. 7 - Average Remaining Life & Area Under the Curve



Q. How does the age of the assets in an account affect the depreciation rate?

A. Industrial property retirements exhibit a pattern in the distribution of aged retirements resembling an upside down bell-shaped. The number of retirements of young plant is low but retirements grow over time to crest at the highest level, which corresponds to the average service life, and then taper off with some older plant lasting out to the future. The corollary to the bell curve is the ski-slope shaped survivor curve. When the retirement curve is subtracted from the original installations, the result is the survivorship curve. The life span of line pipe assets is characterized by three main phases: first, a long period of very low retirements that creates a high level plateau of survivors; second, a period of increasing retirement frequency, which creates the primary slope of the survivor curve; and third, a leveling off of retirements at the end of the life span, which creates a long flat tail of survivors. This general pattern is represented in the survivor curves shown in Graph No. 3 above.

The rate of plant retirements will depend on where along the curve the average plant is located. The average age of the plant in service will indicate, in general, the level of retirements to be expected over the course of the remaining life of the asset. Line pipe that, on average, is 65 years old will have a significantly different retirement rate than line pipe that is 5 years old. The metallurgical differences in materials and changes in construction techniques contribute to variation in life expectancies for both the whole life span of the assets and the near-term expectations given the current respective average ages of the plant. It is important to note, as I did earlier, that the survivor curve is measuring the age of the dollars retired, not the value of the dollars retired. Adjusting the time series for inflation will approximate the age of the plant for retirement purposes rather than the age of the dollars.

IV. SIMULATED PLANT RECORD ANALYSIS

Q. The actuarial survivor curve model you described requires vintaged retirement, i.e., retirement data tied to the year of installation of the assets. What happens if the vintaged data is not available?

A. In the absence of reliable data tying the annual retirements back to the specific year of installation, the Simulated Plant Record Model can provide a similar forecast of annual retirements for depreciation rate purposes. The Simulated Plant Record ("SPR") model relies on the survivor curve theories for its foundation but does not generate a least squares analysis for each data point. Instead, the SPR model applies a prototype Iowa Curve to each annual plant addition and calculates a final balance for the account, assuming the plant has retired in a pattern similar to that of the Iowa Curves. The selected curve is used to forecast future retirements, which provides the average remaining life and ultimately the depreciation rate.

Q. Does ANR have vintaged plant retirement data?

A. No, ANR does not have vintaged retirement data. Consequently, I used the SPR model to simulate the retirement patterns from each plant addition to see which curve came closest to generating an ending balance that matches the actual book balance for each account.

Q. How does the SPR Model represent the actual plant activity?

A. As plant ages, the surviving plant ratio falls as it moves along and down the survivor curve. The average age of the plant in each account determines where the account is, vis-à-vis the survivor curve, at the study date. The SPR method calculates a theoretical retirement trajectory that it applies to each vintage of additions. The curve that best forecasts an ending plant balance closest to the actual plant balance is deemed, generally, to be the best representative pattern for all vintages. That declining survival ratio determines the interim retirements expected to take place between the study date and the terminal date. These retirements, in turn, are the foundation for determining the average remaining life and the negative salvage estimate.

Q. Is there a goodness of fit measurement to gauge the accuracy of the model?

A. Yes there is a goodness of fit measurement – the Conformance Index ("CI"). The CI is derived by dividing the actual ending balance by the absolute value of the difference between the actual ending and the predicted ending balance.

$$\frac{\text{Actual ending value}}{|\text{Predicted ending value} - \text{Actual ending value}|}$$

The predicted ending value is squared to eliminate negative numbers and then the square root is taken to hold the predicted value as close to the actual value as possible. If the difference between the predicted and actual ending balances is high, then the CI ratio will be low. Conversely, if the difference between the predicted and actual ending balances is low, then the CI ratio will be high. The rule of thumb for ranking CIs is:

Over 75	excellent fit
50 to 75	good fit
15 to 50	fait fit
Under 25	poor fit

The rationale for the CI valuation is that in order for the CI to reach 75, the difference between the actual and predicted balances must be within 1.5% of the actual balance. A CI of 50 indicates a differential of only 2%. This ranking system thus requires the forecasted values to fall close to the actual values to be considered even a "fair" fitting of a hypothetical Iowa Survivor curve to the actual data. A CI above 100 indicates a forecast fit that is within 1% of the actual data; larger values for the CI over 100 do not indicate a significantly better fitting curve. If more than one curve has a CI beyond 100, the analyst incorporates other factors to select an appropriate curve. As the difference between the predicted ending balance and the actual ending balance gets smaller, the CI value increases. As the difference approaches zero, the CI approaches infinity.

V. REMAINING LIVES & DEPRECIATION RATES

Q. How did you determine the average remaining lives for each property account?

A. The BWMQ Simulated Plant Record model estimates the average service life on the basis of the Iowa-type Survivor Curve that calculates an ending balance that most closely matches the FERC Form 2 book balance at the close of the study date period. Using the best fit Iowa Curve, the annual surviving plant balance is calculated via the survivor curve decline rate (at the approximate inflation adjusted average age of the surviving plant) multiplied by the total net additions for the account. Then the annual balances are summed and divided by the beginning balance to arrive at the average remaining life estimate.

Q. What data did you use to develop the service life estimates?

A. The plant data is drawn from the FERC Annual Report FERC Form 2 and comes in the form of annual additions, retirements, transfers and adjustments.

Q. What adjustments did you make to accommodate for the inflationary distortions in the data series discussed earlier?

A. As noted earlier, a long-term time series can become distorted by the cumulative impact of inflation such that the data at each end of the data series are no longer compatible. 1950s-era dollars bought more plant and equipment than do current dollars. ANR’s transmission plant data stretch over 64 years, which if left unadjusted, leaves incomparable units of measure for the ANR plant addition and retirement activities. Plant retirements, as shown in the FERC Form 2, are likely to be older invested dollars (ie., more physical material) rather than newer invested dollars. I adjusted for this distortion by applying the BLS deflator series, PPI for steel mill products, to the plant activity data series. Applying the deflator index equalizes the vintage year activities so that 1950s-era additions and retirements carry the same weight as 2000s-era plant activities in developing the average remaining life of the accounts. The deflator index is used to develop only the average age of each account in the transmission function. The data used for developing the survivor curves themselves remained the original cost dollars.

Q. Describe the schedules included in Exhibit Nos. ANR-060 and ANR-061.

A. Exhibit Nos. ANR-060 and ANR-061 are the schedules that reflect the data, survivor curves, and retirement rates for each of the major accounts in the Storage and Transmission functions. Each schedule has six pages. Page 1 contains a) the survivor curve, b) a description of the data and its value, and c) a summary of the pertinent statistics for the account. Page 2 has graphs that present the plant data over time, in both original cost dollars and indexed dollars for transmission plant. Pages 3 and 4 includes the historical data of plant additions, retirements, transfers, and adjustments. Page 5 presents the forecast of interim retirements based on the curve and the concluding average remaining life figure. Page 6 reproduces the relevant portion of the Conformance Index from the model for the curves considered for the account.

Intangible Plant

Q. Describe your assessment of Account 301 Intangible Organization.

A. Account 301 includes $4,395 in organizations costs incurred in 1949, which appear to be the cost of incorporation. These costs are not treated as depreciable.

Q. Describe your assessment of Account 303 Intangible Miscellaneous.

A. Account 303 includes the cost of computer software, measurement software, computer equipment, and other intangible assets that serve a company-wide function. The Intangible Plant is composed of group software assets for which the book depreciation rate is based on the term of the service contract. Each year some contracts expire and new software contracts of varying terms are engaged. The composite average remaining life for the Intangible Plant is 1.85 years, with an associated depreciation rate of 10.78% (as applied to the gross plant for the whole function). The groups and the associated depreciation rates are shown in Schedule No. 8 of Exhibit No. ANR-059, page 19 of 20.

Production & Gathering Plant

Q. Describe your assessment of Account 325 Gathering Rights of Way.

A. Account 325 includes the cost of rights of way for production and gathering facilities. The average age of the plant is 46 years old. I applied the same average remaining life expectancy as I used for Transmission Plant Rights of Way: 30.4 years.

Q. Describe your assessment of Account 328 Field Measuring & Regulating Station Structures.

A. Account 328 includes the cost of sheds, structures, and property improvements used to support gathering and production operations. The average age is 40 years old. I applied the same average remaining life expectancy as I used for Transmission Plant Structures & Improvements: 29.8 years.

Q. Describe your assessment of Account 329 Gathering Other Structures.

A. Account 329 includes two expenses for property improvements. The average age is 7 years old. I applied the same average remaining life expectancy as I used for Transmission Plant Structures & Improvements: 29.8 years.

Q. Describe your assessment of Account 332 Gathering Field Lines.

A. Account 332 includes of small diameter lateral pipe lines connection field operations to the mainline system. The average age is 43 years old. I applied the same average remaining life expectancy as I used for Transmission Plant Mains: 30.3 years.

Q. Describe your assessment of Account 334 Gathering Field Measuring & Regulating Equipment.

A. Account 334 includes the cost of equipment such as meters, piping, controls, and dehydrators. The average age is 26 years old. I applied the same average remaining life expectancy as I used for Transmission Plant Measuring equipment: 30.1 years.

Storage Plant

Q. Describe your assessment of Account 350.2 Storage Rights of Way.

A. Account 350.2 includes the costs of rights-of-way agreements acquired for utility operations. The data for this account covers 1967 through 2014. ANR's Storage Rights-of-Way account has not seen significant expansion for most of its history with the exception of three years - 1980, 2003, and 2010. The history shows few retirements, with one large retirement in 2009 representing over 16% of the existing plant balance. The inflation adjusted average age of the account is 27.5 years. The four best curves, as judged by the Conformance Index, suggest an average physical life of between 55 and 65 years with average remaining lives of between 25 and 30 years. The L_2, S_0, and S_1 curves follow a similar trajectory while the R_1 takes a dramatic decline in the out-years of the truncation period. I selected the 65 S_0 curve because of the goodness of fit measurement. Using this curve forecasts interim retirements that, in turn, produce an average remaining life of 24.4 years over the 35 year economic life. See Exhibit No. ANR-060, Schedule No. A-1.

Q. Describe your assessment of Account 351 Storage Structures & Improvements.

A. Account 351 includes the buildings, garages, access roads, fencing, garage doors, cabinets, lighting systems, sheds, and other housing material in which storage operating equipment is housed, as well as improvements to the structures over time. The inflation adjusted average age of the account is 28.4 years. ANR's Storage Structures & Improvements account had a very long period of plant additions with almost no retirements from 1970 through 2000. There was a cluster of large retirements from 2000 to 2007 but they were minor in comparison to the total balance. I elected to use the 60-S_0 Iowa Curve, which has the highest Conformance Index. The 60-S_0 Curve produces an average remaining life of 30.61 years over the remaining economic life of 35 years. See Exhibit No. ANR-060, Schedule No. A-2.

Q. Describe your assessment of Account 352 Storage Wells, Leaseholds, & Reservoirs.

A. Account 352 is made up of three subaccounts: 352.0 Wells, 352.1 Leaseholds, and 352.2 Reservoirs. The inflation adjusted average age of the account is 31.5 years. The account includes the costs of drilling wells, Christmas trees, deeds and leases, and mineral rights. In this account there are a number of large retirements that are somewhat clustered around 1986 and 2006. The Conformance Index for the 50-R_2 curve indicates a good match with the original data and produces an average remaining life of 29.1 years over the remaining economic life of 35 years. See Exhibit No. ANR-060, Schedule No. A-3.

Q. Describe your assessment of Account 353 Storage Lines.

A. Account 353 includes the cost of line pipe, valves, fittings, and line pack. The inflation adjusted average age of the account is 31.5 years. The average age of the plant is 23 years old. Account 353 has a 45-year history of regular annual plant additions but almost no retirements until 2000 and thereafter. Despite the unbalanced retirement experience, the 50-S_1 curve has a high Conformance Index, suggesting a good match with the original data pointing toward a good indicator of future interim retirements. Using the 50-S_1 curve forecasts interim retirements that produce an average remaining life of 28.7 years over the remaining economic life of 35 years. See Exhibit No. ANR-060, Schedule No. A-4.

Q. Describe your assessment of Account 354 Storage Compressor Station Equipment.

A. Account 354 includes the cost of compressors, control valves, mufflers, lubricating oils, fire suppression systems, and other equipment needed to operate the stations that move gas through the system. The inflation adjusted average age of the account is 25.7 years. Account 354 has a 45-year history of large plant additions and few retirements until 2000 and thereafter. The survivor curve model indicates a wide range of ASLs in the range 40 to 70 years. However, consistent with the discussion below regarding transmission function compressor station equipment, I set the ARL for Account 354 at 10 years. See Exhibit No. ANR-060, Schedule No. A-5.

Q. Describe your assessment of Account 355 Storage Measuring & Regulating Equipment.

A. Account 355 includes the costs of equipment needed to manage the gas flows, such as plug and ball valves, hygrometers, gravitometers, chromatographs, manifolds, control software, and other equipment. The inflation adjusted average age of the account is 32.4 years. Account 355 has few retirements until the 2000s and modest retirements since that time, with an exception in 2003 when a major retirement took place. The survivor curves indicate an average service life in 50- to 55-year range. The CI for the 50-R_1 curve indicates a good match with the original data and should provide the good indicator of future interim retirements; it produces an average remaining life of 24.7 years over the remaining economic life of 35 years. See Exhibit No. ANR-060, Schedule No. A-6.

Q. Describe your assessment of Account 356 Storage Purification Equipment.

A. Account 356 includes the scrubbers and dehydrators, and similar equipment used to clean the gas stream. The Account has no retirements until a 2004 major retirement. The inflation adjusted average age of the account is 29.7 years. The lack of retirement data cautions against relying on any specific survivor curve. Nonetheless, the 65-S_0 Iowa Curve indicates a good match with the original data and forecasts interim retirements that in turn produce an average remaining life of 28.4 years over the remaining economic life of 35 years. See Exhibit No. ANR-060, Schedule No. A-7.

Q. Describe your assessment of Account 357 Other Equipment.

A. Account 357 includes parts and equipment that don’t quite fit into other property accounts. The inflation adjusted average age of the account is 31.5 years. There was insufficient data to run an SPR model so I elected to use the same average remaining life as the purification equipment account due to the similar nature of the assets within the accounts.

Transmission Plant

Q. Describe your assessment of Account 365.2 Transmission Rights of Way.

A. Account 365.2 Transmission Rights of Way includes the cost of acquiring the rights to use property for pipeline operations. The average age of the original cost dollars in the account is 28 years old, the inflation adjusted average age is 46.8 years. The account has had modest retirements throughout its history. The indexed net additions graph and indexed retirement graphs reproduced on page 2 of Section B-1 reflect the relative weight of the early dollars investments. I selected the 80-R_5 Iowa Curve because it has a high Conformance Index and its forecast of a 5-year average of near-term interim retirements is close the actual recent 5-year average retirement level. Using the 80-R_5 curve forecasts interim retirements that in turn produce an average remaining life of 30.4 years over the remaining economic life of 35 years. See Exhibit No. ANR-061, Schedule No. B-1.

Q. Describe your assessment of Account 366 Transmission Structures & Improvements.

A. Account 366 Transmission Structures & Improvements is the account that holds the costs associated with the buildings, garages, and landscape improvements that host the equipment needed to operate the system. The indexed net additions and indexed retirements charts on page 2 of Schedule B-2 indicate the relative impact of the adjusted earl plant activity in 1951 and 1966. These adjustments shift the average age of the account from 29 years old in original cost dollars to 52.8 years old in inflation adjusted dollars. The survivor curve model indicates average service lives in the 65- to 90-year range. I selected the 85-R_5 Iowa Curve because it has a high Conformance Index and its five-year average for interim retirements is reflective of the actual five-year average. Using the 85-R_5 curve forecasts interim retirements that produce an average remaining life of 29.8 years over the remaining economic life of 35 years. See Exhibit No. ANR-061, Schedule No. B-2.

Q. Describe your assessment of Account 367 Transmission Mains.

A. Account 367 Transmission Mains is broken into two subgroups: the Tie Line Integrity program facilities and Mains. The division recognizes ANR's commitment to pipeline safety and integrity in its capital plan to retire and replace the Tie Line that links ANR's Southwest and Southeast Mainlines. Certain Tie Line facilities are line pipe manufactured by Youngstown Steel Works that are known to have structural integrity problems. Although ANR has not had any such problems on its own system, it plans, out of an abundance of caution, to retire and replace these sections of line pipe over the next five years. Consequently, I have assigned the approximately $25 million in Youngstown Tie Line pipe a 5 year average remaining life. The balance of the Mains account is discussed below.

Account 367 holds the costs associated with building the line pipe itself as well as the river crossings, line pack, valves, hauling, and inspections. Account 367 has a robust history of plant additions and retirements going back 64 years. It started with a $75 million balance, expanded by $100 million in the late 1950s, and then experienced a prolonged period of expansion through to the present with $20 to $60 million added per year. When the inflation index is applied to the data series, as shown on page 2 of Schedule B-3, the relative import of additions in 1951 and 1966 become clear, shifting the average age from 32 years old to 49.2 years old. Relative to additions, the annual retirements appear to have been modest until the 2000s when retirements began to top several million every year. But the inflation adjusted series indicates a more robust retirement history in the 1960s/1970s. The relative size of the retirements over the long run results in a survivor curve that indicates a possibly a long lived asset. There are several Iowa Curves that pass the threshold tests for goodness of fit with average service lives ranging from 70 to 90 years old. I selected the 85-R_4 Iowa Curve because the five average of its near-term retirement forecast results in a figure closer to the five year average of recent pipeline experience. Using this curve and ASL results in a 30.3-year average remaining life over the 35-year economic life. See Exhibit No. ANR-061, Schedule No. B-3.

Q. Describe Account 368 Transmission Compressor Station Equipment.

A. Account 368 Transmission Compressor Station Equipment is made up of the compressor engines that pressurize natural gas to push it through the pipeline system, and the associated pipes, meters, control valves, platforms, and exhaust handlers. ANR has approximately 308 compressor units at 58 compressor stations across its system, most of which are powered by reciprocating engines and 37 are powered by gas turbines. The mix of compressor units includes some that are scheduled for abandonment in the near future, some with low annual run rates, some with high annual run rates, some that run day and night, and some that are used on a stand-by basis. Although only 10% of the compressors are turbines, the turbines make up 30% of the compressor station equipment account dollars.

The data on compressor plant addition and retirement dollars reflects that some current plant goes back to the early 1950s, if not further (See Schedule No. B-4 in Exhibit No. ANR-061. The Retirements graph shows that ANR had very low retirement events, as reflected in the original cost dollars in this account for the first three decades, followed by modest retirements in the 1980s and 1990s. But the inflation adjusted net additions and retirement charts show a somewhat more intense retirement history and a much more intense net additions summary. Then in the 2000s, after decades of little to no retirement activity, ANR experienced enormous turnover in Account 368 as millions of dollars of plant and equipment was retired. The inflation adjusted data series shifts the average age from 15 years old to 33 years old.

Q. What does the survivor curve model suggest regarding Account 368?

A. The SPR model indicates a 60-R_5 and a 65-S1 are the best fitting curves, indicating an ASL of 60 to 75 years, and a 27- and 30-year average remaining life, respectively, assuming the 35-year economic truncation life. ANR's Account 368 data (see the

Retirements graph and Plant Balance graph in Schedule No. B-4 of Exhibit No. ANR-061 reflects a long history of low retirement activity from 1951 to the 2000s. The model forecast a 60 year ASL and a 27 year ARL.

Q. Do you concur with the survivor curve projection for Account 368?

A. No, I do not. In reviewing the data and talking to several ANR system managers, I have come to the conclusion that the 30-year ARL projection for Account 368 no longer fits the situation facing the account. The ongoing changes in how ANR uses compression equipment, as well as its ongoing work to modernize its compressor equipment, dictates a different approach. The survivor curve theory can only predict the future based on the mathematical trends inherent in the data. In this instance, the ANR compressor station equipment is not going to follow its historical path. The mix of station equipment and maintenance and modernization policies suggest a much shorter life span than the 30-some year average remaining life predicted by the survivor curve methodology.

Q. What average remaining life do you recommend for Account 368?

A. I developed separate rates for turbines and reciprocating engine equipment as reflected in Schedule No. 5 and then composited the impacts to derive the overall rate.

<u>Turbines</u>

Gas turbine engines are significantly more efficient than reciprocating engines but that efficiency comes at a cost – the turbines are both more expensive to acquire and have a shorter life expectancy. Turbine manufacturers recommend major overhauls at intervals of 35,000 to 40,000 hours, roughly every four to four-and-a-half years assuming the engine ran 24/7 for the year (8,740 hours). The substantial overhauling cost is capitalized, in effect, like purchasing a new turbine. The effective depreciable lifespan of a turbine engine is thus the time between overhauls. While ANR has some turbine equipment that is much older than ten years, the industry standard, in my experience, is that turbines have useful lives between major overhauls of less than ten years. In ANR’s case, the most recent turbine usage data reflect the low throughput levels of the 2012 – 2015 period. On average, ANR’s 37 turbine engines ran 1,311 hours per year, which suggests a 26.3-year lifespan (combined 34,500 average overhaul hour recommendation divided by 1,311 hours). Given that the average age of ANR’s turbine assets is 15-years old, the average remaining life of ANR’s turbine compressors is 11 years.

<u>Recips</u>

ANR has 223 reciprocating engine compressor units in the Transmission function. Some of the investment in plant associated with these engines date back to 1949. The average age of the dollars invested in ANR’s recip engines is approximately 20 years old, although the indexed age is about 33 years old. As noted in the survivor curve discussion above, compressor station equipment can have average service lives into the 60 year range. However, as these machines approach the higher life expectancies, they require more frequent and more expensive maintenance regimens. The cost of major overhauls is capitalized just as it is for turbines. As noted by ANR witness Hampton, ANR’s maintenance policy, given the age of the equipment, is to conduct a major overhaul on each recip engine every ten years. This, in effect, establishes a ten year lifespan for the capitalized overhaul costs for recip engine equipment. In addition, given a 35-year remaining economic life and plant that is at least 20 years old on average, 15 years would be a reasonable ARL estimate. Averaging the 10- and 15-year estimates suggests a 12.5 year ARL for recip compression equipment.

Q. Describe your assessment of Account 369 Transmission Measuring & Regulating Equipment.

A. Account 369 Transmission Measuring & Regulating Equipment holds the costs of the meters, gauges, and minor piping needed to monitor and control the system. ANR has approximately 600 active metering facilities. The account has a lively history of annual plant additions and retirements. The indexed net additions and indexed retirements charts on page 2 of Schedule No. B-5 illustrate the relative impact of inflation adjusted plant activity in the 1960s and early 1970s, which shifts the average age from 15 years old to 24.8 years old. I selected the 65-R_1 Iowa Curve because it has a high Conformance Index score and its five year average forecast retirements is close the most recent five year average for retirements. Using the 65-R_1 Curve results in an average remaining life of 30.1 years over the 35-year economic remaining lifespan. See Exhibit No. ANR-061, Schedule No. B-5.

Q. Describe your assessment of Account 370 Transmission Communications Equipment.

A. Account 370 Transmission Communications Equipment holds the costs associated with the telephones, microwave equipment, towers, and receivers used to manage the system. Account 370 has had frequent retirements throughout its history but a tapering off in net additions of late. The account is currently almost fully accrued. Given that the nature of communications equipment is becoming more digital and wireless, and governed by software rather than hardware, I have elected to suggest a 10% depreciation rate as a placeholder rate pending new plant additions for communications upgrades. ANR uses a separate depreciation rate for Account 370 rather than joining the function wide depreciation rate.

General Plant

Q. What were your conclusions regarding General Plant depreciation rates?

A. The current depreciation rates for ANR's General Plant accounts are shown in column d of Exhibit No. ANR-059, Schedule No. 2; the recommended rates are shown in column f. This analysis gives weight to ANR's substantial capital improvement plans, as reflected in the plant additions shown in Exhibit No. ANR-059, Schedule No. 4. The calculations leading to the recommended depreciation rates are shown on Schedule No. 5 of Exhibit No. ANR-059.

<u>Account 390 Structures & Improvements</u> – Account 390 includes plant such as office space, shelving, phone systems, heating and plumbing improvements. The current depreciation rate is 1.30%. Unlike other structures and improvement accounts, Account 390 does not include buildings themselves but rather the interior fittings; consequently, I recommend using a 20 year service life. Given the average age of approximately 2.8 years, the average remaining life is then 17.2 years. Dividing the projected net plant by 17.2 years, and then dividing by the gross plant in service, the resulting depreciation rate is 5.47%.

<u>Account 391 Office Equipment</u> – The current depreciation rates is 6.67%. I recommend using a 7-year average service life. Given the average age of approximately 2.7 years, the average remaining life is then 4.3 years. Dividing the projected net plant by 4.3 years, and then dividing by the gross plant in service, the resulting depreciation rate is 16.17%.

<u>Account 392 Transportation Equipment</u> – The current depreciation rate is 9.47%. I recommend using a 10-year service life. Given the average age of approximately 4.8 years, the average remaining life is then 8 years. Dividing the projected net plant by 8

years, and then dividing by the gross plant in service, the resulting depreciation rate is 9.79%.

Account 394 Tools, Shop, & Garage Equipment – The current depreciation rate is 5.71%. I recommend using a 15-year service life. Given the average age of approximately 10.9 years, the average remaining life is then 4.1 years. Dividing the projected net plant by 4.1 years, and then dividing by the gross plant in service, the resulting depreciation rate is 10.8%.

Account 396 Power Operated Equipment – The current depreciation rate is 5.71%. I recommend using a 12-year service life and, given the average age of approximately 10.3 years, the average remaining life is then 1.7 years. Dividing the projected net plant by 1.7 years, and then dividing by the gross plant in service, the resulting depreciation rate is 3.76%.

VI. NEGATIVE SALVAGE

Q. What is negative salvage?

A. Negative salvage is the cost of taking plant out of service. In many instances the cost is *de minimis* and treated as maintenance expense but in other instances substantial costs can be incurred. When these costs become sizable they are treated as part of the recovery of capital costs and debited to the accumulated reserve for depreciation. Similarly, the salvage value of assets removed from service represent a recovery of some of the cost of acquiring the asset and are thus also treated as part of the depreciation of capital costs, in this case a credit to the accumulated reserve for depreciation. Where the cost of removal exceeds the salvage value of the retired asset, the excess cost is termed net salvage or "negative salvage" and debited to the accumulated reserve for depreciation.

Companies incur negative salvage in two ways, first on the cost of removing interim retirements and second on the decommissioning, removal, and remediation upon the final termination of the company's assets that remain at the end of the service life. While net salvage is often incorporated into the depreciation expense recovery for individual asset accounts, here a composite net salvage rate estimate for both interim negative salvage ("INS") and terminal negative salvage ("TNS") is computed for the transmission function.

Q. Does ANR currently have negative salvage rates?

A. No.

Q. Do you recommend establishing negative salvage rates on ANR?

A. Yes, I do. Although many ANR property accounts have a modest retirement history, the bulk of its plant is thirty or more years old, with some line pipe and metering equipment approaching 50 years old. These facilities are going to start moving over the edge of the survivor curve decline horizon, after which we should see a much higher rate of plant retirements and associated negative salvage costs. These interim retirements are part of the plant balance forecast discussed above and are used to derive the average remaining life estimate. I would expect that ANR, like all other pipelines, will experience costs of removal that exceed salvage value of the scrap steel and meters. So a negative salvage expense should be anticipated and a negative salvage rate established to accommodate the anticipated costs.

Q. How were the terminal negative salvage estimates derived?

A. Upon reaching the end of the useful life of the pipeline assets, the facilities are either physically removed from the service area for disposal or made safe for abandonment in place. The cost of removal and remediation of retirements is based on the civil engineering study of the storage and transmission function plant done by ANR witness Taylor. Mr. Taylor's exhibits reflect the cost of removal and dismantling on a project by project basis. I have reformatted those costs by FERC property accounts, and calculated the negative salvage rates for the three plant accounts from which most of these costs will arise. His figure is incorporated into Schedule Nos. 6 and 7 of Exhibit No. ANR-059 for the development of composite net salvage rates.

Q. How did you estimate the cost of interim retirements?

A. I developed the interim retirement negative salvage expense by first pulling the plant to be retired from the survivor curve forecasts and then applying the negative salvage ratio by account as determined from the terminal negative salvage study performed by ANR witness Taylor. The TNS study is an engineering based study that examines dismantlement costs for the entire system. The TNS study approaches cost by construction project, such as a river crossing or dismantling of a compressor station, rather than by FERC account numbers.

Q. How did you composite the interim retirement cost estimates and the terminal retirement cost estimates?

A. The composite process is shown on Schedule No. 7 for the Transmission function and Schedule No. 6 for the Storage function. Each schedule is in three parts: A) the Engineering Study, B) Applying the TNS Rate to Retirements, and C) Composite Negative Salvage Rate.

In part A, the methodology converts the TNS study cost estimates into FERC property accounts and converts them into a negative salvage rate in column f by dividing the negative salvage cost in e by the plant in service for that account in column b. Meanwhile, the gross plant in service from column b is separated into the interim retirements developed in the survivor curve analysis (column c) and the remainder of plant that will be subject to the terminal removal costs (column d).

In part B, the methodology applies the TNS rates (column f) to the interim retirements (column c) to develop the cost of removal for interim retirements in column g, and then weights the costs (column i) by the average remaining life (column h) as derived in the survivor curve analysis. Similarly, the methodology also applies the TNS rates (column f) to the terminal retirements (column d) to develop terminal retirement costs (column j) and then weights those costs (column l) by the economic lifespan (column k).

In part C, the methodology composites the interim and terminal retirement costs to develop the average remaining years for recovery of negative salvage costs (column h).

The total salvage costs, as estimated by the TNS study (sum of column e) are then divided by the remaining years for an annual negative salvage recovery amount (column g). That amount is then divided by the gross plant in service (column b) to arrive at the composite negative salvage rate (boxed figure in Column h). I developed the negative salvage rate recommendations for ANR by compositing the estimated cost of retiring interim plant retirements and the estimated cost of retiring all the remaining plant at the economic termination date. I relied on ANR witness Taylor's TNS study for the estimated cost to dismantle and remove the ANR facilities. Using the TNS as a foundation I calculated negative salvage rates by FERC property account (Column e of Schedule No. 6 for Storage Plant and Schedule No. 7 for Transmission Plant, in Exhibit No. ANR-059. I applied these negative salvage rates to the estimated interim retirements to arrive at the cost of interim retirements. Then, subtracting the interim retirements from the total plant in service, I arrived at the plant subject to terminal retirement. I applied the negative salvage rates to the terminal retirement plant to arrive at the cost of terminal retirements. Because these retirement costs will be recovered over the average remaining lives of the assets I weighted the costs by the average remaining lives for each account – the full 35 years for terminal retirements and slightly shorter average remaining lives for the interim retirements. The composite rates are reported on each schedule and on Schedule No. 1. These calculations are shown on Exhibit No. ANR-059, Schedule No. 6 for Storage plant and Schedule No. 7 for Transmission Plant.

Q. What is the composite negative salvage rate for transmission and storage plant?

A. The composite rate for Storage negative salvage is 0.70%; the composite rate for Transmission negative salvage is 1.46%.

Q. Does this conclude your Prepared Direct Testimony?

A. Yes, it does.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

ANR Pipeline Company	)	Docket No. RP16-____-000
District of Columbia	) ss.	

AFFIDAVIT OF PATRICK R. CROWLEY

Patrick R. Crowley, being first duly sworn, on oath states that he is the witness whose testimony appears on the preceding pages entitled "Prepared Direct Testimony of Patrick R. Crowley"; that, if asked the questions which appear in the text of said testimony, he would give the answers that are therein set forth; and that affiant adopts the aforesaid testimony as Patrick R. Crowley's sworn testimony in this proceeding.

____
Patrick R. Crowley

SWORN TO AND SUBSCRIBED BEFORE ME THIS 26th DAY OF January, 2016

STEPHANIE J. WILKERSON
MY COMMISSION EXPIRES 6/30/2019

____
Notary Public
My Commission Expires:

STEPHANIE J. WILKERSON
NOTARY PUBLIC DISTRICT OF COLUMBIA
My Commission Expires June 30, 2019