Rebuttal Testimony
J.A. Stall

Before the Minnesota Public Utilities Commission
State of Minnesota

In the Matter of a Commission Investigation into Xcel Energy's Monticello Life Cycle Management/Extended Power Uprate Project and Request for Recovery of Cost Overruns

Docket No. E002/CI-13-754
Exhibit ___ (JAS-2)

Project Scope and Design

August 26, 2014

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I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is J.A. (Art) Stall. My address is 1803 SW Foxpoint Trail, Palm City, Florida 34990.

Q. HAVE YOU TESTIFIED PREVIOUSLY IN THIS PROCEEDING?

A. Yes. I provided Direct Testimony, Exhibit __ (JAS-1).

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?

A. The purpose of my rebuttal testimony is to address the issues raised in the July 2, 2014 Direct Testimony Department of Commerce, Division of Energy Resources ("Department") related to the Life-Cycle Management ("LCM") and Extended Power Uprate ("EPU") program ("LCM/EPU Program" or "Program") at Monticello Nuclear Generating Plant ("Monticello" or "the Plant").

Q. DO YOU HAVE ANY OVERARCHING OBSERVATIONS ABOUT THE DEPARTMENT'S CONSULTANTS' DIRECT TESTIMONY?

A. Yes. I take issue with the unsupported inferences drawn by the Department's Consultants, Mr. Mark W. Crisp and Dr. William R. Jacobs. They implicitly argue that certain upgrades should not have been made absent a cost-effectiveness benefit from the uprate megawatts. I disagree, as many of the upgrades at Monticello were essential for the long-term safe and reliable operation of the Plant over the next 20 years, whether or not an uprate had been pursued.

I further disagree with any suggestion that the work was not necessary or was excessive. My review of the documents and interviews with key personnel leads me to conclude that Northern States Power Company, a Minnesota corporation ("Xcel Energy") designed, developed and constructed appropriate modifications for the long-term betterment of the Plant. Safety and reliability were greatly enhanced. The Plant was modernized, consistent with nuclear industry best practices.

II. RESPONSE TO CONSULTANTS

Q. WHAT CRITICISMS FROM THE CONSULTANTS' CONCERN YOU?

A. Dr. Jacobs states that he categorized the work largely as "EPU only work – Could have been avoided in the absence of an uprate."[1] He further states, with respect to the LCM work, that "at best, it is uncertain how many of these projects would have actually been accomplished if not for the EPU. Moreover, the timing of such life extension projects most likely would have been significantly later, if at all."[2] I disagree with these statements.

I cannot overstate the importance and necessity of updating nuclear plants with modern technology. Improvements in the design basis are a clear benefit to the Plant, its customers, and surrounding communities. Examples include:

- Replacing the old condensate demineralizer system with a new automated, digital system improves water chemistry and reduces the probability of plant transients and human error. The improved reliability and

[1] Jacobs Direct at 11:3-4.
[2] Jacobs Direct at 12:13-16.

performance of this new system could not have been achieved by a like-for-like replacement. In fact, I doubt a like-for-like replacement could have been procured, considering the antiquated control system.

- Replacing the Power Range Neutron Monitoring ("PRNM") System is another example of a system that was updated from 1960s vintage analog to modern digital technology, enhancing overall system performance. Any like-for-like replacement here would have had to be custom made at great expense and would have been inferior to the system installed at Monticello.

- Replacing the high-pressure turbine utilizing an Advance Vortex design improves quality and consistency with superior reduction on secondary losses and profile losses, and increased efficiency and reliability.

- Replacing the feedwater heaters due to erosion/corrosion was not optional. Testing had shown excessive tube plugging, creating a reliability and efficiency concern; the need to replace them was immediate. I was frankly surprised they lasted as long as they did. Additionally, a failure of one or more tubes during operation could have potentially led to extensive turbine damage due to a water ingestion event.

- The new steam dryer is expected to reduce future operation and maintenance costs by more efficiently removing moisture from the steam produced by the reactor, thereby minimizing corrosion.

Q. WHAT GENERAL OBSERVATIONS DO YOU HAVE CONCERNING THE DEPARTMENT'S CONSULTANTS' APPARENT PERSPECTIVE OF THE WORK THAT WAS NEEDED AT THE PLANT?

A. They appear to take a minimalist approach that favors avoiding doing work on the Plant. Dr. Jacobs implies that Xcel Energy should have continued to execute a piecemeal approach to aging management issues separate from the uprate to avoid major strategic improvements or upgrades to the extent possible. Furthermore, he asserts that virtually all of the work done should be attributed to the uprate, implying that very little of the work done under the Program was needed to support long-term operations of the Plant. The facts do not support those implications.

Q. WHY IS IT NOT A GOOD APPROACH TO MAKE MINIMAL REPAIRS RATHER THAN HAVING UNDERTAKEN A MAJOR INITIATIVE LIKE THE LCM/EPU PROGRAM?

A. A minimalist approach is not consistent with good nuclear utility practices, for a plant intending extend to operations for 20 years or more. Due to the unique risks inherent in operating nuclear plants, utilities must protect, preserve, and enhance nuclear safety when undertaking uprates or LCM projects.

First, when extending operations at a nuclear plant for 20 years or more, it is essential for operators to implement proactive LCM plans that replace equipment prior to significant impacts on reliability, and potential challenges to nuclear safety. It is required by the Nuclear Regulatory Commission ("NRC") Maintenance Rule.

Second, by obtaining its license renewal for extended operations through 2030, Monticello set in motion a series of requirements dictating the need to undertake much of the work done here. A significant cost driver was related to the need to successfully manage a number of margin erosion issues resulting from old systems, equipment, and components as well as issues uncovered through the design process and field implementation.

Third, I was struck by the Department's Consultants' lack of analysis on the importance of ensuring the safe and reliable operation of the power block components of a nuclear power plant, particularly considering the commitments inherent in the renewed operating license. It has been well-documented that failures of power block components are significant contributors to events that can challenge nuclear safety. The Department's Consultants' testimony is inconsistent with guidance and recommendations placed on utilities by the NRC that have been based on industry operating experience and lessons learned.

Q. IS THE CONSULTANTS' APPROACH CONSISTENT WITH GUIDANCE FROM THE INSTITUTE OF NUCLEAR POWER OPERATIONS ("INPO")?

A. No. In my Direct Testimony, I discuss INPO's importance and the necessity that member utilities follow its recommendations. INPO provided guidance on the *Excellence in the Management of Design and Operating Margins*, issued in February 2009 (INPO Document 09-003). This document provides guidance for identifying, assessing, and acting upon margin erosion issues for various situations, including aging equipment and power uprates. It calls for utilities to be proactive in ensuring these issues do not impact nuclear safety. It also

recognizes that many issues may not be revealed until well into complex design work or field implementation of modifications.

Having been responsible for uprates at Florida Power & Light ("FPL") Group, Inc.'s (nka NextEra) four nuclear units, I can assure the Minnesota Public Utilities Commission ("Commission") that the work done here was important and difficult. In addition to the technical difficulties inherent in such work, additional influences come to bear, such as evolving NRC staff expectations and requirements, INPO standards, and operating experience that drive decision-making. The INPO guidance on preserving margins is a perfect example.

A. 13.8 kV Electrical Distribution System

Q. DID DR. JACOBS CRITICIZE XCEL ENERGY'S EFFORT ON THE 13.8 KV SYSTEM?

A. Yes and no. He was certainly critical about the cost of the 13.8 kV system and states that the cost "is not credible."[3] Yet he provides no analysis of the system itself, no critique of the degraded margins the Plant was facing, no discussion of the difficult circumstances Xcel Energy faced in designing and installing the new system, and no discussion of what alternatives Xcel Energy would have had whether or not the uprate had been pursued.

[3] Jacobs Direct at 16:9.

Q. WHAT DOES DR. JACOBS STATE ABOUT THE ELECTRICAL DISTRIBUTION SYSTEM UPGRADE?

A. Specifically, he stated that, but for the EPU, the upgrade would not have been needed because the modification was necessary "only to provide power to the larger reactor feedwater and condensate pumps."[4]

Q. WHY IS DR. JACOBS' CONCLUSION PROBLEMATIC?

A. Dr. Jacobs conclusion fails to recognize the inadequate margin of the legacy 4 kV system and the obvious need to add bus capacity to support the period of extended operations, regardless whether Xcel Energy undertook the uprate. As I stated both in my Direct Testimony and in response to the Department's Information Request No. 21 (attached as Exhibit ___ (TJO-2), Schedule 35 to Company witness Mr. Timothy J. O'Connor's Rebuttal Testimony), it was obvious that an upgrade to the electrical distribution system was necessary because of the inadequate margins of its existing system. Xcel Energy's consideration of the need for increased margin is beyond reasonable dispute as outlined in Xcel Energy's response to the Department's Information Request No. 83 (attached as Exhibit ___ (TJO-2), Schedule 35 to Mr. O'Connor's Rebuttal Testimony).

Q. PLEASE DISCUSS THE INADEQUATE MARGIN OF THE 4 KV ELECTRIC DISTRIBUTION SYSTEM.

A. I was a little surprised that Xcel Energy had not already begun implementing some upgrade to its distribution system. When I visited the Plant and interviewed the key design and engineering professionals, I learned that by the time the LCM/EPU Project was proposed, the existing 4 kV system was

[4] Jacobs Direct at 11:17-18.

operating at close to capacity and the addition of any significant load would have required for that capacity to be expanded. It was clear to me that an increased margin in the electric system was necessary. Had I been involved with Xcel Energy's nuclear program from 2005 to 2007, I would have pushed to install new electrical distribution capacity irrespective of whether they pursued the uprate.

Q. DR. JACOBS STATES THAT IT IS UNKNOWN WHETHER OR WHEN MAJOR SYSTEMS WOULD HAVE NEEDED TO BE REPLACED ABSENT THE UPRATE.[5] DO YOU AGREE?

A. No, and certainly not as it pertains to the distribution system. The 4 kV electrical buses were very close to maximum electrical fault ratings and the existing 1R transformer and 4 kV buses were near the limit of their capabilities in starting the existing motors. In addition, the minimum distribution bus voltages during motor starting is required to be greater than 80 percent nominal during starts. The existing 6000 hp motors caused voltage dipping to approximately 77 percent voltage during start, leading to alarms in the control system. Adding additional load to the existing system would have exacerbated this problem.

Q. ARE THERE ANY OTHER BENEFITS OF UPGRADING THE ELECTRICAL DISTRIBUTION SYSTEM?

A. Yes. By upgrading the distribution system, Xcel Energy is able to operate the Plant with substantially higher operating and safety margins and can provide sufficient capacity to sustain existing and new electrical loads. By splitting the

[5] Jacobs Direct at 12:13-16.

safety-related buses from the non-safety-related buses, the new system will also ensure that Xcel Energy is able to meet future growth of electrical needs.

I recognize that if Xcel Energy had not undertaken the uprate, the additions to the electrical distribution system might have been somewhat different than what was actually installed. But there were multiple needs for additional distribution capacity, irrespective of the uprate. Accordingly, upgrading the electrical distribution system is an important aspect Dr. Jacobs should have recognized as necessary to safely and reliably operate the Plant and to meet evolving regulatory requirements.

B. Feedwater Heaters

Q. WHAT DO THE DEPARTMENT'S CONSULTANTS STATE ABOUT THE REPLACEMENT OF THE FEEDWATER HEATERS AT MONTICELLO?

A. Mr. Crisp states that the replacement of the feedwater heaters is a design change in which Xcel Energy did not conduct proper initial scoping. Mr. Crisp testifies that Xcel Energy's estimated cost of installing the feedwater heaters did not take into account the difficulty in removing the existing feedwater heaters, modifying the size of the concrete "room" and installing the new, larger heaters.[6] Mr. Crisp suggests that a "well thought-out scoping process" would have minimized the issues Xcel Energy encountered.[7]

Q. PLEASE RESPOND TO MR. CRISP'S DISCUSSION OF THE FEEDWATER HEATERS.

A. My issue with Mr. Crisp's discussion of the feedwater heaters is what he fails to say about the need to replace aging equipment to safely and reliably operate a nuclear plant for 20 additional years. I would have expected Mr. Crisp to

[6] Crisp Direct at 19:4-8.
[7] Crisp Direct at 10:32-33.

have acknowledged the importance and necessity of replacing Plant equipment nearing the end of its useful life.

Replacing the legacy feedwater heaters is a classic example of Xcel Energy following the INPO guidance in Document 09-003. Four of the six feedwater heaters they replaced as part of the Program were 40 years old and part of the original plant equipment, and the other two were 30 years old. Xcel Energy determined that the heat exchangers were requiring excessive tube plugging and had degraded to the point where the tube plugging degraded performance.

Q. HOW DO THE DEPARTMENT'S CONSULTANTS ADDRESS THIS ISSUE?

A. Dr. Jacobs assumes that, because Xcel Energy identified the need for larger heaters in the NRC License Amendment Request, that this major modification should be considered to be EPU-related.

Q. DO YOU AGREE?

A. No. In my opinion, it is more important for the Commission to consider the overall practical impact of the equipment and assess its purpose, based on the totality of the circumstances. In this instance, the replacement of the six feedwater heaters was necessary regardless whether the EPU was pursued. The Commission should want Xcel Energy to take these remedial actions, rather than argue that perhaps they could have been avoided.

C. Reactor Feed Pumps and Motors

Q. WHAT DO THE DEPARTMENT'S CONSULTANTS STATE ABOUT THE REACTOR FEED PUMPS AND MOTORS MODIFICATION?

A. Mr. Crisp states that the replacement of the reactor feed pumps and motors is a design change in which Xcel Energy did not conduct proper initial scoping, and implies that a "well thought-out scoping process" would have minimized the issues Xcel Energy encountered with this replacement.[8] Dr. Jacobs makes no comment regarding the reactor feed pumps and motors except in the context of his criticism of the electric distribution system upgrade.

Q. WHAT IS YOUR RESPONSE?

A. The reactor feed pumps and motors were original Plant equipment that needed to be replaced. As Xcel Energy described in response to the Department's Information Request No. 124 (attached at Exhibit ___ (TJO-2), Schedule 32 to Mr. O'Connor's Rebuttal Testimony), replacement of this equipment was driven by degradation issues and obsolescence.

Q. WAS THE REACTOR FEED PUMPS AND MOTORS MODIFICATION NECESSARY FOR THE LONG-TERM VIABILITY OF THE PLANT?

A. Yes. The reactor feed pumps and motors had experienced chronic performance problems that were effectively addressed by replacing them with modern equipment. Although pumps can be repaired, the casing can be welded and machined a limited number of times before replacement is necessary. Xcel Energy determined that the most cost-effective option was to replace the pump assembly which was at the end of its service life. The pump motors also required replacement due to performance degradation.

[8] Crisp Direct at 10:32-33.

The motors were not designed or expected to remain in-service until 2030, at which point they would be approximately 60 years old on a nominal 40-year life.

Q. WAS THE REACTOR FEED PUMPS AND MOTORS MODIFICATION A SCOPE CHANGE?

A. Mr. Crisp criticizes Xcel Energy about scope changes that "would have been minimized with proper initial scoping of the project."[9] Yet he gives no specific criticism of the initial design or of the outcome.

I do not understand his comment about this being a "scope change." In 2006, Xcel Energy considered proceeding with installing a third supplemental feed pump. The two-pump configuration was finalized in 2007 as part of a coordinated design effort by Xcel Energy's design professionals and design consultants. This decision was made as part of the normal scoping process to take the preliminary conceptual project and formalize the scope and designs into a series of Plant modifications that could be implemented to address the pinch points that had been identified. This design decision was not done on an ad hoc or uncoordinated basis. Finally, Mr. Crisp fails to identify any scope change as unreasonable, unnecessary, or imprudent. Mr. Crisp's generalized observations about modifications that cost more than had been planned does not translate into imprudent actions or decisions by Xcel Energy.

[9] Crisp Direct at 10:31-32.

D. NRC Issues

Q. DO YOU AGREE WITH THE DEPARTMENT'S CONSULTANTS' SUGGESTION THAT THE NRC LICENSING PROCESS DID NOT CONTRIBUTE TO THE COSTS?

A. No. I do not take issue with the NRC's requirements or the fact that it is important that the NRC take the time it needs to ensure nuclear safety. Nevertheless, it seems obvious to me that a licensing process that is anticipated to take a year or so taking five years would contribute to the cost of the effort.

Q. PLEASE EXPLAIN.

A. Nuclear utilities must adapt to continually changing regulatory circumstances at the NRC as well as escalating operating requirements that are imposed on nuclear plants. Evolving NRC regulations necessarily impact the cost and timing of compliance. The utility is entirely dependent upon the NRC and its staff's process and determinations. As that process becomes more complex and detailed over time, it is natural that costs would increase. Compliance with those requirements cannot reasonably be considered "imprudent."

Q. ARE THERE ANY OTHER FACTORS THAT CONTRIBUTED TO THE INCREASINGLY CHALLENGING ENVIRONMENT AT THE NRC?

A. Yes. The NRC has changed since the early-mid 2000s. Some of this was due to security and operating measures identified in response to the events of September 11, 2001. Some was due to a different NRC makeup. And some was due to experiences and events that have influenced NRC processes, including problems with the uprates at other plants, extended outages at some units, and ultimately issues arising out of the incident at Fukushima Dai-ichi Nuclear Power Plant. At the time Xcel Energy began implementing its

combined LCM/EPU initiative, scrutiny over every aspect of safe design had been heightened and continued through the Program. It is impossible to quantify what this means in terms of design and implementation, other than things will necessarily go more slowly as substantially more caution, rigor, and testing is now required compared to the prior period.

E. Like-for-Like Replacements

Q. WHAT DO THE CONSULTANTS STATE ABOUT LIKE-FOR-LIKE EXCHANGES?

A. Dr. Jacobs testifies that major construction projects are easier "only when the update is a 'like-for-like' project."[10] His discussion of like-for-like projects implies that Xcel Energy should have undertaken like-for-like instead of the Program and that doing so would have significantly reduced cost.

Q. DO YOU AGREE WITH THE INFERENCE THAT IT WOULD HAVE BEEN EASIER AND CHEAPER TO SIMPLY BUILD LIKE-FOR-LIKE REPLACEMENTS AND AVOID ANY MAJOR UPGRADES?

A. I would agree that, generally speaking, like-for-like replacement is simpler and more economical when possible. However, in this situation, that was not possible. Because these upgrades combined important LCM considerations with the uprate, the equipment needed to be sized accordingly. Additionally, except in isolated cases, even in simple LCM projects, like-for-like replacements are rarely used.

There are several reasons for this, the predominant one being that original equipment is simply not available. In the case of mechanical equipment (pumps, valves, feedwater heaters), the original equipment manufacturer is

[10] Jacobs Direct at 13:18-19.

either no longer in business or no longer supporting the particular system. Further, standard equipment designs have changed since the 1960s when the original Plant equipment was manufactured. To replace equipment with like-for-like would require extensive reverse engineering, which is simply not cost-effective, efficient, or smart. Additionally, the Consultants do not take into consideration the fact that industry codes and standards (American Society of Mechanical Engineers and Institute of Electrical and Electronics Engineers) have also changed, adding more complexity to reverse engineering. Finally, my experience in fossil generating plants is that not even they utilize that strategy unless there are no alternatives. The entire premise that like-for-like replacement was a viable alternative is simply a red herring.

Q. DOES DR. JACOBS' DISCUSSION OF THE LIKE-FOR-LIKE ISSUE REFLECT YOUR EXPERIENCE IN THE NUCLEAR BUSINESS?

A. No. My experience suggests that major construction at a nuclear plant is difficult, whether or not the work is like-for-like or new design. Technology has changed in the 40 years since the original plant equipment was implemented at Monticello, making like-for-like replacements problematic whether or not the uprate was pursued.

F. Prior Experience

Q. HAVE YOU FACED ISSUES LIKE THIS BEFORE?

A. Interestingly, the Consultants' criticisms in this case are similar to ones made by Dr. Jacobs before the Florida Public Service Commission's ("FPSC") review of FPL's EPU project at Turkey Point. Dr. Jacobs testified that the FPSC should disallow costs above its $1.6 billion construction cost estimate,

pointing to a "historical pattern" of annual cost increases.[11] The FPSC rejected this argument, concluding that year-to-year increases in cost estimates themselves do not demonstrate imprudence.[12] The FPSC's decision is consistent with the prudent investment standard, which focuses on the decision-making process over the results.

Likewise, in 2013, Dr. Jacobs argued to the FPSC that it should disallow $200 million from FPL's recovery for failing to accomplish advanced engineering at the outset of its projects.[13] Dr. Jacobs testified that:

> To avoid a case of runaway spending resulting in a project that is harmful to ratepayers, it is clear that a utility contemplating a project having the magnitude and complexity of the Turkey Point EPU project must either perform a level of engineering sufficient to provide a grasp on overall costs, or must incorporate a level of contingency adequate to reflect the uncertainty of not having performed the engineering at the outset.[14]

The FPSC rejected this argument, concluding that Dr. Jacobs provided no supporting evidence that costs would have been less than what FPL reported.[15] Similarly, Mr. Crisp argues that "proper initial scoping of the project" would have minimized the final costs of the project.[16] But, like Dr. Jacobs, he fails to provide any supporting evidence that Xcel Energy's costs would have been lower using the project management he advises.

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[11] William R. Jacobs, Jr, PhD Direct Testimony at 9:14, FPSC Docket No. 130009-EI (July 18, 2013).
[12] FINAL ORDER APPROVING NUCLEAR COST RECOVERY AMOUNT FOR FLORIDA POWER & LIGHT COMPANY AND DUKE ENERGY FLORIDA, INC. at 73, FPSC Docket No. 130009-EI (Dec. 11, 2012).
[13] William R. Jacobs, Jr, PhD Direct Testimony at 20:17-20 and 21:13, FPSC Docket No. 130009-EI (July 18, 2013).
[14] William R. Jacobs, Jr, PhD Direct Testimony at 22:22-23:4, FPSC Docket No. 130009-EI (July 18, 2013).
[15] FINAL ORDER APPROVING NUCLEAR COST RECOVERY AMOUNT FOR FLORIDA POWER & LIGHT COMPANY AND DUKE ENERGY FLORIDA, INC. at 35, FPSC Docket No. 130009-EI (Oct. 18, 2013).
[16] Crisp Direct at 10:32.

III. CONCLUSION

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A. Yes.