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MISSOURI PUBLIC SERVICE COMMISSION

FILE NO. ER-2019-0335

REBUTTAL TESTIMONY

OF

JIM WILLIAMS

ON

BEHALF OF

UNION ELECTRIC COMPANY
d/b/a Ameren Missouri

St. Louis, Missouri
January 2020

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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Jim Williams and my business address is 1901 Chouteau Avenue, St. Louis, Missouri 63103.

Q. By whom are you employed and what is your position?

A. I am employed by Union Electric Company d/b/a Ameren Missouri ("Ameren Missouri" or "Company") as Sr. Director, Operations Excellence Support in the Company's power operations group, which manages the Company's non-nuclear generation resources.

Q. Please describe your educational background and employment experience.

A. I have more than thirty years of experience in power plant operations, including specifically in operating baseload coal-fired power plants. Prior to beginning my career, I received a B.S.in Mechanical Engineering from Southern Illinois University ("SIU") at Carbondale, Illinois-1986. Later, I was awarded a Master's Degree in Business Administration from Eastern Illinois University in Charleston Illinois-1995. I possess several other certificates related to my work, including Project Management Professional -2013, as well as serving on the SIU Engineering Advisory Board for the St Louis area.

I began my professional career as a Plant Engineer at the Central Illinois Public Service Company, Newton Power Station in 1986. In that role, I performed as the Boiler Engineer, Turbine Engineer, Systems Engineer, and Performance Engineer, and Operations Supervisor. In 1993, I was promoted to the position of Tech Support Coordinator. In that role, I was responsible for all of the engineering, environmental, chemical, planning, scheduling, and budgeting activities for the station. I served in that role until January of 2001. At that time, I was promoted to the Plant Director at Ameren Energy Generating Company's ("AEG") Coffeen Power Station. In that role, I was responsible for the safe, reliable, and efficient operation at the station. In 2009, I was transferred back to AEG's Newton Power Station as the Plant Director. I had responsibility for the activities at both the Newton and the Hutsonville Power Stations. In 2013, I was promoted to Sr. Director and was accountable for all of AEG's coal-fired plants. After Ameren Corporation's 2014 divestiture of AEG, I accepted a position with Ameren Missouri as Plant Director at the Sioux Energy Center. I held that role until I was promoted to the Sr. Director, Power Operations in 2015 where I had responsibility for the non-nuclear generation in Missouri. In 2018, I assumed my current positon.

Q. What are your responsibilities in your current position?

A. As the Sr Director, Operations Excellence Support, I have responsibility over the engineering teams at each of the Company's non-nuclear energy centers, including Performance Engineering and Turbine Engineering. I also oversee Laboratory Services, a Corrective Actions Team, the Ameren Missouri Power Operations and

Maintenance Training Center, Plant Construction Maintenance (a maintenance group that travels between different energy centers), and the Operations Excellence Engineering Group.

Q. What is the purpose of your rebuttal testimony?

A. I am responding to two issues raised by Sierra Club witness Avi Allison. First, I respond to Mr. Allison's apparent suggestion that *if* the Rush Island, Labadie, or Sioux Energy Centers were to retire shortly after 2024 (instead of at the currently estimated retirement dates), capital expenditures made at those plants in 2018 and 2019 might not have been necessary. I am also responding to Mr. Allison's suggestion that these capital expenditures reflected "major life extending" projects that would not have been made if, hypothetically, one of these plants retired shortly after 2024. Ameren Missouri witness Matt Michels addresses other aspects of Mr. Allison's testimony regarding the economics of these units. Secondly, I provide information relevant to Mr. Allison's criticism of the approach to unit commitment and dispatch of these same energy centers, specifically information regarding the fact that these energy centers were designed to operate as baseload units and not frequently cycle on and off dictates the unit commitment practices the Company follows. Company witness Andrew Meyers addresses the Company's unit commitment and dispatch practices.

II. CAPITAL EXPENDITURES

Q. Do you agree with Mr. Allison's testimony in regard to the capital costs Ameren Missouri incurred at those plants in 2018 and 2019?

A. No. The capital projects completed in 2018 and 2019 would have been completed regardless of any hypothetical retirement in the mid-2020's, and regardless of any ultimate impact the final outcome of the New Source Review ("NSR") lawsuit may have on the future operation of any of these plants in mid-2020 or beyond. The capital expenditures were required to address then-existing concerns related to the safe and reliable operation of these Energy Centers now and over the next few years and, in some cases, to ensure ongoing environmental compliance.

Q. On what do you base your conclusion?

A. Given Mr. Allison's suggestion that a mid-2020's retirement might have eliminated capital expenditures at these plants, I went back and reviewed all capital projects in excess of $500,000 placed in service at these plants in 2018 and 2019. My review, summarized in Schedule JLW-R1, confirms that these projects were required and would have been done even if today we knew the plants would shut down shortly after 2024.[1]

Q. Before discussing some of the major capital projects completed during this timeframe can you briefly explain the basis for capital planning at Ameren Missouri's generating plants?

[1] A formal post-project review of this nature had not been undertaken when Sierra Club posed its DR No. 1.6, referenced in Mr. Allison's direct testimony. As noted, we had a general understanding of the need for the projects regardless of a hypothetical mid-2020's retirement as we planned, approved, and completed the projects.

A. Capital planning is grounded in three primary principles. First, for the reasons discussed by Mr. Michels in his rebuttal testimony, capital expenditures are developed utilizing the latest preferred resource plan from our triennial Integrated Resource Plan ("IRP") filings. Second, Ameren Missouri invests capital needed to safely and reliably operate the plants and is conservative in making capital investments in that if an investment is needed to err on the side of safety, it will be made. Third, Ameren Missouri Power Operations' business goals are to keep these plants reliable.

Q. Can you discuss some of the major examples of 2018 and 2019 projects at Rush Island and reasons why they were required irrespective of the hypothetical retirement Mr. Allison's suggest might occur?

A. Yes. At Rush Island, the 2018 and 2019 capital expenditures were related to either ongoing environmental compliance that would be necessary regardless of whether the plant retired, or were for component replacements due to issues that were affecting the design basis of that component that needed to be addressed for ongoing operations. In 2018, environmental compliance projects were the largest cost items including approximately $87 million to comply with new coal combustion residuals ("CCR") and effluent limitation guidelines ("ELG") rules, including dry ash conversions and installation of a new waste water treatment system. Installation of the dry bottom ash system required relocation and replacement of the auxiliary boiler at an additional cost of $7.4 million. Another $3.3 million expenditure for the Unit 1 electrostatic precipitator rebuild (to comply with particulate matter regulations) was required due to the component degradation due to air leakage causing corrosion of the casing walls.

Another larger project on Rush Island Unit 1 (approximately $2.4 million) was the economizer strap addition project. This was to address safety and operational concerns. The existing economizer sections of the boiler are supported by hangers and ladder straps. The design basis accounts for proper structural supports to operate within the design temperatures and ash loading expectations. During inspections, it was observed that these straps were failing and the weld attachments to the supporting headers were failing. This was causing the economizer front section to drop significantly, causing a safety and operational concern.

The remaining roughly $15 million of projects in 2018 were for various ongoing replacement or safety needs. Capital expenditures at Rush Island in 2019 were about $7 million for critical spare parts that need to be on hand.

Q. Can you provide an explanation of capital projects at Labadie and Sioux in the same time period?

A. Yes. With regard to the Labadie and Sioux Energy Centers, the capital expenditures during the same period fall into the same categories as those described for Rush Island. Component replacements for these facilities were required to maintain a design basis to provide safe, reliable operation of the energy centers. Of the approximately $160 million in expenditures at Labadie in 2018, more than two-thirds was to comply with ELG and CCR requirements. The remaining expenditures at Labadie in 2018 were primarily for component replacement projects to restore known deficiencies that had a detrimental effect on the design basis and the ability to operate safely and within conservative operating guidelines.

Examples include $12.1 million for a boiler reheater and $7.4 million for the lower slope replacement on Labadie Unit 3. These were required to address material condition and restore reliability of those components. In 2019, similar repairs were made to Labadie Unit 1. In addition to boiler repairs, $5.6 million was expended to replace the last stage turbine blading on the low pressure turbines due to know material issues and design basis concerns. As stated earlier, other expenditures were required to address known issues such as acquiring a generator startup transformer for $6.5 million, and a $4 million project on Labadie Unit 3 to address an Induced Draft Fan with blade issues and cracks. Of the approximately $4.8 million in 2018 capital expenditures at Sioux, approximately $3 million were for safety or security needs at the plant. $1.7 million was expended to deal with coal dusting and coal spillage issues transferring the coal into the plants. OSHA has strong requirements for the amount of coal dusting that is safe. To comply with this regulation, coal transport systems and containment areas needed to be addressed. In 2019, Sioux expended $4.3 million for the ELG and CCR projects and $1.9 million for the U2 HP generator rewind due to known issues found during continued testing.

Capital expenditures at Labadie and Sioux in 2019 were approximately $58 million and $11 million, respectively. More than one-third (40%) of the Labadie expenditures were for ELG/CCR compliance with the rest consisting of needed component replacements or to meet safety needs. Similar to Labadie, nearly 40% of the investments at Sioux were for ELG/CCR compliance with the rest consisting almost entirely of needed component replacements.

Q. Mr. Allison suggests that "major life extending" projects should not be done if retirement would occur within three to five years. Were these expenditures "major life extending" projects?

A. No. These projects were for compliance with environmental laws needed for existing, ongoing operations in the near- to intermediate terms, and to address known issues that were affecting the design basis of the units so that we could continue to provide reliable power for our customers while operating them in a safe and conservative manner now and in the near term. In addition, as discussed by Mr. Michels in his rebuttal testimony, it is very unlikely that these plants could realistically retire in the next three to five years, even if Mr. Allison's suggestion was accurate.

Q. Do you have past experiences with end of life and plant closures?

A. Yes. My operating experience includes the closure of two coal-fired generating facilities as well as the upcoming Meramec Energy Center closure.

Q. How do the capital expenditures made at Labadie, Rush Island, and Sioux in 2018-2019 compare to capital expenditures made at these other plants with which you have experience even where those other plants were expected to close in the next several years?

A. In all these cases, these type of capital expenditures were incurred even when the plants were expected to close in the next several years. As an example, at our Meramec Energy Center, we recently made repairs to the precipitator casing similar to the project completed at Rush Island, even though we know that the Meramec plant will close by 2022. This project was needed to allow the precipitator to perform as designed through the end of its useful life.

III. CYCLING OF BASELOAD COAL UNITS.

Q. Company witness Andrew Meyer testifies that one of the reasons the Company commits the Labadie, Rush Island, and Sioux units in the MISO market in the manner that it does is to avoid damaging the units by frequently cycling them on and off. Is the Company right to be concerned about damage to these units if a must run commitment status were not used?

A. Yes. I know from 33-plus years of experience operating coal-fired units that the impact of cycling on these units is real. While one cannot accurately predict for a given unit exactly what costs frequent cycling will cause, it is well understood in the industry that cycling units on and off increases forced outage rates and creates higher operations and maintenance and capital expenditures. This is particularly the case with units with a 25-30 year or higher operating life, as is the case with all of the units in question. In my experience, cycling leads to higher boiler tube failure rates, increased issues with turbine damage, exciter insulation issues, air heater issues, and precipitator performance problems.

Q. **Please elaborate on your concerns with cycling.**

A. As I noted, cycling impacts several components. Let's first start with the boiler components. The boiler consists of several miles of boiler tubing. There are different thicknesses and materials designed to deal with the different temperatures the boiler experiences throughout the gas path. The tubing is designed to deal with different pressures and temperatures and the ability to operate as the ash is cycled through the system. As boilers are cycled on/off, each of these components move (contract and expand) at different rates causing the welds to fail and develop leaks.

Additionally, the different stages of superheated steam, saturated steam, and condensate change at different rates. In some instances this causes a "water hammer" which, as the name implies, is a violent movement within a particular piping line. These components are restrained with pipe hangers. As these cycling events occur, they cause the components to fail which in turn requires expenditures to repair or replace components, as well as causing outages of the unit. Those outages in turn reduce revenues from the unit.

Q. Are there similar concerns with turbine generator components?

A. Yes. The turbine (rotating and stationary turbine blades) and the generator are affected. The turbine cycle is affected each time the turbine is started and stopped. This is because the quality of steam is critical to the design basis and performance of a steam turbine (steam pressures and steam temperatures). Once a generating unit is on line, the steam quality is of an appropriate quality for prolonged operation. However, when units are cycled on/off, the steam qualities change. High temperature steam may become saturated (containing moisture droplets) at certain points (engineers call the point when condensation starts the "Wilson Line") at which point the turbine blades experience an environment where the trailing edges of the stationary and rotating turbine blades begin to see grooving (caused by the moisture) which leads to blade failure. There are also known issues (material cracking) with the hook fits next to the rotor (location where the turbine blades are affixed to the rotor). As is the case with the boiler, this damage leads to the need for more frequent turbine inspections, which themselves cost money, and other costs. As more wear is incurred, the performance of the unit (heat rate) worsens (i.e., more fuel is required for a given level of generation leading to more costs for customers).

As the units are cycled on/off the generator also experiences added wear. The generator also has rotating and stationary components. As the generator cycles on/off, it can experience stator bar movement and insulation cracking. Over time this is known to cause leakage or generator grounding issues and the resulting costs associated with repairing those issues and well as the impact on unit availability these issue can cause.

Q. Are there other critical systems at risk?

A. Yes. High energy piping is directly affected by cycling of units. Flow Accelerated Corrosion is an industry concern which has been documented several times and that has caused catastrophic failures. As the units run, a thin layer of oxide forms inside the piping. As the units cycle, piping expands and contracts and over time, this thin layer spalls (flakes, breaks) off the inside of the piping and goes downstream. A new layer then begins to form, and eventually it too spalls off. This creates thin spots in the piping leading to failure of the pipe. In high pressure and high temperature applications, which we have in all of these plants, this becomes a serious performance and a critical safety issue. Air heater and precipitator performance is also greatly affected by cycling units on/off. As the units are cycled, the back end temperatures of the boiler and precipitator are increased and reduced. As you cycle the units on/off, the acid dew point (this is where the outlet boiler gasses reaches a certain temperature and pressure allowing the sulfuric acid to condense and increase corrosion) affects the integrity of air heater baskets, precipitator casing, and precipitator internals.

These all contribute to the degradation of operation of these components, which in turn leads to repair or replacement costs and, again, can affect reliability and unit availability.

Q. Does this conclude your rebuttal testimony?

A. Yes.

**BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI**

In the Matter of Union Electric Company d/b/a Ameren Missouri's Tariffs to Decrease Its Revenues for Electric Service.	)))	File No. ER-2019-0335

AFFIDAVIT OF JIM WILLIAMS

STATE OF MISSOURI)
) ss
CITY OF ST. LOUIS)

COMES NOW Jim Williams, and on his oath declares that he is of sound mind and lawful age; that he has prepared the foregoing *Rebuttal Testimony*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

Jim Williams

Jim Williams

Subscribed and sworn to before me this 21st day of January, 2020.

Geri A. Best

Notary Public

My commission expires:

GERI A. BEST
Notary Public - Notary Seal
State of Missouri
Commissioned for St. Louis County
My Commission Expires: February 15, 2022
Commission Number: 14839811

Facility	Expenditure	Project	Reason	Required for 2025 Shutdown
Meramec	659,794	MR U3 Transformer Explosion Protect	GSU Transformer Upgrade (safety)	Y
	576,819	Meramec Drainage Improvements	Facility upgrade	Y
Sioux	1,736,020	Sioux Coal Dusting and Spillage Imp	Safety	Y
	1,269,666	SX NERC CIP 5 Physical Security	Security	Y
	964,428	Sx1 Absorber Oxidation Air Agitator	Component Replacement	Y
	920,860	SX - 1A ID Fan Hub Replacement	Component Replacement	Y
Labadie	45,284,545	LBD Wastewater Treatmen ELG	ELG/CCR	Y
	40,722,255	LBD DRY FLY ASH CONVERSION	ELG/CCR	Y
	23,291,317	LBD U3 DRY BOTTOM ASH CONVERSION	ELG/CCR	Y
	12,185,089	LBD U3 Reheater REPL	Component Replacement	Y
	7,413,379	LBD U3 LOWER SLOPE REPL	Component Replacement	Y
	6,512,865	LB-RI Critical Spare GSU	Critical spare part	Y
	4,037,534	LBD U3 ID Fan Rotor Repl	Component Replacement	Y
	2,676,856	LABADIE WATER TREATMENT CNTRLS	Component Replacement	Y
	2,391,102	LBD U3 Coal Mill Transport Pipe Rep	Component Replacement	Y
	1,893,526	LBD U3 Air Preheater Basket Repl	Component Replacement	Y
	1,867,911	LBD NERC CIP 5 Physical Security	Security	Y
	1,855,777	LBD U3 AUX COOLING H2O COOLERS REPL	Component Replacement	Y
	1,574,349	LBD U3 K LINE BREAKER REPL	Component Replacement	Y
	1,558,130	LBD U3 &4 Gas Conditioning	Component Upgrades	Y
	1,007,809	Labadie Wireless Refresh	Communication Upgrade	
	990,387	LABADIE U3 125 V DC System Repl.	Component Replacement	Y
	854,200	LBD - U3 CRH Safety Vent Stack Mods	Safety	Y
	829,106	LBD U3 Instal 2 New Lances in HorSh	Component Upgrades	Y
	706,639	LBD - U3 Repl C ID Fan Inlet Vanes	Component Replacement	Y
	706,568	LBDS - U3 A&B FD Inlet Vanes	Component Replacement	Y
	657,307	LBD U3 ADDL BLR CLNG DOORS	Component Upgrades	Y
	654,826	LBD U3 XFMR Explosion Protection	GSU Transformer Upgrade (safety)	Y
Rush Island	39,867,233	RI Dry Ash Handling System Retrofit	ELG/CCR	Y
	32,080,337	RI - Wastewater Treatment ELG	ELG/CCR	Y
	15,935,053	RI U1 BOTTOM ASH MODS-SC	ELG/CCR	Y
	7,405,046	RI Aux Boiler Replacement	Component Replacement	Y
	3,417,062	RUSH ISLAND U1 ESP REBUILD	Component Replacement	Y
	2,390,838	RI U1 Economizer Strap Addition	Component Replacement	Y
	2,251,099	RI-Marketing Silo Ash Transfer Sys	Component Replacement	Y
	2,034,787	RI 1 Valve Component & Actuator Rep	Component Replacement	Y
	1,436,153	RI U1 AUXILARY COOLERS	Component Replacement	Y
	1,368,991	RI Coal Dusting and Spillage Improv	Component Upgrades	Y
	1,302,684	Rush Island Cyber Security	Security	Y
	1,234,997	RI U1 Air Preheater Basket Replacem	Component Replacement	Y
	1,030,306	RI Coal Receiving Electrical Racewa	Component Replacement	Y
	980,295	RI U1 BURNER REPLACEMENT (24)	Component Replacement	Y
	895,552	RI U1 Replace Blr Steam Cooled Spac	Component Replacement	Y
	855,154	Rush Island Wi Fi Expansion	Communication Upgrade	Y
	656,478	RI U1 Transformer Explosion Protect	GSU Transformer Upgrade (safety)	Y
	629,998	RI U2 Transformer Explosion Protect	GSU Transformer Upgrade (safety)	Y
	531,694	RI U1 TRB FOAM CLEANING SYS	Component Upgrades	Y

Facility	Expenditure	Project	Reason	Required for 2025 Shutdown
Meramec	1,528,646	MER NERC CIP 5 Physical Security	Security	Y
	1,240,139	MER Flyash Pond 489/495 Closure	ELG/CCR	Y
Sioux	4,281,348	SX Coal Dust & Slurry Proce	ELG/CCR	Y
	1,861,424	SX U2 HP Rotor Rewind	Component Refurbishment	Y
	1,504,911	SX U1 Unit Transformer Replace	Component Replacement	Y
	993,353	SX Addtl ID Fan Hub 2B REPL	Component Replacement	Y
	911,149	SX Coal Handling PLC Upgrades	Component Upgrades	Y
	881,912	SX Wi Fi Expansion	Communication Upgrade	
	723,486	SIOUX NPDES PERMIT	Regulatory	Y
Labadie	21,361,837	LBD U1 Dry Bottom Ash Conv	ELG/CCR	Y
	7,638,392	LBD U1 LOWER SLOPE REPL	Component Replacement	Y
	2,884,001	LBD U1 LP1 Turbine LSB Row Repl	Component Replacement	Y
	2,846,918	LBD U1 LP2 Turbine LSB Row Repl	Component Replacement	Y
	2,506,313	LBD - U1 APH Hot Basket Repl	Component Replacement	Y
	2,189,091	LBD - 1A&D BCP Casing&Suct Vlv Repl	Component Replacement	Y
	2,078,130	LBD U1 Coal Trans Pipe Repl	Component Replacement	Y
	1,802,387	LBD - U3 BCP Casing/Suction Valve R	Component Replacement	Y
	1,563,443	LBD3 Valve Component Replacement	Component Replacement	Y
	1,330,389	LBD U1 UPS & BATTERY REPL	Component Replacement	Y
	1,315,293	LBD U1 138KV ST CIR SW UPGR	Component Upgrades	Y
	1,284,737	LBD U2 STRT TRAN SWITC REPL	Component Replacement	Y
	1,233,333	LBD - 1B&C BCP Casing&Suct Vlv Repl	Component Replacement	Y
	1,042,080	LBD - 1A & 1B APH Drive System REPL	Component Replacement	Y
	962,942	LBD - Repl Intake Structure Warming	Component Replacement	Y
	901,017	LBD U1 C-ESP WIRE REPL	Component Replacement	Y
	880,091	LBD U1 A&B FD Inl Damp REPL	Component Replacement	Y
	808,509	LBD U1 XFMR Explosion Protection	GSU Transformer Upgrade (Safety)	Y
	696,431	LBD U4 UPS & BATTERY REPL	Component Replacement	Y
	683,651	LBD U1 Turb Foam Clean Sys Install	Component Upgrades	Y
	683,414	LBD - 1A HPBFP Casing Repl	Component Replacement	Y
	643,465	LBD - U1 Burner Assembly Repl	Component Replacement	Y
	514,807	2019 - LBD - REPL 3,680 track ft	Component Replacement	Y
Rush Island	6,511,877	RI-LB Critical Spare GSU	Critical Spare	Y
	844,627	RI CRC Water Pump Capital Spare Pa	Critical Spare	Y