American Nuclear Society

Utility Working Conference and Vendor Technology Expo

2017
KNOWLEDGE BASE REPORT

The Nuclear Option - Clean, Safe, Reliable & Affordable

August 6-9, 2017
Omni Amelia Island Plantation
Amelia Island, FL

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CONTENTS

PLENARY SESSIONS

The Case for Nuclear

Choice of asset usage to generate electricity is influenced by the abundance of natural gas, environmental impacts, government subsidies, and deregulation. High-level professionals share insights on the complex energy industry and the role nuclear power should play.

ANS UWC Opening Comments

Bradley Adams *(Vice President of Engineering, Southern Company)*

Session Notes

- 900 registered to attend, number of people attending increasing every year, ~200 utilities.
- Benefits of nuclear energy (environmental impacts), we all need to be advocate for Nuclear Energy.
- Innovation: Advance reactors, ATF (accident tolerant fuel)
- We need continued support & innovation (vendor, utilities, NRC, national labs, other stake holders)

Opening Remarks (no slides)

Bob Coward *(Principal, MPR)*

Session Notes (KM1)

- We keep moving forward with challenges & keep innovating. Innovation is key for success of the nuclear industry.
- Not everybody understands and embraces the challenge of nuclear, but asked everybody to embrace nuclear, and posited that the future has lot for nuclear energy.
- Carbon-free energy can't be achieved without Nuclear.
- We need all sources of energy, but can't ignore Nuclear.
- Solar and Storage (technical challenges with storage), it's good to explore many paths for energy security.
- Right now, we are treated as #1 commodity.
- Support from policy makers has been strongest in a long time, still not at the required level, especially for advance reactors.
- Two things everybody asked to do: create a sense of optimism in industry, we have a bright future. Be more strategic.
- Help with mentorship, help with optimism and strategy for bright future.
- Looking for feedback for attracting more people to ANS.
- We have incredibly bright future if we do right things. It's a great time to be in nuclear, but with lots of challenges.

Session Notes (KM2)

- It is a challenging but exciting time in the industry. The industry has a reputation of being stogy, but if you walk through the vendor expo, the excitement and technology is anything but stogy.
- Industry Needs:
    - Active involvement from utilities
    - NRC and regulatory involvement
    - Vendor involvement
- REMINDER: This is our meeting and our opportunity to interface on our platform.
- It was reiterated the importance of continued innovation and moving the ball forward, so a focus has been given to the TIP awards and thus they are highlighted at this conference.
- The future of nuclear power is virtually unlimited despite what the industry is going through right now. The world has made the decision that carbon free energy systems are the way to go.
- Right now the industry's support with policy makers at the national level is strongest it has been – most of it revolves around advanced reactors.
- Two requests to help:
    - Everyone at UWC is an industry leader. Attendees have a desire to make their organizations stronger. Bring optimism back. The industry needs more optimism – time are tough, but look to the future. Spread that message, especially to the younger people.
    - Be strategic. The industry is in this for the long term, and it's necessary to make decisions with the big picture in mind. Next year let's have more young people here. Be the one that looks at the CNO and says "No let's send the young guy or gal".
- In conclusion, ANS leadership is always looking for thoughts on how to make ANS an even better organization in the future.

The Case for Nuclear in the Nation and the States

Steve Kuczynski *(Chairman, President, CEO, Southern Nuclear)*

Session Notes (KM1)

- In nuclear, anything that happens in state or nation has tendency to go international.
- We need to be more strategic going forward.
- Southern leading Vogtle 3 project in leadership role with smarter work management.
- Energy security is vital for the national security and nuclear is key.
- Younger generation is very curious to how the nuclear technologies will go forward and address concerns with air quality and sustainable development.
- Strategy going forward should be: preserve, sustain, innovate and thrive.
- When current fleet expires, replace with advance nuclear technologies.
- Nuclear can be a major player for the next generation with advance technologies (Advance reactors, SMRs, HTR, ATF) with help of national labs and academia and working closely with regulators (NRC).
- Plenty folks in NRC wants next generation of nuclear technology to prosper and go to market.
- Vogtle 3 & 4: 46% is owned by Southern. Work is going full speed at site, ready and executing. We should be ready to take advantage of all the work done previously with similar projects.

Session Notes (KM2)

Where are we?

1. It's not just a national or state issue. It has tenants that go international.
    a. Difficult to compete on an international level if the US doesn't have nuclear at home.
    b. If humanity is going to power this globe with cheap, safe, clean electricity, then nuclear is necessary.
    c. The US developed this technology and let's leverage that in a more global standpoint.
2. "However beautiful the strategy, you should occasionally look at the results" Winston Churchill. National nuclear energy strategy – where all of our activities should be aiming.
    a. Four major tenants to get there.
    b. At some point the current fleet is going to retire, and it is going to be replaced with some source and we want it to be nuclear. The world has signed up for de-carbonization, so we must play a role there.
    c. We want more options and new technologies can support the drivers.
3. Where are we with Vogtle? Progress and learnings.
    a. Final stages to do the Estimate to Complete (ETC).
    b. Process to file a recommendation with the Georgia Public Service Commission (PSC).
    c. "It is not the critic who counts; not the man who points out how the strong man stumbles, or where the doer of deeds could have done them better. The credit belongs to the man who is actually in the arena, …." - Theodore Roosevelt. It is our job to make those that work on the project successful – the pipefitters, the ironworkers, the welders.

The Case for Nuclear

Shane Johnson *(Deputy Assistant Secretary, Office of Nuclear Energy, U.S. Department of Energy)*

Session Notes (KM1)

- The government of United States is asking and looking at Nuclear Industry for answers, where we should go moving forward?
- Nuclear industry is the answer to itself, learning, sharing lessons learned and moving forward
- President and his administration has kept the nuclear policy on one of his major agenda and want to help the industry succeed.
- DoE Secretary is very vocal and supportive of SMRs and advance technologies. He is very committed to nuclear industry.
- Today is time to make a difference. We all should contribute. Take advantage of DoE resources.
- DoE is committed to showing promise to future-generation of workforce with DoE grants/fellowships to schools helping students in R&D and helping students get advance degrees.
- DoE has taken initiatives to help industry with DoE Lab system.

Session Notes (KM2)

- Working with industry to solve problems and push the DOE nuclear priorities.
- More advantageous to put all advanced reactor technologies into a broad family to avoid warring amongst each other.
- New industry focused funding opportunity announcement to support innovation across the nuclear technologies – expect to roll out in October.

- The DOE welcomes comments on how we can refine this to really help industry – the DOE's bottom line is to get out of the way and let industry take the lead.

Nuclear Policy Conference LG Talking Points

Boyd Rutherford *(Lt Governor, Maryland)*

Session Notes (KM1):

- Long history of Nuclear Power in Maryland and government is very supportive. Nuclear is critical infrastructure for clean energy and economic impacts.

Session Notes (KM2):

- Maryland has a long history with nuclear power – highly skilled, high paying jobs.
- With the merger of Constellation and Exelon, it was identified that there was a benefit to engage with the State early in the process – understand pertinent legal issues and priorities and potential political implications. Together help craft the settlement of the package.
- It is also important to remember that states and citizens care about communities and utilities should seek ways to engage the local community.

Remarks of Commissioner John Rosales Illinois Commerce Commission

John Rosales *(Illinois Commerce Commission)*

Session Notes

- Focuses and solar and wind. Solar for all program. Emission free credits (Clinton & Quad cities) on par with pother form of emission free energy.

Session Summary/Q&A

Key Learnings, Recommendations, and/or Best Practices

- Advance technologies (ATF, advance reactors) are vital for the success of nuclear industry. The federal government and DoE is very supportive of advanced technologies initiatives. Every state should provide emission free energy incentives to nuclear energy as of wind and solar. We all in nuclear industry need to be optimistic and strategic going forward.
- Be optimistic.
- Be strategic.
- Nuclear energy is an international issue and nuclear is necessary.
- National nuclear energy strategy – where all of the industry's activities should be aiming – maintain existing fleet and innovation is necessary.
- The government of the US in the realm of Nuclear is looking and expecting for industry to lead in the direction that government needs to go. Realization that government doesn't have all the answers and looking for a way out by industry itself.

Q&A

Q1. Why VC Summer was not able to do anything?
A1. Not faced with situation like VC summer (SCANA) before. It's real impact on real people with close to 5000.Hope everything is done to preserve the work done and may be in future this can be completed.

Q2.What can we do as an individual to preserve and build new plants ?
A2. Excellence, project development, management and execution is less utilized. We should look at all these core areas , preserve and transfer lessons learned. Leadership and management is key to success with large projects. We also need to look at supply chain, quality and advance technologies going forward.

Q3. What will DoE/Administration do helping people affected by VC Summer?
A3. Not aware at the moment. Will be part of discussion.

Q4. What are the roles of state government and commissions to insure long term success of nuclear industry ?
A4. Incentive for every type of carbon free energy. For Illinois, nuclear is going steady and is vital part of future energy policies. Other states should also provide incentives to nuclear for emission-free source of energy.
Discussion will have to take place at state and federal level going forward for expansion of nuclear industry.

Q1. Why would VC Summer be able to announce so abruptly the stop work?
A1. It has not been announced how Vogtle will proceed and the PSC will ultimately make the decision. It is Southern's job to accurately portray what the different options are and how they would play out. He is not in the same position as SCANA and there are real people with real impacts. However quite a lot of work and value remains at VC Summer and the hope is to preserve all of that.

Q2. After you all have succeeded in completed Vogtle, part of success would be bringing in new athletes and how do we preserve the knowledge?
A2. Project execution has been under-utilized – tremendous opportunity for excellence in project management and construction and performance improvement. Bring in tools and technology to improve how you execute construction. So how do you preserve that and translate those lessons learned so you organize a project up front for how you execute. There have been significant FOAK activities that anyone going forward would not have to deal with. Effective leadership, work management, training… can you translate that into a larger project. Ultimately innovation inside project development and management will be most important to develop and preserve.

Q3. Folks at VC Summer are highly respected within the industry because they took the first step. Are there any discussions on what will administration do and DOE do to help them?
A3. Unfortunately he is not aware of anything, but he plans to run the question to ground.

Implementing the Nuclear Promise, Challenges and Successes

Economic conditions of recent years forced nuclear plant closures. The initiative launched in 2016 to make nuclear power competitive in the marketplace generated the publishing of many new efficiency bulletins. Industry leaders impart their views on the challenges and successes in implementing the Nuclear Promise.

Implementing the Nuclear Promise, Challenges and Successes – Utility Perspective

Danny Bost *(CNO, Southern Nuclear Operating Company)*

- We've been here before. In the '90s we addressed it through outage efficiency and reduction. It's time for us once again to look at what we need to do, why we need to do it, and how we are going to do it.
- Customers are using less load – more efficient appliances, lighting, etc. This is all affecting our cost. Renewables and shale gas are affecting costs and revenues.
- Keeping the tables and charts up to date on recent closures, at risk and announced closures is a constant effort.
- About half of the planned closures had equipment issues that drove closures, but the other half were strong plants.
- Farley's motto is "2037 and Beyond". We want to keep our plants up and running and we want to build new ones.
- Performance improvement is the first point of contact, and the second stop is a CFA as a fleet lead.
- Once a month the executive team is briefed on how the program is working for them; how much they spent and how much they have saved.
- Challenge: It is important to communicate that DNP is there to help us and it is not after someone's position.
- Soft savings have to be converted to hard savings at some point to quantify.

Implementing the Nuclear Promise, Challenges and Successes – INPO's Role and Responsibility

Kim Maza *(Sr VP Accreditation and DNP, INPO)*
Note: INPO presentations will be available through the INPO website

- In reviewing the mission, the word EXCELLENCE has never changed. When TMI occurred, that site was meeting all of the regulatory requirements. After the accident, the industry leadership realized that in order to keep this industry alive, excellence would be required.
- Excellence and efficiency go hand in hand and are not contradictory.
- Plants that are INPO 1, that have achieved excellence, are also the most cost efficient.
- INPO's role:
    - Front End: Review and Approve every efficiency bulletin
    - Back End: Looking for adverse consequences
- INPO is looking at their documents to ensure that there are no adverse consequences of implementation.
- Already have seen decreases in backlog, more efficient FIN teams, more efficient work management.

Implementing the Nuclear Promise, Challenges and Successes – NEI Perspective

Joe Pollock *(NEI)*

- Reviewed events that were almost the death of Nuclear Power. The five funerals:
    - TMI
    - Chernobyl
    - End of operating licenses
    - 9/11
    - Fukushima
    - Today is the economic challenge
- We have learned and are learning how to get congressional support. This means everyone in the industry providing a unified message to the White House and to show importance with jobs.
- There have been lots of good signs with this administration and certainly more support from Rick Perry than any of his recent predecessors, including that nuclear energy was the first topic on the energy conference.
- Costs peaked at $40/MW in 2012; as a result of DNP and the efficiency bulletins, we are down to $34/MW and we are working to $28/MW goal.
- Goal is to drive behavior and thought process for lower cost and being more efficient.
- There have been 59 Efficiency Bulletins with $1.2b enabled savings. This includes reducing the size of the NRC.
- Within the National Nuclear Energy Strategy, there is a real focus at NEI on the SUSTAIN component.
- The industry has always been very quiet, very internal. We have changed that to work with groups we have not worked with before and get our industries message out there.

Analytics-based Enterprise Performance Management

Gary Cokins *(Analytics-Based Performance Management, LLC)*

- "Champion" is in quotes because executives are often preoccupied so it is managers down the chain that often do the pilot projects and actually get these things going.
- EPM is not a new thing that managers now have to learn. It is the implementation of methods and processes you are already familiar with. You get more synergy when you implement them together.
- It is important to know, "How am I doing on what is important? What is important?" We must be measuring the right things.
- Strategy maps are needed and the intelligence is in this.
- Source of ROI is transitioning from tangible assets to intangible assets.
- Mostly what we have to work with is Raw Data and standard reports and we are restricted to answering "what happened?"
- Modeling is so important because now you not only know what happened, but also why did it happened.
- Predictive modeling projects what can happen?
- Analytics provides the real intelligence.
- There is a slow adoption because of technical barriers, perception barriers, and organizational behaviors.

Session Summary/Q&A

Key Learnings, Recommendations, and/or Best Practices

- The industry and utilities have taken care of the low hanging fruit, but the harder ones, the higher benefit ones are going to take more effort and focus – may need NRC approval or INPO documents changed.
- INPO understands that they have been the source of some of the added meetings, bureaucracy, checklists, processes, etc. They are working to identify and alleviate this.
- The industry has always been very quiet, very internal. It is now more important than ever to get the industries message out.
- Technology and software is not the impediment; its organizational behaviors.

Q&A

Q1. We rely on vendors for technical expertise and not day to day work. Are we having a hollowing out of the suppliers and will they have the technical resources?

A1. Suppliers Advisory Committee is familiar with it and involved in DNP committees. There will be impacts all over, so if we don't reinvent ourselves, we won't be here in the future.

Q2. Elaborate or explain the SDP.

A2. If we have 100 sites, we used to have 100 different design procedures. Now we have one single written process.

Q3. Is INPO considering a graded approach?

A3. Yes, but mostly we are looking at team size and how to reduce the team size for every site. We are looking at performance based team sizes. This is contingent on performance modeling program and relies on good data from the site. It is also dependent on self-awareness and being critical. Next year we can likely expect 3 to 4 sites with a reduced team size.

Q4. Effort to be more proactive than reactive?
A4. There are two areas where the industry is specifically trying to be more proactive – predicative maintenance and digital I&C.

Q5. How do we affect culture change?
A5. D x V x F > R; Discomfort x Vision x First Practical Steps > Resistance; Discomfort is really asking tough questions among employees (do we really understand the strategy, do we know the costs, get people uncomfortable); Vision and First Practical Steps are ensuring that once people experience the discomfort, it is followed up with what can be done to fix it. All of this must be greater than the natural resistance to change.

Q6. What is the most important lesson learned from DNP?
A6.

- Time it takes to move it from executive level to the working group level and getting the feedback.
- The devil is really in the details.
- Underestimated how many people and how much time it was really going to take to implement.

Back to the Future—Building the Next Generation of Technology and Nuclear Professionals

The current fleet of nuclear plants was built in the 70s and 80s, and the professionals operating and maintaining these plants are approaching or within retirement age. It is imperative that the next workforce generation absorb current knowledge from their predecessors and take the lead in new plant design. This session addresses knowledge transfer challenges, along with opportunities to ensure our industry continues to thrive.

Eric. G Meyer (Generation Atomic)

- Absolutely thrilling operatic rendition of the United States National Anthem

Advanced Digital I&C at Vogtle 3&4

Brad Adams *(Southern Nuclaer)*

- Today's session is the about the future of nuclear
- Hash and Don were trying to decide who was best dressed today, it's a little difficult to stand on the same stage as the two best dressed men in nuclear power
- Going to talk about advanced digital at Vogtle 3/4
- We all have a vision for using advanced tech and digital analytics to improve our plants
- If you look at the history of these nuclear plants our greatest advantage over all other sources is we can generate safely, reliably, and at low operating cost
- Our job is to produce megawatts!
- The Vogtle simulator control room looks a little like the bridge of the Starship Enterprise
- What are the benefits of a digital control system compared to the current fleet of plants?
- Let's talk a little bit about the impacts form digital I&C
- I really believe we've just touched the surface of these improvements for the future
- When I say data analytics, I also mean better use of the data analytics themselves
- In summary, the digital I&C in the next gen plants has the capability to improve plant performance and drive down operating costs

Nuclear Workforce Development

Hash Hashemian *(AMS Corporation)*

- Hash has 3 PhDs, 3 books, and is an adjunct professor at the University of Tennessee
- In terms of the next generation of nuclear professionals, I don't think anybody is doing more to identify top talent and train them and teach them what it means to be a nuclear professional than Hash.
- In my 42 years as a nuclear professional, I have never seen a senior government official speak out in such support of nuclear power

- The total number of nuclear power plants in the world is actually increasing and will continue increasing
- Brad wanted me to tell you what I do to get the best people in the world working for me
- Well first, I think the US has best people in the world, Tennessee has the best people in the US, and AMS has the best people in Tennessee
- These guys who work for me are in the business of developing and applying new software and technology to improve the current fleet of nuclear power plants
- I want to show you a video on our website about career development and growth opportunities
- How we train our employees?
- The first thing we do is train them in QA and Appendix B
- We mentor our employees in technical and professional development as we go
- We just retired our first electrical engineer this past year, the best man and best engineer
- My last message is for Don Hoffman, you can see that all of the people that work for me are great looking, but I wanted to let you know that that isn't a requirement to work for me, so Don, you can feel free to apply

Our World in Nuclear: Past, Present, and Future

Donald Hoffman (*Excel Services)*

- Honestly after all the abuse I don't know where to go
- But fortunately, at my company I'm used to it
- I'm going to be talking to you about us as a family: who we are, where we've been, where we are now, and where we're going
- In a sense we're a family here because we're all here for the same thing: generating energy from nuclear power is paramount to the success of our nation
- If we're all going to be successful, we're going to have to be willing to share what we did well and what we didn't do well
- Let me say something about where we've been in terms of industry events
- Every time we've had a major issue in this industry, we've risen together and gotten past the events
- I work in 27 different countries and I don't mind telling you that folks will tell me why do you think you can come over and tell me what to do with our plants when you can't succeed with your own plants at home?
- If we're going to be successful moving forward, we're going to do it together
- If we're going to be better, we need to be better here first before we can be better internationally
- We have the technology, the capability, and the competency to succeed, but we have challenges outside of our control that we need to overcome
- Not all kilowatts are created equal, you know what makes nuclear power special
- The reality is the regulatory and licensing process is broken
- Make Nuclear Great Again!

Living a Rich Life

Stan K. Gibson *(Wells Fargo)*

- Brad is too humble to say this, but he was one hell of a quarterback in high school
- He threw a spiral so tight, an alligator could catch it
- Bad news, he had a 35 yards max, 36 yards? Forget about it
- Good news, he had a tall, uncoordinated, lanky receiver who could only run 20 years
- He never had to air it out in high school, he just had to throw it high
- Think about how hard we work to make money, only to spend that money to regain our health
- Your body is like a Lamborghini. Do you take it to some cheap gas station for service? No, you take it to the highest quality service location you possibly can
- Heart disease, stress, and inflammation are the three top leading causes of death in this nation
- The first century philosopher Seneca said we suffer more in our imagination than we do in reality
- Go with what the good lord gave you. You probably have 5 or 6 great qualities that you wake up with naturally every morning. Go with those qualities. Use them to your advantage
- Its easier to get a good reputation than it is to lose a bad one
- You don't have to do anything crazy in life, but make the most out of your experience

Q&A

Q1. Especially after listening to Donald's remarks about how we make nuclear great again especially in relation to climate change, what kind of value do you think nuclear has on an international scale?
A1. We can talk offline for a more in-depth conversation, but I can assure you that we are engaging the highest levels of the US government about what we can do, and what everyone can do. But also please remember that you all in this room can really do a lot to help.

BUSINESS AND ECONOMIC PERFORMANCE

Macro Energy Market Trends, Current/Future Impacts and DNP Feasibility

Session Organizer: Jordan Gillis *(ScottMadden)*

This session will focus on a "no-nonsense" state of the nuclear market looking at energy price trends, secondary market subsidy impacts (investment and production tax credits, zero emission credits, etc.), current fleet financial health and a cursory look at the results of the Delivering the Nuclear Promise (DNP) initiative. As the forefront of energy economics and policy continues to shift from the federal to state level, speakers will discuss how nuclear plant and fleet operators can stay competitive in this constantly changing environment.

Cross-Linked Session: N/A
DNP Session: Yes

Energy Market Trends

Ed Baker *(ScottMadden)*

Session Notes

- Liquefied Natural Gas (LNG) - Drilling of wet plays has increased overall value of natural gas by refining ethane as a by-product.
- Renewables - Economics of wind and solar are becoming more affordable along with subsidizations.
- Solar - Investment tax credit has been extended past 2021 with a permanent 10% continuously.
- Wind - Long term wind capacity additions remain uncertain past 2020.
- Markets – Long run marginal costs should have been used instead of short run marginal costs. This is evident by the decrease in the gas market and the nuclear industry's lack of market entry and exit.
- Short run marginal cost of solar = 0, short run marginal cost of wind = could be negative.

Retail Energy Markets 101: Electricity Markets and Buying

Tim Hanley *(Exelon)*

Session Notes

- The most important parts of the wholesale market structure are the establishment of energy, congestion, capacity, and ancillary service markets.
- Negative pricing is often seen in the real-time energy market, and positive pricing in day-ahead energy market.
- In order to discount price of energy in Quad Cities, the rights have to be purchased for the transmission of energy through capacities and ancillaries. This often leads to congestion between HUB and delivery point.

Session Summary/Q&A

Key Learnings, Recommendations, and/or Best Practices

- Three strategic focus areas for DNP are to maintain operational focus, increase value, and improve efficiency.

Q&A

Q1. Quad Cities was the first plant to get on people's radar as a negative pricing operation; can you explain the market strategy behind this?
A1. Knowing the right coalition and identifying is key from a plant standpoint. Labor is a main cost. So, cuts are required for savings.

Q2. Who gets paid the transmission rights in Quad Cities, can you give an example in scale?
A2. FTR's are sold in an auction; money goes to PGM for transmission costs. Congestion monitors these lines rather they trip or overload.

Q3. The price per KW has a 200% markup, besides the utility, who is making this profit?
A3. The energy trading companies. Markup is always higher in residential areas because the volume is not as great.

Q4. What framework would be best for the consumer and generator?
A4. Not allowing any of the out of market tax credits and payments be available. Subsidized markets need to recover their costs leading to rise in price innovation.

Q5. What can we as the industry do to help keep these plants alive?

A5. Safe operation, develop the relations with the right people/politicians, understand everything nuclear energy has to offer (zero emission energy).

Nuclear Financial Post-Mortem - Lessons Learned and Strategies Going Forward

Session Organizer: Tim Schlimpert *(MCR Performance Solutions)*

This session will focus on diagnosing the financial and business root causes of recent plant closures as well as current pertinent business-related plant issues outside the current DNP efficiency bulletin paradigm. Presentations will focus on the hard decisions which need to be made in order to hit station financial goals focusing on cost/risk tradeoffs, project portfolio optimization as well as shifting and percolating financial culture through an organization.

Cross-Linked Session: N/A
DNP Session: Yes

Nuclear Plants in Wholesale Markets

Mike Twomey *(Entergy)*

Session Notes

- Capacity charge is the purchase of the availability to use energy while energy charge is the actual use of this energy.
- Energy prices are determined by Locational Marginal Pricing which consists of three components: energy, losses, transmission congestion.
- State and policy makers change market structure to create competition; this creates peaks and valleys of energy pricing.
- The general public has a perception that the reduction in nuclear energy will lead to more energy from wind and solar. However, the replacement for Nuclear and Coal is natural gas as a primary fuel source.
- Failure in market design is that the public does not realize the benefits of nuclear like baseload energy/ price stabilization.
- New York Clean Energy Standard Order: Established a public necessity test.

STP Nuclear Operating Company

Dennis Koehl *(STPNOC)*

Session Notes

- NRG, CPS, and Austin energy are the three main owners of the STP Nuclear Operating Company with about 1200 employees (over 5000 people rely on the success of this project). The two main investments at any plant are always the equipment and the people that run the plant.
- Generating costs at US nuclear plants have increased 28% during the last decade.
- Major goal is to enhance the safety and reliability during the operations of STP.
- In order to Deliver the Nuclear Promise, we need to unravel and take it step by step while creating an efficient process (Example: you do not have a plumber take a test before he starts his work. We need an efficient ad standard training and testing).
- Utilizing zero based budgeting is one of the key business improvement initiatives. STP has saved over $300MM through business improvement initiatives over the past couple of years.
- Outages are not a race; they are an opportunity to improve the price of energy and require the balance of schedule and money spent.

Key Learnings, Recommendations, and/or Best Practices

- Focus on workforce development, knowledge transfer and retention.

Q&A

Q1. Give an example of workface rallying around cost saving benefits.
A1. 6800 safety glasses, hard hat lights, scrubs, and other craft equipment were being wasted or disappearing. A lot of money wasted in parts around the office, general streamlining of office supplies.

Proven Initiatives to Reach Station Financial Goals

Tim Schlimpert (MCR Performance Solutions)

Session Notes

- Well over half a billion dollars saved from Capital Project Evaluation.

- Multiple approaches are available to deliver a common goal. (Reduce and control costs in order to gain economic competitiveness with natural gas based generation and other distributed energy technologies like renewables).
- Re-evaluate baseline assumptions that got into work processes and budget development.

Q&A

Q1. How much involvement do you have in organizational change managements?
A1. Great messages from executives to employees of what consequences are and what the benefits are in effective change management.

Q2. For the 44% reduction in work force, what are obvious gaps in areas/ disciplines such as engineering?
A2. The attrition of the workforce is not uniform, but engineering involved with reactors has a high turnover rate.

Measuring Cost Savings from Work Management / Maintenance Efficiency Bulletins

See Maintenance/Work Management

The System Engineering Role in Business and Plant Processes

Session Organizer: Adam Dow *(MCR Performance Solutions)*

Recent Delivering The Nuclear Promise (DNP) efficiency bulletins (EB) have focused on optimizing system and program health reporting requirements. This is achieved via process streamlining and/or reducing the number of program/system health reports through the elimination of low-value system and administrative burdens and replacing them with a graded approach leveraging Key Performance Indicators (KPIs) or other valid forms of communication. The desired end state is an efficient and cost-effective means of translating plant condition through an appropriate mode, coalescing data into projects within the plants portfolio and planning horizon. At the forefront of this DNP initiative are the system engineers, the custodians of plant system assets. Presentations and discussions will focus on the role of (and burden on) the system engineers, driving complete discovery of the known or knowable issues and rigorous, risk-informed evaluation of discovered information within the context of system/program reporting, plant health committee interfaces (PHC), and life cycle management processes.

Cross-Linked Session: N/A
DNP Session: Yes

2017 Xcel Session 4 System Engineering Role

Molly Strasser *(Xcel Energy)*

Session Notes

- Health reports have been a snapshot in time. However, EB is reducing the reporting. There was a poll put out to see how many health reports were done at each site. Some had already implemented a graded approach. Others had 100+ every quarter. Focus now on those systems who can have unacceptable consequences. Balance between regulatory reporting, reliability margin.
- Life cycle management is important too. Need to control engineering's appetite for modifications.
- We had a large mod backlog. We found the low cost, low risk Plant Health Committee items were being implemented first. Priority needed to be elsewhere. Came up with a risk integration to compare the many lists (Ops watch list, Top 10 lists, etc) against themselves and see what needs to get done. Evaluated the issue driver. Consequence looks at how the regulator would view this. When multiple project having the same score, there is an "adder" that adds probability of occurrence. Projects that fell to the low end were eliminated, not sent through the budget process.
- Important note - risk doesn't stay the same as time goes on. There needs to be a review periodically.

Q&A

Q1. What approach do you uses to keep track of the ideas that didn't measure up? So if a new person asks about it, how do you know that was already evaluated?
A1a. Xcel - Not a specific list, have for example if from Ops, they still have to take it through the PHC process. So that would be documented through the notes. We don't keep a running list. But may be captured in our tool called Unifier.
A1b. Excelon – have a program that Engage LCM that keeps all the documents. Whoever owns that issue drives it through, but stays as a tracking mechanism. Can search by description, and station. Had this program 3-4 years. Only as good as what people put into it, but should be able to find old ideas.

Q2. When coming up with the Long Range risk, do you use it for Long Range budget plan? Or do you use it because you have a budget and how to use it?
A2. Both. Near term we are squeezing. But looking long term

Q3. One of the reasons that engineering likes mods, is they can't always do alternate analysis. Do you have a way to help with this?
A3. In theory, an alternate analysis should have been done as part of the mod process. Once at Plant Health Committee meeting, you have to justify why you selected this option. We do see that Engineering sometimes does not understand cost. We are starting to educate those on how much things actually cost. Working on determining ways to measure cost, need to be smart about this. At late in life of a plant, shouldn't be doing too many mods.

Case-Study in Equipment Reliability and Business Planning

Trevor Krawcyk *(Exelon)*

Session Notes

- Clinton took the DNP ideas and implemented them fast-tracked in order to get the outage planned in 5 months. Since they had been scheduled to be shut down they had put all their effort toward decommissioning. Had to rebuild Long Range Plan.
- ENG-004 establishes a "best athlete" concept. Have to evaluate who should own things, for example - rad waste went to chemistry and Ops.
- Security designated a project manager to own their systems.
- With the redistribution of some systems, the System Engineers had to help by mentoring of the rest of the site, and teach how to be owners of the systems.

Q&A

Q1. Now Maintenance, Chemistry, Security has their equipment, how does that work?
A1. Had a CMO organization. For example, large pumps and motors are their own set and owned by maintenance. It was a stretch to get ownership, but once it got through, they saw they had a success path. Had a NEO bring through two things through PHC and go back and tell his shift. There was an excitement from it, word of mouth is huge.

Q2. Do you keep low risk/low probability items on the chart?
A2. No, not everything will even make it to the chart.

Q3. When scoring risk and consequence, how do you challenge and control scoring? Since there are qualitative descriptions? How to you keep from people gaming the system to get their item though?
A3a. Excelon - Ranking gets challenged in approval process several times - at the PHC subcommittee, and then at PHC. The ranking may shift as they go through the process. PRC is procedurally driven to have a vote on the ranking level.
A3a. Xcel – has to go before senior leadership to defend their ranking, so haven't have an issue with improper ranking.

Comment: Consistency comes when you look at everything as arrogate, helps make sure things are properly ranked. You can easily see the outliers.

Q5. For your monthly cash flows, how does the detail changes as the time goes on?
A5. We have action tracking items, will ask the point of contact for the item to update periodically. Since ideally our process starts 2 years out, a year before the implementation will send out actions to update, make sure numbers are still good. Their tool actually makes the power point for PHC, to make sure the owner has all the important pieces

Comment: Clinton streamlined the budgeting process, fast tracked Eng-004, combined PHC and PRC. If there was horizontal alignment already, just host both meetings at the same time, just bounced back and forth. Implementing the combined meeting was very helpful to get things approved easily.

Q6. Remote monitoring seems to be something on the horizon, where is Xcel on that?
A6. We are piggy backing on our fossil side. We are upgrading the PI software for new models. Other fossil, renewables have these, leveraging this technology.

Comment: When NEIL comes around, you get credits for what you remotely monitor.

Engineering: Business Planning

Emily DeBrock *(Exelon)*

Session Notes

- At Excelon, ideas go to PHC subcommittee, then to PHC. If it's not important and not needed, it needs to stop at PHC and not continue down the process.
- Like to ensure young engineers have an experienced person to go through the process with them the first time to aid in learning the process.
- In the authorization package there is a list of other alternatives that were considered and risk of not completing the work.
- Comment: Excelon - developed training session for engineers to teach the process. When they come talk to business operations manager about the item, work together to understand the money/project/process. This is not a common process for them, fairly rarely done so expect to help them with the process.

Q&A

Q1. Equipment doesn't always fail when you want it to. How to handle emergent issues?
A1. Have a savings and usage account, use this to cover emergent. If have no money internally, or at corporate, then we have to go back to PRC and cut a project.

Q2. The issue estimating tool, does going through that help engineers?
A2. It helps, makes them count the cost and make sure they aren't missing anything. Are we strategic with resources? Tedious process, the tool populates the form for you, and makes the power point for PHC.

Comment: The fact that it is going to electronic format is important, even just getting the signatures is a long process. This can help so the engineer does not run around for a half of day, just getting signatures.

Prerequisites for Cost Reductions

See Maintenance/Work Management

Value Based Maintenance (VBM), What it is and What do we need to do to Prepare for it?

See Engineering & Equipment Reliability

Second License Renewal: Delivering the Nuclear Promise from 60 to 80 Years

See Regulatory Relations

ENGINEERING AND EQUIPMENT RELIABILITY

Think Smart Think Digital: Digital I&C Regulatory Modernization

Session Organizer: Pareez Golub *(Excel Services)*

Join us in learning about the exciting changes taking place in the industry and regulatory infrastructures related to digital I&C! In October 2016, the Commission approved the NRC Digital I&C "Integrated Action Plan" (IAP) with the objective of modernizing the digital I&C regulatory infrastructure. Industry and NRC identified key topics that have the greatest near-term impact in addressing regulatory challenges and improving timeliness / efficiency of digital modifications. Join key industry and NRC stakeholders to discuss progress on these important initiatives. This panel will discuss how the NRC and industry efforts will allow the utilities to take advantage of this technology for long-term, safe and efficient operation.

Cross-Linked Session: Regulatory Relations & Engineering and Equipment Reliability
DNP Session: No

Think Smart Think Digital: Digital I&C Regulatory Modernization

John Connelly *(Exelon)*, Pareez Golub *(Excel Services),* Raymond Herb *(Southern Nuclear)*, John Lubinski *(NRC)*

Session Notes

- Plants are rapidly moving into the digital domain. Very broad digital implementation exists in non-safety space.
- Being able to standardize a broad and centralized digital process will open various doors for other plants and utilities in digital space.
- Historically, digital has not been leveraged for safety equipment. This notion has changed with recent increases in digital device reliability and confidence.
- NRC recognizes safety improvements with going digital. This is not required now since existing plants using analog systems are safe.
- As long as digitization remains a priority in the nuclear industry it will also be a priority for the NRC. NRC assigns priority of resources based on the number of applications, users, etc. for a specific digitization process.
- As an industry, it is critical to have a consistent and efficient process for inspectors, industry OE, etc.
- Standardized Digital Design Process will be implemented into next revision on EPRI Standard Design Guide to set a standard for the industry.
- Changes to Standard Design Guide will be made in an effort to provide the industry an off-the-shelf tool ready for implementation.
- Part of the "Delivering the Nuclear Process" includes training implementation. The EPRI Digital Design Guide is the pilot program for training and training qualification going forward to be used by the industry. The purpose of this effort is to minimize the number of training and training qualification programs that currently exist throughout the industry. Standardization and centralization is key.
- A large number of organizational hand offs currently exist in the industry. Standardization and centralization of digital processes will greatly benefit the industry by further taking advantage of economies of scale.
- One current struggle within digital space is determining the required scrutiny for digital common cause failure.
- As associated with digitization, the ability to use off-the-shelf digital items and equipment will yield the best bang-for-the-buck for plants and the industry as a whole.
- The whole industry is coming together in an effort to make digitization an economical, safe, and effective solution.
- INPO has recently made it a digital initiative to look at digital NEI 50-59's.
- Every NEI 50-59 currently has to be a standalone document.
- The requirements for digital items and processes are constantly changing as technology, regulation, etc. evolve.
- The NRC is trying to put something out the door that can get low hanging digital components and processes for safety systems. Goal is to then expand these digital programs to broader and more complex safety systems.
- Currently with the way ISG-06 is worded regulatory approval of digital item/process does not occur until late in the process. This results in increased financial risk since approval uncertainty exists. An effort is ongoing right now to move the approval process up in the process.
- Current efforts are underway to improve digitization acceptance in the nuclear industry. Alignment between parties exists but increased confidence of regulatory parties and industry are required to take.
- It is crucial that OE, supplier experience, and industry needs be taken into account as digitization is pushed throughout the nuclear industry because at the end of the day nuclear has to be safe and reliable.
- Maintenance needs a different skillset to maintain. If you don't address the organizational structure, we introduce ourselves to operational and financial risk.
- NRC steering committee will continue until next major digital I&C application.

- NEI 96-07 Appendix D addition is almost complete. This update provides guidance for digital I&C related 50.59s.
- The more complicated the process for implementing patches, the more expensive it is going to be. Very important to find right people to manage the digital systems and find the right process for implementing changes in what is a very flexible system.
- Looking for OEM, vendor, and utility participation in new revision of Digital Design Guide. End of August NPC will decide on dates for a working meeting in September/October timeframe. Design guide will become the industry standard process going forward. It is intended to reduce costs of implementing digital modifications and improve the regulator's confidence in the process.
- NRC staff are currently reviewing NEI 96-07 Appendix D and NEI 16-16 (common cause failure evaluation).
- ISG-6 is a guidance doc for NRC reviews of LARs and topical report acceptance. Industry has struggled with LAR implementation.
- NRC concern with ISG-6 consistent with industry post-DCPP upgrade. Revised ISG-6 will hopefully not require factory acceptance test for LAR approval.

Key Learnings, Recommendations, and/or Best Practices

- For successful implementation and ability to leverage the benefits of modern digital technology and processes it is critical that all affected parties work together smartly in order to efficiently move forward. Specifically, an improved regulatory framework, a standardized technical framework, and willing, agile, and efficient organizations are necessary for regulatory stability, technical excellence, improved plant performance, etc.
- Organizational structures may need to be modified to accommodate digital I&C upgrades. Maintenance for digital I&C is a combination of IT, maintenance, and engineering.
- Utilities should adopt the EPRI Standard Digital Design Guide in their modification processes for cost-savings. EPRI is piloting a training initiative for digital I&C using CBTs, workshops, and other training methods.
- Contact INPO for an assist with Digital I&C modifications and 50.59s.
- Consider significant operating experience of digital equipment when evaluating susceptibility to common cause failure.
- NRC believes there is no reason to withhold safety related digital I&C modifications right now. NRC recently approved Hope Creek source range flux monitoring LAR.

Q&A

Q1. When are you going to start the digitization of safety systems; both critical and non-critical systems?
A1. Predicated on current regulatory review and acceptance process; starting today it would take years to implement a safety digital system.

Q2. Are the same coordination efforts being applied to common cause failures as they apply to diversity/redundancy and testing requirements?
A2. This is a known issue and is being looked at by the industry and regulatory parties. New requirements are not being added under 50-59 but steps are being taken to confirm that common cause failure does not increase with the added/converted digital system.

Q3. Please comment on The Nuclear Promise and increasing efficiency.
A3. Standardized design and implementation process.

Q4. To what expense has Operation Experience (OE) been leveraged from other industry and other locations around the globe in the creation of the EPRI Standard Design Guide?
A4. We have reached out to international nuclear communities, the Navy, and space program. We are working to integrate that historical experience into the standard design guide. From a regulatory standpoint, we are very involved with other nuclear groups, etc. We really need to be responsive to what is going on in North America and how current utilities would like to be regulated. OE from other countries is welcomed but differences of regulatory rules, etc. are noted.

Q1. What is Exelon's timeframe for implementing safety related digital I&C upgrades?
A1. The issue of the Regulatory Information Summary (in comment receival phase) and streamlined licensing process will help. Major safety related I&C modifications can take several years due to the significance of what is being modified and the license amendment process.

Q2. Has NRC and industry come to an agreement on requirements for 100% testability and redundancy?
A2. Digital Working Group has provided comments on BTP 7-19. Licensees should consider the operating experience of the equipment to justify protection against common cause failure.

Q3. How can the industry become more efficient in this area?
A3: The standardize design process has great promise for achieving greater economies of scale.

Q4. To what extent have you reached out to international community for the design guides and licensing updates?

A4: The committees have included people knowledgeable with international standards and regulations. NRC has been engaged with other countries to learn from international digital experience. NRC is looking at how the utilities want to be regulated, not necessarily how international regulators operate.

Q5. What additional guidance can you provide system engineers for plant health committee to justify making the business case for going through a digital upgrade?
A5: With digital, a lot of the maintenance activities go away. There is a large reduction is components, but it is much an art as a science. It is difficult to provide generic cost-benefit information, but it is something the Digital Working Group could consider.

Advanced Non-LWR Reactor Design

Session Organizers: Nicholas V. Smith *(Southern Company Services)*

Multiple non-LWR designs are being developed towards commercialization in the US right now. This session will feature presentations from startup companies in the non-LWR advanced reactor space. These presenters will discuss their reactor designs, development strategies, and regulatory challenges going forward. Designs covered in this session will include TerraPower's Molten Chloride Fast Reactor, X-energy's Xe-100, and Oklo's micro-modular reactor. Expect to learn more about how these emerging technologies are shaping the future of nuclear energy.

Cross-Linked Session: N/A
DNP Session: No

Xe-100: Technical Overview

Eben Mulder *(X Energy, LLC)*

Session Notes

- The leap in advanced Non-LWR reactor was fueled by the decision to design a reactor that cannot melt.
- Throughout the history of advanced and experimental reactors many lessons have been learned and leveraged in newer designs.
- X-Energy has taken these lessons learned and applied them to the currently in process conceptual design.
- X-Energy conceptual design is a pebble bed reactor. This reactor can be continuously loaded and pebbles are removed after reaching predefined burnout requirements. Pebble can last roughly 36 months.
- Pebbles reactors cannot meltdown due to low power density.
- TRISO particles provide the primary fission product barrier.
- Difference between Xe pebble reactor and Chinese equivalent is size. Xe reactor is transportable. Can also be placed anywhere in North America that is seismically deemed safe.

TerraPower's Molten Chloride Fast Reactor Program

Jeff Latkowski *(TerraPower)*

Session Notes

- 12 ½ % enrichment.
- Less harmful fission products than typical reactors.
- Plan is to construct a test reactor by 2021 and then prototype reactor soon after.
- Currently in IET (Integrated Effects Test) phase.
- There is a pathway to licensing in the current regulatory environment. Current environment is cumbersome so any changes to streamline the licensing process are welcome.
- 35 to 40 nuclear startup companies exist around the globe. Half of those are molten salt reactors.
- Computer analysis and computations do not suffice. Testing is required.
- TerraPower has initiated conversations with colleges to expand testing and data capture.
- A large amount of flow loop testing and procurement is taking place and will continue to take place soon.
- IET uses electric heat source to confirm natural circulation in flow loops, etc. Scheduled to be in operation in roughly 19 months.

Session Summary/Q&A

Q1. It looks like the X-Energy fuel is the safety feature to protect against meltdown. Does this reduce the overall cost of plant?
A1. Yes, but the fuel is only part of the story. There is still a reactor and reactor building, etc.

Q2. This panel is critical to the nuclear industry. Is there a path for the national labs to help innovative nuclear designs?
A2. X-Energy does not want to test and prototype until they have a client. You also need suppliers and the whole package. Hopefully the federal government will shift toward nuclear and contribute to its success. TerraPower is already working with Oakridge and the government. The government is in a unique position in which they must balance funding across a set of projects. Working groups have met to help determine desired actions from DOE and then taken this information to guide the DOE.

Q3. TerraPower had looked into trying to not use full flow pumps? What have you been looking into to do this (materials, etc.)?
A3. TerraPower has looked into different materials to try to get away from expensive pump assemblies, etc.

Q4. How about fast neutrons for your fast chloride system?
A4. A test reactor is going to give us the opportunity to tests those types of things.

Q5. Is TerraPower going to have a grid prototype?
A5. Yes, the prototype will be grid connected.

Q6. Do you think that enough data exists to bypass an X-Energy prototype?
A6. Yes, there is a lot of data that existing to support our type of reactor.

Q7. Have you guys done an economic study to determine how they compare to other facilities and new builds?
A7. TerraPower has done a 9 month study that shows that their reactor would be cost effective when compared to gas plants. We believe that there are economies of scale. Smaller, modular reactors support this philosophy. Target is to be competitive in North America. 8.5 per kw/hr currently. I think this places us at a competitive place. Need to make sure we are comparing apples to apples. X-Energy has done a lot of work looking into this item.

Q8. Is there a point that makes the reactor financially viable?
A8. Need to see the real numbers to really get a good feel of that point. It is important to compare apples to apples at the same moment in time.

Realizing the Promise of 50.69 Risk Informed Component Categorization

Session Organizer: Shannon Rafferty-Czincila *(Exelon)*

This session will focus on the key aspects of a 50.69 Risk-Informed Engineering Programs effort, required to fulfill DNP Efficiency Bulletin: 17–09 "Implementation of 10 CFR 50.69: Categorization and Alternative Treatment." This focus will include exploring ideas on establishing a 50.69 project plan, the appropriate multi-disciplinary categorization team structure, implementing procedures, Panel (IDP) training, and how to engage all stakeholders including design engineering and procurement. The session will highlight recent experience with performing categorization, actual results (including the various "drivers" that influence RISC-1 versus 3), system selection criteria, process efficiencies and lessons learned from recent projects. Presentations will touch upon the equally important topics of which engineering programs to target (for optimal savings), what the specific alternative treatment options look like for each program (e.g. IST, ISI, EQ, procurement, design control, etc.) and how to prioritize which systems/programs provide the best plant-specific cost savings. Last, the importance of a strong change management plan for the entire Station will be addressed.

Cross-Linked Session: Risk Management
DNP Session: No

50.69 Project Plan Development

Heather Szews *(Duke)*

Session Notes

- Efficiency Bulletin was created to act as a tool to fuel industry cooperation and knowledge sharing.
- LAR categorization templates are available on NEI's website.
- 50.69 includes a section on organizational structure.
- 50.69 is an engineering dominated and led activity but also includes insight from/on operations, supplier chain, maintenance, etc.

10CFR50.69 Categorization Results, Lessons Learned, & Efficiencies

Adam Coker *(Southern Nuclear)*

Session Notes

- Presentation to discuss work completed at the Vogtle 1&2 as applicable to 10CFR50.69.
- Not using PRA right now; using a SSC equipment list instead. Projected usage in future.
- It's important to document considerations during categorization process.
- A database or similar tool to list, monitor, and control categorization of equipment saves time after setup and learning curve.
- Another recommendation from the NRC was to have 2 IDP reviews (Integrated Decision-Making Panel); one initially and one later on. This catches early issues.

10CFR50.69 Alternative Treatment of Systems, Structures and Components

Maricarmen Trexler *(Exelon Nuclear),* Pat O'Rourke *(EPRI)*

Session Notes

- Excelon created a playbook that deals with the treatment of SSCs.
- The idea at Excelon is to revise current procedures to adopt 10CFR50.69 requirements.
- EPRI has developed guidance on the treat of SSC and other guidance on implementation of EQ and Seismic.
- EPRI is working on case studies in collaboration with the industry.
- NEI has put together a working group on this topic in which EPRI and other utilities are participants of.

Palo Verde 50.69 Change Management Plan

Bryan Thiele *(APS)*

Session Notes

- Palo Verde did a cost benefit analysis for systems that had at least 1 safety related component.
- PV (Palo Verde) has implemented an overview training course on 50.69
- PV has also implemented a series of impact meetings that review treatments and their associated impacts to various groups.
- These activities are expensive. For complex systems costs could reach $300000 and smaller, less complex systems may cost $50000.
- Readiness Review prior to seeking NRC approval is beneficial to save time and money and identify issues early.

Q&A

Q1. Has Vogtle 1 & 2 had any risk 2 items and how have you treated them; additional treatments?
A1. No, no additional treatments

Q2. Has the change management package become a design change package?
A2. It's a pretty informal document that is not considered a design change. A large amount of information is included in document but not considered a design change; living breathing changing document; not part of design change, part of implementation plan.

Q3. What was the alternative treatment for EPRI relief valve example?
A3. Went one by one and addressed regulation, can share documentation. Additional information to be provided by EPRI speaker (not present); EPRI trying to accelerate guidance information on additional treatment; Projected to provide many different treatment methods.

Q4. Say you have a risk 3 components; you go out to test with alternate treatment and it fails under alternative test what do you do?
A4. Use CAFTA to address it. There are monitoring aspects to prevent this from occurring.

Q5. There is a lot of groups working on 50.69; do we know who is working on what?
A5. Yes, there is a working group having these discussions.

Q6. Does the 50.69 road map exist on the NEI website?
A6. Yes

DNP Status and Overview

Session Organizer: Brad Adams *(Southern Nuclear)*

Brad Adams will host a session on the current state of the DNP initiatives, what is upcoming what has completed. How is the program evolving and adapting? Where are the successes and what can we expect in 2018. This panel will cover the DNP major topical areas and we will be here to answer your questions.

Cross-Linked Session: N/A
DNP Session: Yes

Delivering the Nuclear Promise Panel Discussion

Brad Adams *(Southern Nuclear)*

Session Notes

- Discussion to focus on cultural changes needed to improve industry dynamics and success.
- 10CFR50.59 – Vogtle was a pilot plant; Working on new process to make PRA process more streamline; Vogtle has struggled to make implementation progress due to the difficulty and stringent nature of 50.69 which is very resource intensive
- We will have to share and be innovative in how we handle review to truly benefit from 50.69.
- 50.69 is very arduous the way it is set up.
- Combining accident tolerant fuel with 50.69 could be a game changing for the industry.
- On AP1000 diesel generators are non-safety pieces of equipment but important.
- Southern Nuclear is planning to test accident tolerant fuel in 2018. We can't afford the current 20-year period of validating and qualifying new fuel sources, etc.
- CAP Reduction has historically been though. This more is better mindset does not support DNP in terms of cost, etc. A lot of negative items that we deal with in the nuclear industry has to do with over designing/ "over-doing" various aspects of plants.
- We need to think differently and look at what items and processes are really required.
- "When the cure is worse than the disease, we are just being stupid."
- We must challenge the things that don't make sense and shouldn't settle for the status quo.
- Benefits of Standard Design Process include that we are all using same process which helps with training.
- Consistency is important because we can apply this same model to other processes, etc. We can use this model to get better.
- DNP Program Evolution – A lot of the DNP bulletins have to be pushed into the industry and accepted because of issues with the industry's willingness to change.
- Future plans associated with DNP include a standard design tool that is complicated and will be optional instead of mandatory especially digital from analog modifications.
- Safety related vs Non-safety related does not equal important vs. not important.
- There are a lot of challenges associated with our industry's culture that we will need to resolve for long term success of the nuclear industry.
- People in the nuclear industry need to realize that anyone has the power to initiate change. Change is doable and can be done. DNP is just a start.
- Less is better, less is safer, less is smarter.
- It's very hard to get things done here. We are killing our own-selves.
- The DNP is unprecedented in this industry and must be leveraged to increase efficiency and decrease cost, etc.
- What is going to make DNP successful is industry collaboration (true industry collaboration and sharing).
- Training needs to be leveraged to promote thinking rather than "checklist mentality."
- We need to always ask ourselves "Why are we doing?" and "How did we get here?"

Key Learnings, Recommendations, and/or Best Practices

- The true benefits of DNP initiatives will only be realized when the industry as a whole truly collaborates and shares knowledge, lessons learned, etc., and embraces change for the long-term betterment of the nuclear industry.
- As an industry, we need a cultural change that promotes change and critical thinking.

Q&A

Q1. How far is the DNP looking into and achieving the needed changes to take full of its benefits across the industry?
A1. We stood the standard design process up by setting up software, working group, and structure to monitor feedback from industry going forward. Continuous efforts will occur to change and improve DNP initiatives as required based on this information and data. Participate, engage, and get involved in this effort. Current efforts and structure have achieved sustainability moving forward.

Q2. What can we do from the supplier side to support DNP efforts?
A2. Controlling scope and requirements in an efficient and effective way such that they minimize costs and mitigate cost increases. All parties have to striving for a common goal. We must not think short term but rather long term.

Q3. Duke is looking forward to using the Standard Design Process. How are we going to handle customization of the Standard Design Review process? Will there be a central point to handles change requests associated with the Standard Design Process?
A3. The working group has representatives from involved parties to assess proposed changes to Standard Design Process. Change processes have been documented.

Q4. Is DNP going to look into NEI 04-10 process dictating surveillance test intervals, etc.?
A4. Yes, we are looking into it.

Q5. In general, do you see us moving out of the current DNP formal process?
A5. There are formal DNP initiatives but there are also non-formal initiates not affiliated with DNP. DNP will continue to look at ways to make its processes more efficient.

Q6. How has DNP cut major equipment cost? Has it?
A6. Leverage the online Nuclear Energy community. Leveraging this information will decrease costs by using proven installation techniques, processes, etc.

Standard Design Process Update

Session Organizer: Rick McAdams (*Southern Nuclear)*

At the beginning of the year over 30 units have adopted the Standard Design Process (SDP) and by the end of July all domestic units will be operating with this new process. This session will provide a high level overview of the SDP, lessons learned from the roll out both from the utility and EOC perspectives, and performance and efficiency gains.

The session will also provide an overview of two new initiatives that will build on the SDP process and infrastructure. This includes integrating digital strategies into the SDP, and industry standardized processes and infrastructure for item equivalencies and parts obsolescence.

Cross-Linked Session: N/A
DNP Session: No

Standard Design Process (SDP) Update

Amir Shahkarami *(CASE Global Partners), Sudesh Gambhir (INPO), John Grabnar (FENOC), Eugene Kelley (Exelon Generation LLC)*
Note: INPO presentations will be available through the INPO website

Session Notes

- Call to action to take advantage of SDP.
- Design Oversight Working Group (DOWG) – Reach out to your DOWG representative in your company with comments and questions.
- Engineering Change Type – Design Change is most involved (highest tier).
- Design Equivalent Change – No change in design basis; offers a more streamline process for smaller changes.
- Commercial Change – Lowest level of change type; simple change; non-safety, etc.
- Design Attribute Review Tool – Impact Assessment tool for stakeholder; design consideration; spreadsheet format with various questions to fuel engineering thinking process; not a checklist; a thinking tool.
- Temporary Modifications – Graded approach that follows change types.
- SDP Resource Manual available online.
- Efficiency Bulletin required monitoring of the implementation of the SDP; SDP working group developed 8 indicators to measure success; take into account various plant measures.
- Standardized Software tool is compatible with programs already existing at plants.
- In order for the SDP to be worth it, it is critical to avoid “piling on” of additional reviews.
- MPR recognized that have vendor insights would be essential to the SDP.
- Successes of SDP include lower paperwork levels.
- The whole intent of the SDP was to save cost.
- Guiderails present to verifying that change management process was followed; standards do not change.
- INPO will not look through the SDP to find problems.
- Culture is the main ingredient that will drive the success of the nuclear industry.
- Implementing the SDP has its cultural issues.

- Standard Item Equivalency (supply chain side of the house including both safety and non-safety)
- Industry does not have same qualification and training requirements and programs.
- Digital Design Guide – Includes EPRI research data and information; comprehensive inventory of things you have to deal with as they are unique to digital components and processes.
- Initial Design Guide lacked a graded approach; drove EPRI to create a more streamlined process.
- The DDG was created to fix and standardize digital equipment modification processes and activities.
- EPRI recognizes that the DDG needs to be updated as changes in digital space continue to emerge.
- Goal is to enable the sharing of digital control designs between utilities.
- ENG-008 aimed at created risk informed design procedure for digital I&C.
- Important to note that we are not standardizing to just standardize but leveraging standardization to take advantage of sharing and collaboration.
- We now have an industry common procedure. The SDP is just a trailblazer for other industry common procedures.

Key Learnings, Recommendations, and/or Best Practices

- The various parts feeding the SDP show promise for long term success in the nuclear industry. It is important to note, however, that a cultural change will be required to truly take advantage of industry collaboration and knowledge sharing. These combined efforts will decrease costs and increase efficiency and further fulfill the focus areas of Delivering the Nuclear Promise.

Q&A

Q1. Is the idea that we are going to use INPO as a clearing house?
A1. Will have a spreadsheet template that can be sent to INPO for input.

Q2. Where are the savings coming from as applicable to the DDG?
A2. We looked at typical I&C costs and took a % of cost savings from that; also assumed reduced training and quality costs.

Q3. For the SDDG, is that going to be a standard design document or will it be standalone document?
A3. Currently trying to figure out that interface now.

Value Based Maintenance (VBM), What it is and What do we need to do to Prepare for it?

Session Organizer: Jon Anderson *(ACA)*, Adam Dow *(MCR Performance Solutions)*

There are three Engineering Efficiency Bulletins that have the potential to have a significant impact on Engineering, Operations, Work Management, Maintenance and Supply Chain. This workshop will start with Engineering describing the changes that will come from EB-16-25-Critical-Component-Reduction, EB 17-03a Value-Based Maintenance, and EB 17-03b Embracing Cultural Shifts for Value-Based Maintenance. Industry leaders from Engineering, Business, Maintenance and Work Management will then lead the discussion of concrete actions that should be taken to prepare for these changes and how to measure the cost savings from these changes.

Cross-Linked Session: Maintenance and Work Management, Business and Economic Performance
DNP Session: No

Value Based Maintenance Overview and Process

Jeff Greene *(EPRI)*

Session Notes (Engineering and Equipment Reliability KM)

- EPRI is now getting into software products.
- Efficiency Bulletin (EB)
- A cultural change is required for long term nuclear industry success as it applies to Value Based Maintenance; need new maintenance strategies that maintain balance between reliability and cost.
- EPRI is working on 2 software tools aimed to evaluate new maintenance strategies.
- First tool, Work Order Data Visualization Tool – a way to easily view, visualize, and trend Work Order data. (See tutorial video @ EPRI.com); includes many different dashboards with customizable filters.
- Tool uses is endless and can be customized to fit user needs.
- EPRI's goal was to create a common ground software platform to fuel a universal value based maintenance program.
- International groups are not left out and have access to this software.

- Second tool, CAT (Cost Analysis Tool) – allows you to weigh your cost against your desired reliability for a specific component or system.
- Other similar tools already exist.
- Planned release of both tools by the end of year.
- EPRI's main purpose is to be a collaborative hub of industry information; these tools are another avenue to fulfill this purpose.

Session Notes (Business and Economic Performance KM)

- Developing two tools for value based maintenance, work order data visualization tool and a cost analysis tool. These tools will help capture the findings of new maintenance strategies from the different utilities.
- The work order visualization tool will be able to tell you what your costs at a component level.
- The initial purpose of this tool was to be used for identifying the top 10 components that needed to be targeted when focusing on value based maintenance (VBM).

Session Notes (Work Management and Maintenance KM)

- EPRI's goal is to have the central place for lessons learned, white papers, etc. in the PM basis.
- Clickview software available through EPRI, they purchased for the industry use. EPRI wanted to have a common platform for Value Based Maintenance. Have about half the sites using Clickview, and have given access to their work order data. They desire to get 90% of sites using it by the end of the year.
- Plants have seen a variety of uses for the capabilities of Clickview. Identifying top 10 list of non-critical components to target for cost reduction, prioritizing systems of interest for 50.69, determining supply/demand labor forecasting, challenging modifications, are just a few.

Q&A

Q1. To what degree is language different across the industry?
A1. There are some similarities but enough differences to justify a common naming convention. We are working with various groups currently to development an industry dashboard.

Q2. ICE from INPO, how much overlap is there with the core data?
A2. ICE provides a lot of data and useful data but lacks ability to retrieve in service data. EPRI did meet with INPO but agreed that the steps required to leverage some of the ICE data would not be worth it.

Q1. Do what degree is the language in the tool not common and unusable
A1. We are establishing the initial mapping needed to create a common naming convention and interface.

Q2. How much overlap with ICE data in INPO with EPRI?
A2. It was difficult to come up with failure rates when using the tool and could not pull in the data easily.

Q1. Mentioned that you are trying to common language for the work order data, how diverse is the set you are getting from the plants?
A1. Quite diverse;when it comes to using the tool, there are enough differences so that it's hard to select the right one. A commonality is definitely needed.

Q2. Are you familiar with ICES data? How much overlap is there of the core data?
A2. We sat down with INPO at the start of this project to determine if and how we could use ICES report data. However, from looking at the ICES data, was difficult to come up with in-service life, and tough to determine failure rates. Hard to pull that data into Clickview for our uses, would require lots of extra work.

Delivering the Nuclear Promise Based Maintenance, "The Right Reliability at the Right Cost," Implementation and the Future

Richard Weisband (Exelon)

Session Notes (Engineering and Equipment Reliability KM)

- Some risk is required to be cost efficient.
- Certain component lines have been targeted by executives for value based maintenance review.
- NRC findings on maintenance have been steadily on the incline; this justifies the need for an effective value based maintenance program.
- It is important to monitor costs for maintenance strategy changes.

- Want White Papers to be incorporated in the PM templates.
- Important to maintain good communication between affected groups.

Session Notes (Business and Economic Performance KM)

- Some VBM strategies include ensuring consideration of cycle plan / system outage window strategies.
- Corrective action program supports periodic failures of non-critical and run-to-maintenance components.
- The future of VBM strategies include Implement short cycle process (plan, execute), expand use of FIN / minor maintenance processes.
- The VBM plan includes to obtain site historical PM/CM data and place into data visualization tool and use to identify VBM opportunities
- Prior to sending the PMMRs hold a Pre-Job Brief with those who will be reviewing them, ensure a discussion so there is no misunderstanding of the goals and reasons for changes. Helps there be less back and forth approving changes. Sending out the risk appetite statement beforehand is helpful as well.

Q&A

Q1. Do you see a lot of revisions to our PM templates?
A1. I expect a revision every time we change and improve the process.

Q2. Have you seen more items now move from online to outages when regarding risk to reliability?
A2. We have fleet wide assessment to see if we should test that online or move to an outage.

Q3. Have you seen a lot of revision to our PCM template?
A3. I expect a different revision every go through of the template.

Q4. With the risk based appetite, have you seen more on items move from on-line scheduling to outage?
A4. We are doing an assessment to challenge a move, does it makes sense to do on-line or in an outage?

Q5. Have you been facing challenges from System Engineers on changes to PMs?
A5. Yes, we have seen some push back and they have not approved all changes. Normally in a long list, there is only a handful they have an issue with changing. After a discussion we are normally able to move ahead with the changes.

Q3. Do you expect to see a revision for every component on the on the PCM template?
A3. We expect changes in all of them, even if it's just beefing up the justification.

Efficient Maintenance Solutions through Value-Based Maintenance

Tim Schlimpert *(MCR Performance Solutions)*

Session Notes (Engineering and Equipment Reliability KM)

- Value based maintenance approve requires a different approach compared to historical maintenance approaches (i.e. 0 tolerance for equipment failure)
- Full Flow Condensate Polishing Demineralizer example: Can degrade rapidly when outside and exposed to caustics; results and lessons learned described in slides.

Session Notes (Business and Economic Performance KM)

- VBM has a tendency to be a relatively subjective term with implementation typically representing a hybrid approach between NEI, INPO and station direction
- 17-03a VBM targeted component (Circuit Breakers, Air-Operated Valves, and Relays) maintenance strategies to be evaluated for implementation by December 2018
- **Historic Nuclear Culture:** Keep equipment at maximum reliability → Minimize Corrective Maintenance cost
- **Value-Based Maintenance Approach:** Minimize total maintenance cost → Balance CM and PM costs: PM cost decreases, CM cost increases, but overall total cost **decreases**
- Engineering wanted to replace all isolation valves with new. Upon further evaluation, we discovered the in-house valve crew wanted to completely refurb all valves in question. The data showed a complete refurb most often fixed the issues thereby avoiding a costly design change of replacing valves with new design.

Key Learnings, Recommendations, and/or Best Practices

- Value Based Maintenance practices are vital to the success of delivering the nuclear promise.

How do we (Maintenance and Work Management) Prepare for Value Based Maintenance (VBM)?

Jon Anderson *(ACA Inc.)*

Session Notes (Engineering and Equipment Reliability KM)

- Ask managers the hard questions as they related to maintenance. Ask them what their expectations are on cost, etc.
- Value Based Maintenance (VBM) is optimized around component type.
- VBM can be applied to functional equipment groups all around the plant.

Session Notes (Business and Economic Performance KM)

- Potential outcomes from VBMs. There are no measurable changes – life did not change, but we did not see any cost reduction.
- PM cost and total cost is different by total cost including PM (preventative maintenance), corrective, deficit, and other kind of VBM.

Session Notes (Maintenance and Work Management KM)

- The PM costs were only the Work Orders coded as PMs
- Maintenance cost included all PMs, Corrective Action WOs, and deficient packages
- Be smart about setting for frequencies in functional equipment groups. If they are not in alignment with cycles or a multiple, then they will eventually creep into outages. Is this something that you are okay with?

Q&A

Q1. How are you dealing with bringing in more contingency parts to mitigate equipment failure?
A1. Some equipment classified as critical have their own processes and spare part requirements to mitigate failure effects.

Q2. As applicable to the DNP, what is the approximate/typical expenditure to implement NRC cyber security program?
A2. Don't know. Estimates of 10 to 20 million.

Q3. It looked like you were taking critical components that can cause <72 hour LCOs and making them non-critical, why would I want to do that?
A3. Non-critical does not mean not important. Looking through those that could cause <72 hour LCO, there are ones we already know that we can easily get out of, should we have that component failure. We must recognize that we have been too conservative to begin with. We have recognized that we can tolerate some failures.

Q4. Talked about more non-intrusive PMs, to extend intrusive PM frequencies. How are you handling bring it more contingency parts in, to cope with failures? Are you having to put more contingency warehouse plans in place?
A4. Supply chain is a little different for crit/non-crit. The definition of critical spare is unchanged.

NRC Concern Related to the Use of Silicone Foam (Dow Corning 6548) as an Internal Conduit Seal

Session Organizer: J. Kent Johnson *(Southern Nuclear)*

This session will provide the background and initial response to an NRC concern related to the use of silicone foam (Dow Corning 6548) as an electrical conduit internal seal. Silicone foam can shrink after several days of cure time and lead to the leakage of water past an electrical conduit internal seal. The session will share information regarding the utility's strategy to be prepared for a NUREG that is expected to be issued in the future. Portions of the session will be presented by a Seal Material Subject Matter Expert who will provide information related to seal test results and introduce concepts to resolve the issue. An overview of the sources of external flooding events will also be included.

Cross-Linked Session: N/A
DNP Session: No

Utility Response to an NRC Concern related to the use of silicone foam as an electrical conduit internal seal - Part 1

J. Kent Johnson *(Southern Nuclear)*

Session Notes

- All Southern Nuclear sites are dry sites but still recognize concerns for flooding events.
- Seiche is an event where you would have a standing wave due to some reason; can last several days due to ripple/ tidal effects.

- Some natural flood considerations may be combined depending on event (i.e. hurricane – wind and storm surges, etc.)
- SNC does structural monitoring at all sites; NRC questions concerning internal seals were generated in conduit trench inspection at Southern Nuclear site; SNC created a condition report on the issue to determine impact and potential risk associated with findings.
- Historically testing did not result in enough data (i.e. silicon foam cure time, etc.); questions existed around shrinkage effect of foam and leakage.
- Need to come up with an economical way to handle seal replacement and maintenance.
- All sites will document vulnerabilities and response in preparation for NUREG document release.

Utility Response to an NRC Concern related to the use of silicone foam as an electrical conduit internal seal - Part 2

John Antignano *(Nuvia-USA)*

Session Notes

- Nuvia is based in Charlotte but international company.
- Fukishima kick started coordinated efforts concerning flooding.
- NRC is looking at external and internal flooding effects. Internal flooding introduces another level of complexity.
- Silicone foam seals shrink with age.
- Flooding testing procedure and requirements are expected to examine seal leak rate and pass/ fail rate; this data will then be compared to site PRA requirements and actions issued accordingly.
- Important to understand flood design levels and flood planes.
- Any test that a utility may run may be duplicated by regulatory testing efforts; best to wait for regulatory efforts to take place due to cost and risk associated with testing and testing results being accepted by industry.

Key Learnings, Recommendations, and/or Best Practices

- Internal and external flooding is obviously a concern in the nuclear industry. There are many innovative solutions currently available that are robust and reliable.

Q&A

Q1. Where does the shrinkage of silicone foam take place?
A1. Shrinkage occurs at all seal contact point including the outside circumference of conduit and outside of cables/hose/etc. Shrinkage is typically seen on any seals over 2 years of age.

Q2. Can a utility apply TRS-750 coating on existing fire seal?
A2. Yes it can be applied over fire seal.

Q3. How long is the cure time for the TRS-750 coating?
A3. 4 to 8 (ideal) hour cure time; cure time is temperature dependent

Q4. How viscous is elastomeric seal?
A4. Elastomeric seal is very think before it is cured.

Q5. Have you completed your own review of silicone seals at your sites?
A5. We found for our design basis flood levels we had very low silicone seal vulnerability. For those that are at risk we are planning to review and develop an action plan to correct.

EXECUTIVE AND LEADERSHIP

"Billions and Billions, and Nothing to Wear" - Leveraging Risk Based Decision Making for Effective Inventory Management

See Supply Chain

Technology-Enabled Business Improvement

Session Organizers: Bruce Hallbert *(INL)*, Ken Thomas *(INL)*

Nuclear plants today are excessively burdened with implementing the substantial process and human performance requirements that have built up over time in pursuit of nuclear safety and production goals. At the same time, competitive forces have driven many industries to transform their business models with advanced digital technologies to increase production, improve quality, and reduce cost. Greater efficiency improvements are possible when technologies are applied systematically to broad business functions, rather than as point solutions to current performance problems. See two examples of how innovative organizations are transforming their business models with advanced digital technologies; followed by a presentation on technology development efforts by the Department of Energy's Light Water Reactor Sustainability Program to assist U.S. nuclear plant operators in achieving substantial business improvement.

Cross-Linked Session: N/A
DNP Session: No

Integrated Operations for Off-Shore Oil Production

Andreas Bye *(OECD Halden Reactor Project, IFE)*

Session Notes

- Experience with Integrated Operations from oil and gas operations can be applied to the nuclear industry to achieve increased efficiencies and cost savings.
- Organizational and work processing role modeling may be seen as an 'old-fashioned' concept but the purpose is to look at constraints and address what type of competencies are required for your staff.
- There are many parallels between the challenges experienced by the oil and gas industry and the nuclear industry. Integrated operations implementation was instrumental in influencing the viability of the changing oil and gas industry, it should be considered a tool to assist with the sustainability of the nuclear industry.

Key Learnings, Recommendations, and/or Best Practices

Integrated operations were implemented during a time of change in the oil and gas industry in order to support the viability of the industry. During this time of change for the nuclear industry, successful implementation of integrated operations is essential to the viability of nuclear in the future.

Q&A

Q1. Our typical reaction to an issue in the nuclear industry is to create a new organization with new staff to make sure that issue doesn't occur again. When Delivering the Nuclear Promise, how do we capture the knowledge from people ready to retire so it can be easily used by the new generation in nuclear?
A1. The petroleum industry did not have a reason to change during its strong years. Changes in the business caused the change in approach and the utilization of integrated operations. This is the same path that the nuclear industry could follow.

Palo Verde Digital Modernization

Lorenzo Slay *(Arizona Public Service)*

Session Notes

- Obsolescence issues are driving technological innovations as equipment is requiring replacement and is no longer available for direct replacement.
- Consolidating training and software programs can optimize the use of resources and reduce O&M costs.
- The industry's fear of technology and 'set in our ways' mentality needs to be challenged to move the industry forward.
- Palo Verde is collaborating with Idaho National Laboratory (INL) to look at modernization of the nuclear power plant main control room.

- Partnerships with INL and Westinghouse are essential for accomplishing challenging projects such as the control room modernization project.

Key Learnings, Recommendations, and/or Best Practices

Partnerships used to perform research and development for plant modernizations are essential to the modernization of the existing nuclear fleet. Industry leaders must keep an open mind to accept changes in plant technology that can help with reducing O&M costs.

Q&A

Q1. What have you done in terms of implementing modernization at the Palo Verde plant?
A1. Palo Verde has gone wireless in the control room as well as the turbine building. Wireless communications facilitate things like electronic work packages. Palo Verde's approach to digital instrumentation and controls (I&C) is to delay implementation of digital I&C equipment and continue to replace components with like-for-like equipment through reverse engineering, if required.

Q2. What are you doing with technology to increase efficiencies in work management? Reduction in the number of man hours to complete tasks seems to be the focus of the industry. At what point do we begin to use technology to assist with reducing man hours to accomplish tasks on site?
A2. There has been initial use of tablet technology to assist with work management. Smart procedures are being developed to assist with efficiency improvements. Palo Verde is rolling out the implementation of these smart procedures. Palo Verde's Information Technology staff is playing a key role in the effective roll out and adoption of the new technologies.

Advanced Instrumentation, Information and Control Systems Technologies Pathway: Seamless Digital Environment for Nuclear Power Plants

Bruce Hallbert, *(INL)*

Session Notes

- 70% of the power generation cost at a nuclear site is attributed to labor. This is not seen in other energy production power plants.
- From the beginning of research efforts, there were 6 key development areas:
    1. Human Performance Improvement for NPP Field Workers
        - Electronic work packages, implementation of new technologies
    2. Outage Safety and Efficiency
    3. Online Monitoring
    4. Integrated Operations
        - This is where we will see the economies of scale
    5. Automated Plant
    6. Hybrid Control Room
        - Currently working with Palo Verde, Exelon and Duke Energy
- The seamless digital environment (SDE) is the path to get you to innovation.
- The seamless digital environment will allow for the work in one activity to be available to another work activity where it is useful. Communication of this material throughout an organization currently requires additional labor (cost).
- The main control room interfaces with various groups to address different activities. With the SDE, the efforts to digitally facilitate all of the communication between these groups would increase work efficiencies.
- Current control room monitoring can be expanded over time to include things like predictive preventative maintenance modeling.

Key Learnings, Recommendations, and/or Best Practices

The increased utilization of technology at nuclear power plants presents the opportunity to our industry to deliver the nuclear promise through operations and maintenance cost reductions. National laboratories and industry utilities have begun to look at different technologies to capture these cost savings. In order to keep nuclear technology viable, we must look at reducing costs to stay competitive.

Q&A

Q1. On slide #13 of the presentation, there is savings per plant? How do you get these values?
A1. Yes, they are per 2-unit plant. A consulting firm was hired to independently develop the cost savings estimates – these estimates are available on request from INL.

Westinghouse – State of the Business

Session Organizer: Sean Clark *(Atkins Global)*

This will be a session that provides an update on the business at Westinghouse following the bankruptcy.

Cross-Linked Session: N/A
DNP Session: No

Westinghouse's Role in the Nuclear Industry – Today and In the Future

David Howell (*Westinghouse*)

Session Notes

- In order to protect the company's core business and restructure the organization, Chapter 11 bankruptcy was filed in March 2017.
- Westinghouse's operating nuclear plant business line remains healthy and stable from a cash and profitability perspective.
- Westinghouse remains engaged with the V.C. Summer customers with the stop work efforts and reassigning resources, where possible, to the Vogtle construction project.
- Westinghouse has developed a 5-year business plan that includes exiting from bankruptcy status. This plan is in the process of being updated due to the V.C. Summer stop work order.
- Westinghouse will pursue a sale process. Toshiba is withdrawing from the nuclear market outside of Japan so the Westinghouse company must be sold. All efforts will be made to sell the company as a whole piece. It is believed that this approach is in the best interest of the industry and the United States.
- Westinghouse is currently a 100% nuclear industry company. The company is dedicated to the advance of nuclear power.
- Westinghouse was at a total of 43 different sites across the U.S. and Europe for the 2017 spring outage season. Over 4,000 people assigned as resources to these outages.
- The two AP1000 plants under construction in China are progressing towards completion. Fuel will be loaded at the Sanmen AP1000 plant in the near future and Haiyang will be loaded shortly after.
- Westinghouse has re-launched the Westinghouse Government Services Business. They intend to leverage their nuclear technologies to address U.S. government nuclear needs.
- Westinghouse intends to continue to pursue the construction of new nuclear plants. United Kingdom regulatory confirmation of AP1000 plant design was recently gained to support these efforts. Opportunities for entering the India nuclear market are being pursued.

Westinghouse Innovations:

- One of the biggest challenges Westinghouse's customers is having now is fuel.
    - Westinghouse's EnCore fuel will help to address some of these challenges.
    - Westinghouse will be installing lead test rods in the Byron station.
    - The EnCore fuel will achieve a 24-month fuel cycle that will help save their customers money.
- Westinghouse's WeLink program will link key subject matter experts in the nuclear industry to innovators around the world.
    - Westinghouse sees this as a way to help address the high cost of large R&D programs that are not as sustainable as they once were.
- Westinghouse is nearing completion of its Triton 11 BWR fuel.
    - 11x11 design is expected to save customers >$4 million per operating cycle.
    - Expected availability date of 2020.
- A next generation baffle bolt replacement tool is being developed.
    - This tool will provide a more efficient way to replace small amounts of baffle bolts.
    - This tool will be on stand-by for utilization at outages in fall 2017.
- LiveCAN has been deployed at 5 sites.
    - This is a system related to video and data communication between outage workers and experts at an offsite location.

Key Learnings, Recommendations, and/or Best Practices

Westinghouse is experiencing business challenges but has developed a plan to emerge from bankruptcy. The company continues to invest in its people and technologies and remains committed to the success of the nuclear industry through dedicated service to its customers.

Q&A

Q1. What will happen to WECTEC? Will that organization continue or be sold?
A1. WECTEC is part of the Westinghouse plan going forward. WECTEC is important to the current fleet and the construction of any new AP1000 plants. Second licensing activities will likely also require the support of the WECTEC organization. It is expected that WECTEC staffing will be reviewed and adjusted to align with the organization's restructuring plan. The core group of people, and the entity itself, will remain intact.

Q2. Seguin (INPO) – Did Westinghouse always have construction responsibility for the Vogtle and Summer nuclear plants?
A2. There was a consortium put together at the beginning of the project. The construction and NSSS portions of the plant were always guaranteed by the parent company, Toshiba.

Q3. Has Westinghouse considered the issues related with the sale of Westinghouse due to buyers outside of national security interests?
A3. The goal of the sale will be to maximize the value for the creditors and shareholders. The bidders list will be made known to the proper government organizations and discussions will be held on the path forward.

The Pursuit of "Excessilence" – Can We Go Back to "Good Enough?"

Session Organizer: Jim Little

The U.S. the nuclear industry is facing a new and significant set of challenges to its very existence and future including aging fleets, equipment obsolescence, fragmented supply chains, and ever increasing retirements of knowledge workers and an accompanying set of increasing regulations and requirements. The resulting increase in operational cost combined with of low demand growth, significant increases in competing sources of supply with historically low natural gas prices, and the rapid deployment of renewable technologies bolstered by regulatory policies with significant subsidies and tax credits will, if left alone, see nuclear generation significantly decline as investors will seek more profitable opportunities elsewhere.

The panel of key engineering, operations and regulatory executives and managers will explore further opportunities for significant cost reductions achieved through the critical and thorough re-examination of the requirements, and responses to those requirements that the industry has imposed upon itself over the past decades in the pursuit of excellence and continuous improvement. As the industry has already been successful in advancing risk informed regulation to explore whether proposed regulations actually produce a needed safety benefit, it seems logical to examine the industry's own self-imposed practices, using risk-informed techniques, to see indeed if they are producing the desired financial benefits as well. This topic is not without some controversy and hesitation and begs the question," Has the industry lost sight of "good enough" results and gone too far in the pursuit of excellence to end up in an era of "excessilence"?

Cross-Linked Session: N/A
DNP Session: No

Nuclear's Fork in the Road

Jim Little *(ANS)*

Session Notes

- Utilities are naturally diversifying through investment in other generation options like natural gas, solar, etc.
    - It is difficult to attract investment in the nuclear industry with declining profits and electricity demand.
- The nuclear industry is now at a critical business point.
    - With the nuclear fleet operating at 92% availability, is it feasible to think that we can advance the industry through small, incremental increases?
- Policy initiatives are underway that may change the nuclear industry when combined with cost efficiency initiatives.
    - How can we go deeper with cost efficiencies without focusing only on capacity availability improvements?
    - We should ask 'Why' we are doing something rather than just continuing to do it because we have in the past.
        - The nuclear industry should examine our current position and determine if we have gotten to a point of 'Excessilence' rather than Excellence.
        - We should consider what we can change, what we should stop doing and how we can back up without unintended consequences.
- The cost of the Nuclear Regulatory Commission is considered by some to be one area that is reducing the competitiveness of the nuclear industry. Is there merit to this view?
    - Answer: Merrifield (Pillsbury Winthrop Shaw Pittman LLP) – The NRC is too big. Right now, the agency consists of around 3,400. I believe that the agency can be reduced to 3,000 while achieving the same objectives.
        - There is a need for external reviews of the agency. Non-agency people need to review the agency and provide suggested inputs better the agency.
        - The commission must re-baseline the agency's attitude towards continuously improving.
        - NRC agency managers have to manage. In the past, there was a tendency to push issues down to lower levels. The bottom up organization approach must be changed to a top-down organization.
        - The commission needs to reinforce the notion that to be a good inspector doesn't mean you need to have findings.

        - The commission needs to set the tone that we don't need to reinvent the wheel. Asking 'Why?' to every task the agency has hindered progress.
        - The commission needs to set the tone that it is going to be an effective and timely regulator. Manage to a budget and time just like the industry does.
        - The agency needs clear messages from the commission.
        - The commission needs to get back to risk informing and common sense.
        - The industry and commission need to get rid of the notion that the NRC is the 'Gold Standard' of regulators.
            - The NRC is too big, has too many people and is constantly trying to reinvent the wheel.
            - This notion breeds complacency in the NRC when they need to lead the effort on changes being seen in the nuclear industry.
- Leidich (Western Electricity Coordinating Council) – Market designs in certain regions of the U.S. are challenging the nuclear industry. How can rates change drastically year to year? This only reinforces that capacity is not being properly valued in the market.
        - 37% of California's electricity is imported from outside the state.
        - The industry needs to look at what is in the cost of electricity generation from nuclear.
            - The allocation of overheads can drag down nuclear assets. Some companies assign company overheads to entire fleets without recognizing the impact to certain assets.
            - Bureaucracy around the work we do.
                - We have internal assessments, external assessments. We're watching ourselves many times over to make sure we're doing the right thing.
                - We need to question legacy agencies' applicability in the new nuclear industry.
                    - Why do we have INPO? Are they still needed or is our industry capable of performing safe operations without this added oversight and associated cost?
- What is the Delivering the Nuclear Promise initiative (DNP) doing for you at Robinson Nuclear Station? What is Duke Energy doing beyond this initiative?
    - Answer: Kapapolous (Duke Energy-Robinson Nuclear Plant) – Everything done over the past 40 years was done for a reason. When we look at redesigning the industry, we must make sure everything is done for a reason.
        - Duke Energy took the approach that DNP doesn't quite hit the mark.
            - DNA – Duke Nuclear Advantage
                - Still participated in and executed DNP initiatives.
        - In past 3 years, Duke Energy has been able to reduce outage costs by 30% and get outages down to ~28 days.
        - Duke Energy realized the need to inform the group of people spending in the organization with how spending impacts the organization's performance.
            - Tracking a budget only tracks spending. Informing the spending decision makers gets you in front of budgets to actually control costs.
- We must return to the days of suppliers and utilities interfacing to understand actual needs of the utilities. We must move away from new procurement standards to keep both parties at arm's length.
    - Maybe we should consider alliance contracts – look at combined success rewards for performance of utilities and suppliers.
    - We should ask if there are better models to promote success across the industry for vendors and utilities.

Key Learnings, Recommendations, and/or Best Practices

Executives and industry leaders need to be proactive and think in new ways about the industry. We should challenge the status-quo and find ways to increase cost efficiencies. Our industry has changed over past decades and a business as usual mentality will continue to dampen the progress of the nuclear industry.

Q&A

Q1. When you talk about bold leadership, who at the NRC do you think should be the person to look at industry game-changing initiatives?
A1. President Trump did not have a huge number of supporters before his administration was confirmed. We have an opportunity to have good things done at the agency and cabinet level now that his administration is addressing those positions. FERC has the opportunity to have a fundamental look at how we can give nuclear proper value. We need to get the NRC commission on board with these opportunities. NEI and the utilities have been doing good work but there are differences in opinion in the group on where the nuclear industry stands. We need to support industry advocacy groups and work towards a uniform message and goal.

Q2. How do you get bold, new leadership in a small, incestuous industry? People seem to only move around in the industry with little addition of new perspectives.
A2. We've cancelled V.C Summer, Vogtle's future is teetering and Indian Point is feeling pressure. We need to focus on these events in the industry and leaders internal to the industry need to wake up and lead the efforts to change the industry. The people at this conference need to go back to their communities and treat the current industry status as a significant event rather than a slow death through incremental changes. Changing our outlook on current industry events to see them as a significant, single event with drastic changes will change people's responses to those events and can inspire people to take the initiative to lead the industry.

Q3. How do you keep a pipeline of talent fresh to implement these initiatives?
A3. Robinson has been through the aging talent change over. Average ages in certain areas of the plant have decreased to late 20's and early 30's. The employees at Robinson have gotten together to address how to achieve subsequent license renewal. Slowly the industry will have to change over to new talent.

Preserving Nuclear Competitiveness Amid Technological Disruption

Session Organizer: Clinton Carter *(Luminant)*

Market forces and technological disruption are challenging the ongoing competitiveness of the nuclear power industry. The Fourth Industrial Revolution, using the capabilities of advanced technologies, holds the promise of enabling the kind of nuclear power transformation needed to ensure its availability as a key provider of energy for the foreseeable future. This session provides an overview of the drivers behind this technological revolution, what it means for the future and how, through collaboration, the nuclear power industry can continue to deliver its inherent benefits for all mankind

Cross-Linked Session: N/A
DNP Session: No

Advanced Monitoring and Diagnostics: "Preserving Nuclear Competitiveness Amid Technological Disruption

For accompanying video please contact Clint Carter at clint.carter@luminant.com
Clinton Carter (*Luminant*)

Session Notes

- The United States' new 'Sputnik' problem is the nuclear industry.
    - The nation rallied together disregarding divisive issues of that time to achieve a common goal.
    - The Kodak organization failed to adapt their core business and business processes to adapt to the digital environment around it and subsequently went from a premier technology provider to a company struggling to stay relevant.
- In the 'cave-man' days of our industry, most of the processes and monitoring was done manually. The plant manager was king of his 'kingdom'.
    - Now we've migrated to a fleet-level view of operations.
        - Advanced monitoring and diagnostics is coming into its own to further automate all data collection.
        - We should rely on technology to do the manual processes we have done for the past number of years. This change is imperative to the survival of our industry.
- With initiatives like Delivering the Nuclear Promise, the industry should focus on the 'end state' of those initiatives. We must 'begin with the end in mind' and understand our goals.
- Why do we need people walking around plants every day? Advanced monitoring technologies could eliminate these non-value added tasks and thereby reduce costs.
- In the past, needs and associated expenditures at plants were justified by being able to improve safety. In today's nuclear industry, we must consider a fleet-centric culture combined with an entrepreneurial mindset.
- A continuous transformation strategy must be developed. Technology will continue to transform and the industry's strategy to address the technological transformation is key to a prosperous future for the industry.
- Luminant has built out wireless monitoring solutions for a number of plant components. These components are monitored from the Luminant Power Optimization Center (POC).
    - The Luminant POC monitors equipment across their generating fleet (fossil and nuclear) in a central location.
    - Luminant's POC has extended operations to serve other utility plants.
    - The system monitors plant components continuously to bring potential plant issues to the attention of plant operators before the issue becomes too large.
- Success story of the Luminant POC:

    - Primary oil line going to the bearing of a fan was damaged and oil was spraying on the fan collecting coal dust causing an imbalance of the fan blade. Operations personnel were made aware of the issue on day one of the POC's operation and the situation was remedied before complete damage and disrepair to the system.
- Success story of the Luminant POC:
    - Main transformer winding temperatures at an operating generation site were increasing quickly. Pumps and fans for the main power transformer were not operating as designed. Site operations alarms in the control room were not alarming operators as designed. The Luminant POC made the plant operators aware of the issue and resolution was quickly achieved. If the POC had not intervened to alert the plant the transformer would have been a total loss and it likely would have not been economical to restart the plant.
- Luminant is offering a system called NuSuite to expand the benefits associated with the POC to interested nuclear utilities.
- A proposed efficiency bulletin for advanced remote monitoring is being presented to the DNP steering committee for approval.
    - A timeline has been developed for the release of the official efficiency bulletin.
- Luminant is working towards the Industrial Internet of Things.
    - A system of self-monitoring equipment feeding information on industrial applications back to a centralized monitoring facility.

Key Learnings, Recommendations, and/or Best Practices

The nuclear industry must transform in order to survive in an environment of disruptive technologies. The current path forward is unsustainable. Technologies similar to Luminant's POC are essential to reducing costs and maintaining competitiveness.

Q&A

Q1. How is the role of the system engineer changed with the roll out of this self-monitoring equipment?
A1. The role is enhanced now that the engineer does not have to walk down the equipment. There will be natural attrition due to age of the industry and the role of the engineer will become more focused on the technical tasks rather than regular oversight.

MAINTENANCE AND WORK MANAGEMENT

INPO Review of 2016 & 2017 Trends in Work Management and Maintenance

Session Organizers: Pete Arthur *(INPO)*, Bryant Hearne *(INPO)*

This session starts with a presentation by INPO on the current trends in performance. The session then opens to a discussion of what is working and not working by plant personnel in the areas discussed by INPO. Participants will leave this session with a good understanding of industry performance in general. They will also gain specific information and contact personal for what is and is not working in the areas discussed by INPO.

Cross-Linked Session: N/A
DNP Session: No

INPO Review of 2016 & 2017 Trends in Maintenance

Pete Arthur *(INPO)*
Note: INPO presentations will be available through the INPO website

Session Notes

- Maintenance related AFIs account for half of total AFIs for 2017. Maintenance related AFIs are currently on tracking to be higher in 2017 than 2016.
- Rigging and Lifting has a high number so far this year, so watched focus area for INPO during evaluations.
- Consequential ICES events are on track for Mechanical Assembly to be higher in 2017 than in 2015 and 2016.
- What INPO is seeing: Training not in place for mechanics on proper selection of anti-movement devices.
- To determine if managers understand good field observations, during evaluations INPO will ask for 3-4 main technical fundaments that the manager is looking while observing the line.
- INPO is observing that the managers are not always prepared to challenge the workers in Pre-Job Briefs. Managers can't effectively challenge the line if they don't know the technical side of the work. Most of what is observed is a reinforcement in Pre-Job Briefs, and managers are looking for in observations is Procedure Use & Adherence and other Human Performance Tools during job performance.
- The IER is discussed in this session, on track to be out on August 28, 2017
- If a site is in elevate or higher for a maintenance-related reason at the time of the IER issuance, the site must report on the IER integration. Otherwise, sites will take a graded approach. If a site goes elevate after the issuance of this IER, this most likely will be incorporated into the recovery/or action plan (this has not been decided yet).
- Due to what INPO has seen at sites, this IER will have limited or no HU process changes incorporated.
- In the future INPO hopes to have Lessons Learned from sites on this IER on the Maintenance webpage.
- The focus of this IER is for Maintenance to get ahold of the maintenance fundamentals. Currently, in most cases, Human Performance Tools are used to try and fix the errors/problems encountered. However, this is not fixing the issues - trends have been increasing over the past few years. This requires a mindset shift in how completion of a job in the field is evaluated. The industry must move from ***"Are all the steps in the procedure circle/slashed?" to "Is the job complete technical sense? Did what I just finished, make sense? Does this look complete to me as a craftsman?"***
- The focus will be on fixing behaviors, so that the Human Performance process isn't where mistakes/errors are caught.
- A good way to really evaluate if the error/mistake was a lack of understanding fundamentals is to ask ***"If I eliminate human performance tools from this task, should the mistake have been realized? Should this error should have been prevented solely based on the worker's fundamental knowledge of the component/system?"***.
- INPO rarely see behaviors/fundamentals denoted as the cause in ICES reports, and if they repeatedly see that sites submit ICES reports that are just Procedure Use & Adherence or a Human Performance tool as the cause, then that's getting flagged. It tells INPO that maybe that site does not actually have a handle on the fundamentals.
- Next revision of INPO 05-004 will incorporate INPO 15-001, and INPO 12-007 into it.
- AP-930 will essentially be a re-write of the document.

Q&A

Q1. For plants that are reducing the size of management staff, will this have any effect on workload for them if they each have more employees?

A1. With the shift to use of minor maintenance, and maintenance single person tasks from the DNP Efficiency Bulletins – shift to reliance on maintenance fundamentals over Human Performance Tools becomes very important. If a task is only performed by a single person, there can be no peer check. New work situations call for new ways of ensuring excellence.

Q2. Doesn't something have to come off the plate?
A2. This shift should not be adding something. The current view is 10% technical fundamental reliance, 90% Human Performance Reliance. This will be a drive back to 50% technical, 50% Human Performance Tools. This shift should not add work, just refocus onto the field work. To accomplish this training will need to do a gap analysis to determine where fundamentals training is needed, not additional training, just updated training.

Comment: Entergy has started to use this approach – they identified gap in Maintenance Fundamentals. So far, it has not added work, to accommodate this shift they have updated cycle training, changed Pre-Job Brief template, and walkdowns. "Anyone can follow procs, not everyone can rebuild a pump" – the latter is what needs to be focused on.

Q3. In the ICES reports, what are the contribution from supplemental workers? Do they make up a significant portion?
A3. No, supplemental worker errors do not make up an overwhelming majority, most are from the in-house craft.

Comment: Interestingly, these errors are not primarily from the new workforce. This was an area of concern that was looked at – to see if errors were predominately from inexperienced workers, however, a greater percentage was seen from seasoned workers.

Q4. How was it determined that errors weren't actual Human Performance errors? How was it determined that it was technical fundamentals problem?
A4. When looking at events, the reports included bad technical behaviors of maintenance fundamentals. It was clear in the report that something was done/not done that should have been caught by understanding fundamentals (lifting all leads at once, not appropriately shielding, etc) and not solely by the procedure use. Correct procedure use is a barrier to error, yes. But should not be the main thing between the worker making an error in the field and not.

Comment: One site shifting this focus away from over-reliance on Human Performance Tools to Maintenance Fundamentals shared that they had great buy-in from Maintenance when this training changed was proposed. The craft workers were receptive to training on fundamentals and were very welcome to the change, and felt like it was about time and was needed and relevant to their craft.

Q5. Currently the maintenance fundamentals are wordy and long, especially compared to the Operations fundamentals. Will there be a simplified version coming out?
A5. The next revision of INPO 05-004 will have revised and simplified Maintenance Fundamentals.

Hope Creek developed a training Dynamic Learning Activity for Maintenance Fundamentals - for more information contact John Garecth, Director of Work Management for Hope Creek at John.Garecht@pseg.com

INPO Review of 2016 & 2017 Trends in Work Management

Bryant Hearne *(INPO)*
Note: INPO presentations will be available through the INPO website

- So far only one AFI to date in Work Management. INPO realizes that they have a tendency as evaluators to look at surface on work management. Depending on the age of an issue, it's possible to have and AFI and be exemplary, so sometimes this does not show the whole story.
- In general, if the outage schedule was accomplished fairly close to the planned time, it's considered good. However, more probing beneath the surface needs to be done. Stations must ask themselves, if critical scope is selected and focused on, why cannot 100% of the planned work be competed?
- In the past few years, the strengths given have been for site turning their programs around. Not necessarily just for pure strengths, but fixing the program.
- The evaluation schedules are changing, there is more involvement for the peer on the INPO evaluation team. This change was made in order to get more value from the peer's unique perspective. The peer is now gone from their home site for 3 weeks.
- There is a great opportunity to innovate and use technology to reduce the number of times a repetitive work order has to get touch by the planner. There are attributes that still get touched in these work orders (needs to try and automate as much as possible).

- In the future, sites might to perform a re-evaluation of functional equipment groups, to make sure all the equipment in a functional group, should actually be there.
- INPO has been to other countries without the process we have, and it still works. Take any process you want, it will work. If you are encountering problems in Work Management, it's probably not your process.
- Pre-release Work Orders: It will take work to maintenance used to pre-release. It requires a culture shift. At some sites, they will give the Ops a curtesy phone call when starting work. Eventually want to be at the point that Ops know what we are working on today and expects the work to be done at a certain time, so no stop by or call is required.

Q&A

Q1. Is the 10% metric going to change?
A1. New revision of AP-920 will not have any additional bands, 10% still will be the indicator. Mostly likely there will be more on instances of occurrence showing up as well.

Q2. For the change in evaluation process you described, what are key benefits?
A2. More thorough scrub of work management can be performed (which was seen to be needed), some cross-functional areas were determined to be functional. Better peer interface by having them part of the team longer – the evaluators desire their current perspective, and they provide more challenge in the gap focus areas.

Direction of Delivering the Nuclear Promise Work Management Planning and Execution Team

Session Organizers: Pete Arthur *(INPO)*, Bryant Hearne *(INPO)*

This will be a very informative session that will help participants understand the big picture of what is coming from the Nuclear Promise. A similar session conducted last year was well received by participants. Some said it was the first time they had heard of what other Promise bulletins are doing. This discussion will point to other sessions in our tracks. This discussion will also discuss what we are "getting for our buck" with the Promise.

Cross-Linked Session: N/A
DNP Session: Yes

Direction of Delivering the Nuclear Promise Work Management Planning and Execution Team

Tony Mueller Jr. *(First Energy Corporation)*

Session Notes

- Clickview is a good program to look at. It can take day to day work order history, and helps sites understand where the most challenges on your components are.
- Upcoming: Standardized Performance Indicators (all sites will be looking at the same).

Q&A

Q1. Where is the industry on standardized Personal History Questionnaire, and moving to electronic forms?
A1. Some sites are using it, not all.

Comment: The Union General Presidents Maintenance Agreement on Compensation is being revised this year, if you would like to give input, please contact Brian Wiese, Senior Manager of Projects & Maintenance Services, Entergy, at b.wiese@entergy.com

Q2. Is an STE (Standard Training Examination) good infinitely?
A2. Right now, yes. Training is moving towards more need based, using the Systematic Approach to Training process.

Comments:

- Issue potential at a site where workers were that were on-boarded that had a STE qualification. This qualification was accepted as good, even though worker had not performed task in 5-10 years. Have not seen any periodicity built into to refresh/requalification. Suggestion was made that qualification current does not mean proficiency, and that there might need to be a proficiency check added.
- Recommend that all sites establish (if they don't already) a branding and public relations plan to their employees for Delivering the Nuclear Promise Efficiency Bulletins. DNP is changing the nuclear industry's culture. You are now telling them it is okay to do

something that once was not, this will not be easy. Communicate your message clearly and often to the site: know why you did it, and have your reasons to support it.

- INPO does not evaluate DNP Efficiency Bulletins, but they know what they contain and advise to make sure to use the guiderails. INPO ranked them when they came out to look at their concerns for nuclear safety and reliability and are looking at their criteria. Overarching parameters can be met with successful implementation, if the guiderails are used properly.

Q4. Has anyone gotten deep into the change management?
A4. At a single utility, a graded approach was used where they went and got daily input while refining their process.

Comments:

- There are benefits to taking advantage of JITT training. One site has it embed into their procedures. So, there is not cycle training for a certain topic, the trigger to have the training is captured in the procedure. Benefit is, instead of entire crew or department going through the training for a task, only have the specific group performing the task go through the JITT.
- For categorizing preventative maintenance, one site has observed the mechanics "playing it safe" when reporting on work orders and suggesting to maintain the current frequency, even if the component was in very good condition. Then, based on that feedback, the engineers are not reviewing that PM to extend the frequency, since the mechanic reported the frequency was good. Need to ensure that Maintenance understand the frequency levels, and how to report. Suggested that I&C Work Orders are an easy target for this, since there is a measurement of something. Material condition can prove harder to judge.
- Post job critiques – most sites aren't great about regularly doing these. This would be a good place to capture what was seen in the field to warrant a PM frequency extension. It seems that no one wants to be the responsible for making the change. Is the leadership empowering the line to make these decisions? Understandably, individual engineers and maintenance workers don't want to open themselves to being to the one to blame for a failure. At its core, the DNP is about accepting some risk, and it's hard to make that culture shift.
- Farley went through 400 PMs to look at what could be reduced, and in the end, only achieved a reduction rate of 10%. The question was posed - is this really the right number? From the team working on reducing the PMs the feedback gathered was that they were afraid there would be reproductions if they made a mistake and eliminated a PM that they shouldn't have, resulting in some type of failure. Farley had the Site VP sit down with team and convey that the risk of mistake is understood and accepted, and they trust decisions of the team. The Site VP shared that there was an understanding that there would be some mistakes, but the efficiencies gained were worth it. The team went back over the PMs and from the original number of 400 PMs, achieved a reduction rate of 40%.
- Currently we see a lot of "soft" cost savings, in time returned to employees. "Hard" cost savings are realized in not needing as many people to accomplish the work. Allow attrition through retirements.
- At one site, they say "hard" cost savings through less materials being ordered. Saw that components were being replaced that were still in good condition. With PMs extended the purchasing was less often.
- Caution against completely halting hiring. At one time a site had 15 year gaps in most departments and was undesirable. Save off waves of retirement by staggering hiring, maybe reducing but not completely stopping.
- The upcoming "Transform the Maintaining the Plant Organization" EB timeline is to have a draft out this month to CNOs for review, and then have the bulletin later this year, in the fall.

Measuring Cost Savings from Work Management / Maintenance Efficiency Bulletins

Session Organizer: Jon Anderson *(ACA)*, Pete Arthur *(INPO)*
Room: Amelia Ballroom 1

This workshop will include proactive game changers from Business, Maintenance and Work Management. These experts will be discussing the Nuclear Promise changes being made to reduce the cost and increase the effectiveness of Work Management and Maintenance. They will be identifying concrete actions that have been taken to significantly improve the value of these initiatives. This will be a conversation changing event where we measure the before and after costs associated with these topics. The topics they will be discussing include:
• EB 16-15a: Work Screening Process
• EB 16-15b: Utilizing Minor Maintenance
• EB 16-15c: FIN Team Efficiency

Cross-Linked Session: Business and Economic Performance
DNP Session: Yes

Discussion of EB's issued for Work Management at SNC

John McDonald *(Southern Nuclear)*

Session Notes (Maintenance and Work Management KM)

- There should be a great discussion on challenging operations, the best sites are the sites that have continuous discussion and talks about the work management.
- Schedules drive operations review, so scheduling minor maintenance is necessary instead of having the traditional minor maintenance list.
- EB 16-31: Pre-Approval Criteria for Work Execution - Implementation is in progress on this. This will lead to worker efficiency as well as the opportunity to place more work in the schedule.
- Reducing work management administrative burden and inefficiencies accumulated over time

Key Learnings, Recommendations, and/or Best Practices

Suggest considering the time of day you hold screening meetings: Farley made changes to when WO screening is done. Meeting was in the morning, but was moved to 1230 to make sure the FIN team has time to go through the CR package and perform walk-downs, to know which are minor maintenance or not. This resulted in the FIN team more prepared at the meeting, since time was given to gather information.

What INPO is seeing is that the sites that do it best have a conversation/discussion at the WO screening meeting. If at your site, you go to a WO screening meeting and there is no discussion, challenge that. You are probably missing an opportunity by not challenging. Challenge Operations on the use of the prioritization matrix. There is no "I want it" listed on there.

Q&A

Q1. Has Southern done any analysis to see why Vogtle is behind the others in implementation?
A1. Lack of understanding that minor maintenance can be scheduled. Need understanding that minor maintenance is not only on FIN.

Comment: INPO sees plants treating Minor Maintenance like a job jar or the "honey-do" list. This should not always be the case. If it needs to be done, schedule it, even if it's minor maintenance. Operations will know you are doing this because it is schedule.

Q2. Are FIN orders included into Minor Maintenance?
A2. Yes, it includes everything but a full package.

Comment:

- One site implemented a delta level schedule for Minor Maintenance to make sure it gets done, however, doesn't get penalized if it slips some. Because it has pre-authorization, can just go do the work.
- With eliminating some T- week meetings, managers have used that time getting into the field.
- One site described changing their process – they didn't feel they had the maturity required and for reviewing WOs so they set up a line by line review to teach and coach the organization on this new process for a while. They decided to change the daily 1600 meeting essentially be a placeholder in order to give time back. Left scheduling it at the discretion of the Work Window Manager, and they would set attendees list each day. Only those who had not already submitted information were required to attend the meeting. This is built in accountability like 'if your stuff gets in you don't have to attend the meeting'. The meeting is held whenever the WWM needs more information in order to have a successful turnover with the on-coming shift.

Q3. Have you all seen any benefit in how much work is getting done?
A3. Productivity is up and not everyone is going through the shift supervisor to approve work. We are seeing time being won back since they aren't in line waiting for approval, but we still are a work in progress. This change has been effective for 2.5 months.

Q4. Have you been looking at wrench time as a metric to measure improvement?
A4. Not yet, but expect to see more wrench time availability. Had people stand in line for 2 hours to get approval. So, that is actual time being returned to the worker for other tasks.

Q5. Are you all getting any pushback on the shops doing more Minor Maintenance?
A5. We are still working through at Harris to help them see what's in it for them, what benefits them about Minor Maintenance. It's a culture shift for those who aren't on the Fix-It-Now crew.

Q6. So far, we have been talking "soft" savings, are there any "hard" cost savings you have seen?
A6. Yes, three planners did not have to be hired. Personnel equates to "hard" savings. Reductions in meetings and adding pre-authorization are "soft" savings, but we can physically see the time saved.

Q7. Since rolling out the pre-authorization process, have you seen any increase in corrective action work orders as a result?
A7. Not yet, since we have only been at this for 2 and half months.

Q8. Do any of the metrics you've shown today take into account any backlog reduction?
A8. No, not specifically.

Measuring Cost Savings from Work Management / Maintenance Efficiency Bulletins

Adam Dow *(MCR Performance Solutions, LLC)*

Session Notes (Maintenance and Work Management KM)

- Southern has started adding monetary cost of the work week at T9. This is O&M work that is maintenance's budget. Allows maintenance management to question the work going on that week.

Key Learnings, Recommendations, and/or Best Practices

In the future, difficult decisions will be made as the budgets we know today may be dramatically reduced depending on what happens in the market.

Q&A

Q1. Your direct correlation of projected cost savings, does that only include people? Or take into material costs as well?
A1. This was the entire labor piece except for EB on the 50.69 process, since it gave cost savings in the EB.

Q2. On your estimate of the 200 WOs a day, was that just tasks, or the total packages? 200 seems a bit high, we do about 300/week.
A2. That was packages. So the estimate might be a little high.

Q3. Were large projects and outage costs looked at?
A3. No, only O&M.

Comment:

- For each bulletin the authoring subcommittee came up with a cost analysis. The expected savings is known. If we are implementing these bulletins at every site, are we fully implementing them and seeing these cost savings? At some point the CNOs have to say to the Site VP, I'm taking away this much of your budget because you told me you have implemented this bulleting. Make sure your site harvests the "soft" costs into the "hard" costs.
- At one site, they have implemented a lot, but with small gains, don't always see more work getting done. Sometimes it's hard to find something small to place into the work window gained, if it's only about 1-2 hours.

Q4. In your analysis of PM reductions, did you add any cost back in for the corrective action needed to fix the few mistakes that fall though?
A4. No, that was not included in the analysis.

Comment:

- Bottom line, we will be judged by the cost/MWh. We must keep this in mind.
- In your analysis, for the PM reduction you said you only accounted for the labor cost reduction, there will also be a gain due to less materials being purchased.
- Reducing the number of critical PMs will also drive down the costs, we may still be doing the work, but non-critical parts are usually much lower in price than critical ones.
- With high capacity factors, we don't have an opportunity to make more revenue through increased generation. Are there any other creative options to make for revenue as an industry? What tools do we have that could be marketed to other industries?
- These efficiency bulletins are not magic black boxes. Real cost savings have to be found in order to work, and that can be a challenge. Sometimes you have to take a numbers approach. Instead of finding reductions, then counting your savings, sites might have to come up with the number first, and then make reductions until they meet that number.

Proposed Simplified Work Management Process (Revision to INPO AP-928. The target for issuance of AP-928 rev 5 is 9/4/17)

Session Organizers: Pete Arthur *(INPO)*, John McDonald *(Southern Nuclear Company)*

This session will introduce the proposed simplified work management process. The simplified work management process is intended to expedite the work flow for new incoming work and significantly reduce the "hands on" or "touching" of repetitive or reoccurring type work. Repetitive or reoccurring work will introduce the concept of more automation and less human interface in order to reduce the "touching" or "hands on" of these type tasks.

Cross-Linked Session: N/A
DNP Session: Yes

AP-928 Rev 5 Overview

John McDonald *(Southern Nuclear Company)*

Session Notes

- Do we really have a detailed cycling plan (CP) to complete work? Some change officers believe in a cycle plan that is too detailed, the real challenge is to take a look at CP. "Can I grab that work plan and just go to work or do I need a selected process to pick and choose which buckets to complete." Need to answer if it is detailed enough for this automation?
- "Someone needs to do this activity that means it is not auto generated"; the discussion that came out of this is that the Ops PM can recreate the clearance work and we need a clear understanding of what Auto Generating is, if it includes someone it isn't AG.
- Problems of never auto generating the parts request, tie it into materials management program.
- Simplified work management process is based on "can I absorb the work into the work week, and do I have my constraints resolved?"
- Desired end state streamlined work management process – need to provide a proper methodology for work prioritization to ensure the right work is done in the right time-period.
- Maximum benefit is obtained when this efficiency opportunity is implemented in conjunction with efficiency bulletins EB 16-01, Eliminate Administrative Changes to Preventive Maintenance Work Orders, EB 16-02, Implement a Graded Approach to Walkdowns, EB 16-15a, Utilizing Minor Maintenance, EB 16-15b, FIN Team Efficiency, EB 16-15c, Work Screening Process, EB 16-16, High Cost, Non-critical Preventive Maintenance Reduction, EB 16-22, Implementing an Effective and Efficient Work Management T-Week Process, EB 16-25, Critical Component Reduction, EB 16-31, Pre-approval Criteria for Work Execution, EB 17-03a, Value Based Maintenance, and EB 17-11, Maximize Implementation of the Surveillance Frequency Control Program.
- Overall, simplifying the work management process will allow department managers and supervisors to quickly respond to new equipment deficiencies while maintaining the schedule, and provide more time to focus on preparing and executing work of greater importance
- Let's talk about getting work in the WM short process cycle faster – work comes in, selection process, freeze, go do it, can't do it, do loop, why can't maintenance do PM and surveillance. All incoming work in FIN team.
- Cost gap analysis to see if it supports implementation of the simplified work management system or requires continuation of the traditional work management system.
- Road to green – use to use a system health report to grade work completed, now have eliminated a lot of these tools
- AP-928 is a gear document / guideline. Rev 5 has the option for the simplified process.
- Change management process big picture not there, but individual experts are the ones who need to implement – perhaps through Maximo.

Key Learnings, Recommendations, and/or Best Practices

- Need to keep FEGs running, the other half of the industry need to learn this process and start implementing it – Contact Brent Jungman at Callaway.
- Duke's work with DNP and CM is probably top in the industry, reach out for those leaders for advice- Contact Tom Natalie & Chuck Morris
- Great Change management process currently in place – contact info (Carl.thiele@aps.com for 56.9 WCM plan)
- For best practices on Electronic permitting – Contact Alan Jelalian of EPM (ahj@epm-inc.com)

Q&A

Q1. Can you expand upon the constraints of a FIN team?
A1. FIN team can have a backlog; question is the management of that backlog. Need a quarterly review of backlog for the FIN team. Question comes up now of how we resolve procurement engineering.

Q2. Where's the work planning milestone?
A2. It's identified as what needs to go into the planning scope selection and also what minor maintenance gets accomplished.

Q3. Has there been an effort to start with high level attributes of work to be completed, reinvent process with zero base model?
A3. Started from scratch for lean effort on WM, found interface is where the real work needs to be done.

Q4. What is the value of multi week FEG?
A4. Interjecting work into its prime accomplishment times, or when you want to bundle this work with a similar work process.

Q5. Number of restraints in procurement engineering; is there a look at the aggregate of the efficiency of this process?
A5. It comes down to the quality of CM program; we can't assume all groups will automatically support you because they may have their own initiatives. We need that rapid response team to assist.

Prerequisites for Cost Reductions

Session Organizer: Jon Anderson *(Anderson, Chavet, & Anderson)*, Adam Dow *(MCR)*, Jordan Gillis *(ScottMadden)*

The cost of operations at a nuclear plant can be reduced by 20 to 30% by "simply" reducing the number of full time employees, supplemental employees, and amount of overtime. However, safe and efficient implementation requires that several necessary "prerequisites" are met before these reductions can be made in a way that realizes actual improvement. This workshop will include some of the most forward thinking Business, Work Management and Maintenance personnel who are analyzing the Efficiency Bulletins and developing a strategic approach to not only implement the bulletins, but also ensure these prerequisites are met. Engaged participants in this workshop will leave with a greater understanding of what needs to happen to be ready to make changes and sustain safe operations with only 70% to 80% of their current staff.

Cross-Linked Session: N/A
DNP Session: No

Prerequisites for Cost Reduction (Presentation not included in Knowledge Base)

David Kruegel *(NextEra Energy, Florida Power & Light Company Nuclear Fleet)*

Session Notes (Maintenance and Work Management KM)

- FPL was able to reduce internal spending by 14% with no impacts to the site. External spending was determined to be driven by outages. Looked at how they were bidding work, how many equipment types were serviced, how many WOs, saw they were outpaced what the personnel could do.
- Identified waste, found the multi-touched items, built-in repeat cycles and rework. Captured standardized work plans. Categorized everything down to a commodity to evaluate across the fleet, to identify who was doing it best.
- Leveraged the fleet, even went in with non-nuclear parts of the fleet to look at purchasing in bulk.
- Analyzed work requirements based on detailed build up, strategized, and were able to negotiate with the vendor to reduce 20% of costs for turbine work.
- Interestingly, they found that practices/behaviors at sites had more effect on savings, than type/style of plant.
- Look for ways to bring maintenance in-house. They found cost savings from this, and the shop was eager to learn and do this work.

Session Notes (Business and Economic Performance KM)

- Collaborating with key vendors on productivity plans to with win-win benefits for safely taking costs out.
- The difference between hard cost and soft cost savings – where is the offset and what are you going to be doing to get that money out of the budget.

Key Learnings, Recommendations, and/or Best Practices

- Point beach had the best practice for strategically sourcing.

Q&A

(Maintenance and Work Management KM)

Q2. How difficult was it to align across all the sites?
A2. We attempted to make it a grass roots type thing, even if they were fleet driven initiatives. For example, Electronic Work Packages. We made a journeymen electrician at each site, the champion of this initiative. We found someone who believed in the benefit to switching to digital and was well-respected, and they became they king of this on their site. This proved to be effective for us.

Q3. How was your change management process? Even simple plans can be tough if you are the first to go through.

A3. We shared resources from site to site on outages so each site could see the benefits. We had comprehensive change management plans. With rolling out new processes, there was some duplicate work in some cases, but extending the timeline and strategically selected the champions at sites helped the growing pains.

Q4. For turbine services, how did you reduce costs? Did you have to bring in some outside business consulting?
A4. We figured that out in house. We had multiple vendors for turbines, and inconsistent results. So started strategic sourcing. Costs have been continuing to go down. Had to create a specialty union rate in order to keep the same people on the job.

Q5. As you reduce your staff, what happened to supplemental workers? Did that go up or down?
A5. Down, that was part of the cost reduction. Among sites, craft is not shared. Engineering is centralized.

Q4. How difficult was it to bring former vendor performed tasks, in-house?
A4. Did not have too much of a problem with the transition. We also had one site that was already performing the task in-house, and that helped.

Comment: With the DNP EBs, there is no true forcing function to ensure sites see the cost savings that were projected. It's designed to be on the CNOs. They are to be the drivers, holding sites accountable to finding the "hard" cost savings.

Comment: As our "go ideas" are approved, then the money is taken out of the budget. Then if it's seen that we are no getting the cost savings we expect, they have to go back to the steering committee and tell where else they will get the money from in order to make that number.

(Business and Economic Performance KM)
Q1. How difficult was it to get alignment of strategic objective from HQ to sites.
A1. Using SIP (site improvement process) which was fleet driven and assigning key personnel (senior electrician).

Q2. Talk about change management with DNP initiatives.
A2. By bringing personnel to other sites and informing those of what the best practices are currently.

Transforming Nuclear for Long Term Competitive Operations

Don Goldsmith *(Xcel Nuclear)*

Session Notes (Maintenance and Work Management KM)

- Every material request, contract request, or contract change that was above 5k, is gone through daily by the "control tower". This team is led by Maintenance Director, with reps from engineering and procurement.
- Major success – in 24 weeks, reduced spending by 6 mil dollars, through the Control Tower's cancelations and changes.
- Overtime: benchmark is 2% in the industry, and saw they were above that. Developed a risk flowchart to determine if the work actually needed to be accomplished in overtime.
- Evaluated open contracts, reviewed all in one week and got back 8%.
- Staff augmentation reduction – initially underestimated this cost. In two week-long reviews, found they could reduce personnel by ~100. Currently working through a burndown curve to reduce augmented personnel.
- Will provide Performance Indicator transition metric templates if anyone is interested. Contract Don Goldsmith, Xcel, General Manager of Fleet Operations.
- Put in continuous improvement centers. Converted meeting rooms, that are open 24/7 – focus of the room is all the initiatives, work down plans, place to challenge the leaders of the initiatives on if we are meeting the goals. Also, it is an idea generation center. Individual contributors can walk in and submit an idea, then ideas are tracked across the board to see how they are being evaluated. You can see exactly what they plan is, what the progress is, and what the benefits have been post-implementation.
- In the first 2 months we had 152 walk in ideas, 19 of those were immediately actionable, 38 are being evaluated for use.

Session Notes (Business and Economic Performance KM)

- Xcel is a regulated utility but will soon be cost competitive.
- To drive cost control you need to change behavior. This has been implemented through the "Control Tower", which addresses all the materials and services spent.
- The biggest growth of staffing has been in the support organizations and functions.
- One of the key components has been to over-communicate, to tell people how you are going to progress, the steps taken, the process needed.

- The goal is to get down to $25 MegaWatt hour, to do this we need to bring down our O&M by 6-7% every year for the next 4 years.

Q&A
(Business and Economic Performance KM)

Q1. What kind of hurdles did you run into? Labor problems?
A1. Wave 1 of all departments was not a developmental program. We are working with HR in order to be ready to centralize those functions and take out unnecessary resources.

Q2. How big is the IT group in this process of automation?
A2. They are the first partner in this automation process and provide the correct staff needed.

(Maintenance and Work Management KM)
Q1. What kind of hurdles have you encountered?
A1. Have change packages ahead of time. Centralizing jobs mean reducing about 100 jobs.

Q2. Do you have an example of one of the 19 ideas that was immediately actionable?
A2. At our site, we had an observation program that was specific for nuclear, an idea that came is was to use the one the rest of the company is using. We checked into it and it was lower cost, and still met our needs.

Q3. What is the sustainability of the continuous improvement centers?
Q3. We held open houses for them to kick off, and periodically make videos highlighting ideas that were brought in and how they have become reality for the organization. In the past few weeks we have had another 50 more ideas have come in.

Q4. How big of a role has technology played in being able to do staff reductions?
A4. A significant one, IT is a partner in helping drive the enablers to accomplish reductions.

Q5. Support organizations did not get to be the size they are currently, just because they wanted to – they were driven by leadership expectations. How is leadership changing what they expect from support organizations? Are you getting a behavior change from leaders?
A5. We did a day in the life, and found that we had allowed support organizations to be reactionary or just in time. We also found people had large job descriptions, but really were only doing a narrow scope and each got specialized. We have gone back to having everyone do all duties of their job description. The transition in expectations of our support organizations is in our risk matrix. Preparing the organization for no more just in time, that priorities have to be set. Rolled out last week, so haven't been long enough to see behaviors yet.

Prerequisites for Cost Reduction

Amir Shahkarami *(CASe Global Partners)*

Session Notes (Maintenance and Work Management KM)

- When someone called to ask for something – ask the question, "how does this fit into the company's/department's vision and goals"? If it doesn't, do you really need to be doing it?
- Speaker has seen great behaviors at Palisades - they take ownership for the problems, no blame game when there is a failure.
- When you have a failure, are you going back to behaviors, preventive program and culture to see if those contributed to the failure? You can spend all the money you have on Long Term Asset Management, but if you don't have good culture, it doesn't matter.
- Operation – leads & demands at the site. Engineering and Maintenance must both have 100% accountability. Is maintenance a part of your root causes? On the ERI ask yourself, who owns the indicators? Does engineering own too much? Can Maintenance share more and add valuable insight. Equipment reliability should be owned by all stakeholders.
- Fix the known problems – you know what's broken. Run To Failure does not mean Run To Forget. With DNP, maintenance has more responsibilities on making decisions now, make sure they own that.

Session Notes (Business and Economic Performance KM)

- The correct nuclear culture is essential for fixing known problems within the industry.
- Equipment reliability has complete accountability covered by both engineering and maintenance.

Q&A
(Business and Economic Performance KM)
Q1. Where do you think the high value things to go after are in DNP?

A1. Going after PM DNP and cost perspective still has a lot of progress to be made and improvements needed.

Q2. What do you see as the biggest pitfall that we need to be aware of as maintenance backs off of the technical side?
A2. Sometimes maintenance doesn't have a technical side, they need to have the ability to gain enough technical knowledge.

(Maintenance and Work Management KM)
Q1. Where do you think the high value thing in Equipment Reliability is to go after?
A1. Going after de-classifying components and PMs. However, from culture there is still work to do to accomplish this. DNP (to date) does not address the culture, but if you can get a handle on it as you make these changes to culture with rolling out new processes, you capitalize on this. Be aware there might be some slip, we will have to find where we went too far.

Q2. With the upcoming "Transform Maintaining" EB where do you think the challenges are as we pull engineering out of the equation in some places?
A2. Technical competency may not be there; we have to transition craft into having more of this. Will maintenance gain enough technical capability to cope with the changes? Are we setting them up for their new responsibilities?

Value Based Maintenance (VBM), What it is and What do we need to do to Prepare for it?

See Engineering & Equipment Reliability

Open Discussion & Future DNP Activities for Work Management and Maintenance

Session Organizer: Pete Arthur *(INPO)*, Bryant Hearne *(INPO)*

This session will include an open discussion of challenges that stations are facing. Pete Arthur and Bryant Hearne will kick off the discussion and turn it over to participants to bring up for discussion of the challenges that they are facing. Discussion by other participants will help to provide solutions that work for them.

Cross-Linked Session: N/A
DNP Session: Yes

Open Discussion (No Presentation)

Moderated by: Pete Arthur *(INPO)*, Bryant Hearne *(INPO)*

Discussion Notes

Hope Creek: What does FIN team sizing look like now? Has it gotten larger? Ours is 22 including supervisors - 6 electrical, 6 I&C, 4 mechanicals.
INPO: Sounds like a good size, from what we have seen. See that consistency is more important than size. Diablo Canyon was given a strength for FIN team – had a T-5 roster that they put out, to fill any holes. It was the shop's responsibility to fill void, however, the FIN team had final say for filling. Always had someone. They did this well.

Also make sure you have strength in the people you put in FIN, not just a numbers game. Need to the best players. 1 SRO for FIN team, and has a dedicated backup.

Do you supplement FIN team with shop? Yes, and it goes both way sometimes FIN will be sent to the shop to supplement on important tasks.

Does FIN focus on single person tasks? Yes. Shops tasks are 2-person tasks primarily.

INPO: Saw one site had not considered historical data on work, when planning what to give to FIN team or what size it needed to be. What does 75% of work and 95% of high priority, actually translate to? That has to be part of your formula to determine the FIN team size. That gives you a justification to make the team size.

Catawba: In their FIN process , there is an expectation to do a certain amount of minor maintenance.

Q1: In talking to vendors, even the ones here, what is the difference between EPRI's version for WO data processing software (clickview) and what the vendor is offering?

A1: Vendor can only look at your data, with EPRI you can see what your costs verses other plants. Additionally, EPRI will not charge for additional engineering services, we have the comparison tab (hopefully available by the end of the year) will have additional value in seeing that.

Perry: Work Management started using clickview to get ahead of analyzing the WO data, have seen great value.

Comment: Is your site clearly designating ownership for implementing value based maintenance? This needs to be established now, so there is no pointing back and forth in a year between maintenance, engineering and work control.

Palo Verde: Has a special group (6 people all maintenance, best and brightest), and then engineering signs off on the changes. The VBM DNP EB came out of their process, been doing it for the past 5 years. Offer for benchmarking if you like to come to site: Contact John Langskov at John.Langskov@aps.com

Cost savings you see from VBM should justify a dedicated person/group.

Fear of DNP: That doubling frequencies will just happen. We need to minimize effect to reliability. If not, size of FIN team will have to support more often and it will not be an efficiency gain. Don't want PMs to just become Corrective Action Maintenance. If something becomes Run To Failure, you may have to troubleshoot, periodic refurbish may be the way to go here. Adding monitoring will help with this, predictive technologies. If you cross over the line extending PM, then you will see more maintenance, more cost associated

Palo Verde: Reduced 130,000 man hours in 5 years, but have increased capacity factor, and even added PMs in some cases.

Palo Verde: CA labor demand has actually been decreasing. Just now starting to go up a bit, as expected. EPRI building a software program to say how much Corrective Action will go up if a PM is extended.

Q2: What was the big ticket that helped Work Management get better?
A2: There was just more preparation overall ahead of time. When the shops went out to do work they didn't have to wait in line, didn't have to wait for clearances, all was ready for them, just got to work.

Susquehanna: For two year or less PMs, work packages should be automated. Has anyone used a lower frequency to walkdown? Maintenance doesn't spend too much time on walkdowns for PMs, in procedure for graded approach. Still the changing culture. Haven't seen any shortfall from reduction of walkdowns.

Harris: Adopted graded approach, low to no value walkdown PMs eliminated. But people still expect the walkdown when something goes wrong. Getting challenged at Oconee for work being near SPVs, our executives are trying to drive the idea that if you are within 2 feet of SPV, need high risk tag and you would only see that in walkdown. Relying on Ops to have this labeled.

DNP attributed a lot of savings to VBM, got to figure out how to capitalize on this, the CNOs will be looking for the money in the near future.

INPO: We know there are potential costs savings, so rather than looking at individual components, look at large classes of components. The Equipment Reliability working group is trying to pull together the new practices, maybe updating EPRI PM templates. This will be the bulk of the work of the industry in the next year or two. Fear is that with downgraded critical components, you can now have some of the most risk critical components as non-critical. Maintenance Rule High Safety Significance components can now be non-critical. This makes the guardrail important from the EB - it needs to be reviewed by technical authority. What is meant by technical authority is someone with specific expertise in maintenance or engineering on that component. Need to figure out which failures we can tolerate, and which we cannot. Some use the Preventus system, and EPRI is working on the basic cost analysis, to determine how far is too far.

Using the software, like clickview, allows you to better identify where the money is going. As analysis occurs, the budgets that can find money that is going to "miscellaneous" and not actually attributed to anything. One site found a couple million dollars that was allocated but not attributed to really anything.

At Diablo Canyon, it was found that most expensive PMs were eyewash stations, more than even the ones on the turbine. Small amount can chip away at large figure. Clickview can help you identify these areas, and then can prove what you are doing is working, once you make changes.

Palo Verde: The in clickview, the calculation is only as good as the data, initially when running optimization, you can tell when there are some that are off. So we went through the data, mapped the critical components going back 15 years, then that goes back in to the calculations, improving the results you get. Compared to failure rates in ICES reports, and it is now tracking well.

When you go through component type evaluation, tune that up first, then align you PM frequencies within the FEG.

Palo Verde: PM team comes in a changes a frequency, sets “late date”. Then the Work Management team can put in their own frequencies for scheduling, as long as they stay within the outer band that the PM team set.

For the change in work Management INPO evaluation schedule: In general, functional areas will be closed by Friday. Debrief on Friday for first week of all function areas, but at the discretion of team leaders. Not totally rigid. Might can continue on Monday, with ones that have cause and contributors. There’s a little opportunity to not be so rigid. Functional Area that had cause and contributors with tentacles, if closed on Monday, have the weekend to work through with counterparts (possibly now a cross functional area).

PSA: this morning the CNOs approved the EB on re-engineering of engineering organization. Basically it takes what exists and shrinks it, calls system engineers, strategic engineers now. More engineers will be component/maintenance support engineers. Vision is for them to be component specialists. EFIN team, if you already have one, will be larger now. It’s a green EB, but many stations have already moved in that direction. There will be issues to work through, for example - HIT teams for outage makeup.

Critical scope 100% survival. From an INPO stand point, it indicates a lot. If you aren’t getting it all done, indicates a problem.

One site having a problem with WOs being critical that shouldn’t be. For example, painting a breaker in the switchyard just because attached to breaker (which is a critical component). It’s not really a critical WO. Need to figure out how to change how they are coded. Small things can take a hit. All the little things that can get you later, have to be addressed up front – but no one is really excited about doing that.

When evaluating critical WOs, look to see if it’s a critical component, and then job function. Need two criteria to evaluate the activity. Need to make these changes and if there is push back when downgrading them, make sure it is understood they are ultimately responsible for this number of critical WOs.

Update: IER discussed in session 1 is on it’s way through approval cycle, sent to CNOs. Still tracking for 8/28/17 release.

How many have stations are in elevate or above – you have 60 days to get plans put together for this upcoming IER. Have you started on the plans? On the website there is a generic maintenance improvement plan, including maintenance fundamentals. This plan is not comprehensive, but it is a good starting point. Rest of the sites will have 120, 180 days to get a plan together. Recommend to take AFIs from your station, and overlay the trends we are seeing, to see where yours are. Also, take your ICES event, CR that were close to ICES reporting, rework WOs, and clock resets and see where they fall in this. Either way you have to address maintenance fundamentals.

Hope Creek: Already went through this process this year, wanted to get chiefs engaged to look at everything. Put 05-004 in front of them. Went through all events, and the chiefs decided which “bin” the event fell in. The chiefs would choose one 05-004 point and have a focus for each discipline. When It went to shops, they (the chiefs) rolled it out. The shops rallied around one area per shop. Intentionally, this was not management driven and had great success. Did this in January, plan to go back in September. The go-tos in the fields are the ones who are in the best place to lead this. Became not just a flavor of the week, the chiefs enforce and discuss in their PJB.

OPERATIONS AND OPS TRAINING

Crew Performance Evaluation

Session Organizer and Moderator: Bruce Hennigan *(Exelon)*

As the CPE process continues to develop, Operations managers must continue to efficiently and effectively implement strategies for success. This discussion will center around changes to the process and the best strategies for making crews successful.

Cross-Linked Session: N/A
DNP Session: Yes

Crew Performance Evaluations

Bruce Hennigan *(Exelon),* Sara Lange *(Ameren)*, George Pickar (*Southern Nuclear)*, Matt Henson *(Southern Nuclear)*

Session Notes

- IER L1-17-5 fingers reaching into CPE process. ODSI-3, Rev.16 is the current document provided from INPO discussing the recommended practices.
- The goal is to have CPE's aligned with E&A's. These have been seen as a "catch-all" for 6-year accreditation, and have been seen as mini ATV's (Assist Training Visits). These have been used with determining Operator Fundamental proficiency. The CPE process is a part of trying to stop cyclic Operator Fundamental Performance. CPE – NLO JPM's (Job Performance Measures) are being eliminated, and observations are used to determine performance deficiencies. CPE's are being performed with a mixed crew and a regular crew.
- Minor wording changes in ODSI Rev. 16 to reflect lower difficulty and make more realistic scenarios. Lack of teamwork, worker practices can be seen without having to run "Midwest Tsunami" scenarios. Scenarios should not be designed to "bust the bank". Under DNP, CPE is being made smaller. The intent is to look at end results of training based on how well or not well that the crew performed. The "Crew Performance" mode was discussed.
- Out of the Box Evaluations(OBEs) are to be 60 – 90 minute scenarios. In 2018, CPE will monitor Operator Fundamental Performance, and expectation will be for instructors to provide coaching.
- The proposed schedule is as follows:
    - Day 1 – 1st crew gets evaluated in CPE scenario
    - Day 2 – a mixed crew gets evaluated in the same CPE scenario as the 1st crew
    - Day 3 – OBE performed for 1st crew in morning, mixed crew in afternoon
    - Day 4 - Operator Rounds could be monitored for in plant evaluation.
- Some Managers see evaluators for 2 weeks for E&A 2nd week.
- Crew doesn't get feedback right away at all plants. If we evaluate on Monday, no feedbacks are available until Thursday from instructors.
- At Exelon, qualifications are pulled at beginning of training week. Most plants do not disqualify individuals unless failure occurs.
- On the wording change, most team leaders know change to CPE process is coming. The changes will:
    - Restructure with scenarios that aren't incredibly difficult, complex scenarios.
    - No more than 90 minute scenarios (60-minute scenario, 30-minute critique).
    - Provide outline of scenario to CPE.
- If comfortable w/ OBE's, leave as is before INPO comes. Pick out things left on the table from the critique.
- Feedback from CPE evaluators should focus on if the scenario was too low key or too hard, or not what INPO had expected.
- CPE should be performed during the crew's training week.
- It is desirable to share what we have done – CPE 1st week, E&A 2nd week.
- At Exelon, if crew fails first scenario, with CPE in progress, that crew won't be reevaluated for CPE. Other plants may have to use the failed crew and evaluate remediation observed scenario. Determine scheduling and logistics. May have different philosophies.
- With OBE pass/fail criteria – SM/STA/ or other individual could fail, determine replacement crew member per available dayshift operator, if workforce allows.
- No ambiguity on 5 pilot weeks, but flawless CPE performance was seen. No disagreements between INPO and Site on CPE evaluation results.
- Validation can be done right up to right before CPE performed, if it can be performed with other crew before evaluation (not a month out). This helps get INPO the product they desire.
- CPE in March ran out of simulator time for validation, and requested moving CPE 1 week and openly communicate need to move evaluation with lead INPO evaluator. Discuss moving CPE clearly in advance.

- For E&A's, some plants have evaluators for 1 week, others have them for 2. For plants that get them for the 2nd week, it is recommended that the plant being evaluated be upfront in communications with the lead evaluator to keep them abreast of performance from CPE's for E&A. The goal is to get these individuals as up to speed as possible on for the 2nd week evaluation.
- Triple the number of TR findings have been issued in 2017. One was on Fire Brigade performance.
- INPO PIC has CPE data available that should be utilized to keep up to speed on operating experience used in CPE evaluations. This OE should be used in development of the CPE scenarios.

Key Learnings, Recommendations, and/or Best Practices

Scheduling for CPE discussion:

- Plants can request CPE to be performed 2 months before the Plant Evaluation if it is scheduled a year in advance with INPO with proper justification. Timeline of scenario, and clear communication of scenario should occur. The scenario is evaluated 6 weeks prior to CPE.

Host Peer Preparation:

- Ensure a strongly prepared, highly motivated individual is selected to be a positive ambassador for the plant in describing why the plant performs actions certain ways.
- Should send 2 host peers if possible and available.
- Should send SM/SS to other sites going through CPE evaluation.

Q&A

Q1. Will there be a single scenario run for two crews for the CPE's?
A1. Yes, the same scenario will be given to two crews.

Q2. Will the critique format be clearly identified? Will follow ups be documented?
A2. Not sold on observation, but make sure that the Operators know what expected response was at the critique. Add this to the list of items for the evaluation week.

Q3. How is' Instructor Evaluation' it done?
A3. Exelon has OBE evaluation. In the plant, the Supervisor leads the critique talking about the scenario. Shift Manager starts critique with discussion of scenario with instructors, then joins the crew. Lots of details on facts should be provided. Choreography should be aligned. 3 exist at Exelon, but most effective should be communicated and consistently facts should be obtained from scenario.

Q4. Any feedback on Crew Composition in ODSI for SRO's on the board?
A4. For ODSI feedback, you need to consider if it is plant practice to have SRO's operating at the Control Board. If not, that is not evaluated, if they are, then then do evaluate the SRO's.

Pre-Approval Criteria for Work Execution

Session Organizer and Moderator: John Reimer *(Exelon Nuclear Duty Officer)*

Efficiency Bulletin 16-31 describes efficiency opportunities to be found by "...Removing unnecessary approvals and delays [to]...allow workers to get to...perform more work." We will exchange ideas and best practices for implementing a graded approach to work release easing the burden on both Operations and Maintenance while avoiding adverse consequences.

Cross-Linked Session: Risk Management
DNP Session: Yes
TIP Session: No

NEI Efficiency Bulletin: 16-31 Pre-Approval Criteria for Work Execution (DNP W-M-P12)

John Reimer *(Exelon Nuclear Duty Officer)*

Session Notes

- Work approval occurs 4 weeks in advance by SRO. Individuals are allowed to perform work on the scheduled day of execution without needing to obtain Control Room Authorization for work schedule items that do not impact Operations Department in the Control Room. Streamlined Pre-Job Briefs are not required to be an hour long for tasks that only take a few minutes to perform. The goal is to get workers in the field right away with only the tools necessary to perform the task safely.
- The goal is to have 60% of Pre-Approval of Work Orders. The tool to measure this is being developed.

- Briefs that need to be performed in the Control Room should be less than 10 minutes to prevent unnecessary control room distractions for proper monitoring of the reactor.
- INPO efforts are to help deemphasize administrative areas by:
    - Eliminate focus on excessive Pre-Job Briefs.
    - Avoid having to verify qualifications daily if worker has already been qualified to perform task.
    - Avoid additional layers of review.
- Some stations utilize a paper site work order Pre-Authorization Form. Other stations are able to utilize Passport, Maximo, SAP to electronically authorize electronic work packages.

Key Learnings, Recommendations, and/or Best Practices

Opportunity exists for the next day's work could be briefed the day before when possible.

Q&A

Q1. If work will give an alarm in the control room, does it need to be briefed in the Control Room?
A1. Yes, Control Room Brief is required for work items that will cause Control Room alarms, as well as for Tech Spec, PRA, MSPI Fire Protection equipment that is required to be logged or compensatory measures to be taken.

Q2. Does a single worker go out for work on safety related pieces of equipment?
A2. No, a peer checker is required for work on safety related pieces of equipment.

Q3. How does the Shift Manager know what work is coming for the day or upcoming work week?
A3. Shift Manager owns the schedule for week of execution, and is provided a report that is updated 2 – 3 times per day on day of work execution on what work is scheduled and what has been completed. Morning meetings discuss the work to be performed for the day, and it is at that time the Shift Manager will request maintenance to be deferred if the plant is in a condition that cannot support the work to be completed that day.

SNC Work Order Pre-authorization

Howard Fitzwater *(Southern Nuclear)*

Session Notes

- P-6 (Primavera 6) Maximo codes work orders with release information.
- When Operations is preparing at T-1, T-2, they determine which items are coded that require CR communication. At Southern Nuclear, work is not preauthorized if it requires CR communications.
- The following are the 3 levels of release at Southern Nuclear:
    - None – no or minor risk /operational impact
    - Phone Call – intermediate risk/operational impact
    - Visit – high risk/ operational impact

- AP-928 white paper helped to mitigate the wait times at the work control center desk. It also helped to eliminate/reduce work having to be authorized from the Control Room. This has required training work supervisors of their ability to authorize low or no risk work. Work Order coding was changed to be version tasks to preauthorize repetitive tasks.
- If clearance order is hung, work can be released, as Operations has control of the plant, and has verified energy release by control of the plant through the tagout.
- Southern Nuclear is working to use system/component ID to identify Tech Spec / PRA / Fire Protection / etc. equipment to planners.
- Operations department screens all work orders. Work orders that are repetitive tasks are only screened once. Modified / Revised work orders are required to be reviewed by Operations prior to authorization. Only Ops can remove "Visit" designation to ensure proper authority assigned. Ops is required to review all work orders.
- Level of Effort has been to upgrade Maximo, and to identify and screen all repetitive tasks. Prescreening of Work Orders has allowed for Risk assessments to be already completed, and to ensure that the work sequence is truly fixing what was intended to be fixed.
- Change Management Plan was used to understand and communicate procedure allowances to properly implement work preauthorization. Prescreening is in place to allow planners the authority to release work. SAT based process was used for work planners.
- The proposed metric for performance would be for preauthorized work orders divided by entire work orders for week that have been released.
- Former stance of most plants was for Operations to be the authority on releasing all work.

- In industry, there have been several instances of workers going to work on the wrong train of equipment. Single Point of Vulnerabilities need to be clearly identified. Event Review teams will hold individuals accountable for events, and not require procedures or additional processes to be developed considering event occurrences.
- Efforts of Operational Focus have been to shift focus on the plant to Maintenance, Engineering, Production Planning, and other groups outside of Operations Department.
- With regards to Plant Impact, Maintenance has tendency to fall back to old practice of asking for permission to go to work, but Maintenance supervision needs to be onboard with not requiring its workers to have to request permission from Operations prior to going to work that does not require communication with Operations.

Key Learnings, Recommendations, and/or Best Practices

None

Q&A

Q1. How have your plants implemented work preauthorization?
A1. Callaway has implemented similar philosophy as Southern Nuclear. In house program has been used for identifying no contact to CR, Tech Spec required with AutoLog, Equipment Out of Service, PRA. Night shift supervisor reviews and authorizes work for upcoming dayshift.

WPA is used to hold off for work control for work group, similar to FEG (Functional Equipment Group). There is a tendency associated with that for hanging tagouts when not required. Efficiency Bulletin is coming for not using the Clearance and Tagging process for configuration control of the plant.

Our job, as supervisors and leaders, is to develop people to maintain a proper broad plant operational perspective.

Q2. Do stations conduct real time monitoring of when work has been released when it was not supposed and write CAP's?
A2. When work has been released when it is not supposed to be, it should be considered a Condition Adverse to Quality, with a CAP written to document the occurrence. This is to bin events on whether they were human performance related issues, or organizational process related issues that need to be addressed.

Q3. How is the SAT process used for planners?
A3. The SAT process is used to determine which work disciplines have a performance deficiency in performing assigned activities, and will determine the appropriate method of training to be provided to planners, technicians, operators accordingly. Several plants do not require planners to go through systems training, and only require some form of planner training. The SAT process is used to describe the target audience and determine the needs of the plant based on risk.

Q4. Is there a way to reduce PMT required?
A4. With PMT, not everything requires surveillance testing to be performed. There was an instance of a valve associated with a diesel generator that needed to be repacked, that did not require PMT to be performed. Guidance should be provided testing the function of the repaired equipment. At Southern Nuclear, Ops reviews PMT, and gets it corrected as necessary. There is a need to ask if this is the right thing to do. There needs to be an increased tendency to rely on maintenance to better describe the work or repair to be performed.

Training to Improve Operator Performance

Session Organizer and Moderator: RJ Frederes *(Exelon)*

Is "training for performance improvement" a platitude or the core of how we train? This panel discussion will provide real insights into what it means to train for performance improvement.

Cross-Linked Session: N/A
DNP Session: No

Training to Improve Operator Performance

George Pickar (*Southern Nuclear)*, Stephen Harris *(Southern Nuclear)*, Wes Lyon *(Southern Nuclear)*, Bruce Hennigan *(Exelon)*

Session Notes

- Scenario is being designed at Exelon for operators to perform 8-hour session for taking unit from Point of Adding Heat to Online.

- Strength was given at Dresden station for EO training on the simulator: Misposition Event occurred where a breaker was opened on the wrong train. EO's were brought into the simulator to show the difficulties that were encountered by the Control Room Operators in doing this, and what the required response of the operating crew was to this event.
- Noise cancelling headsets have improved training in noisy areas.
- Plants have taken a stance to be strategic about performance rather than reactive:
    - Senior Leadership Team was taken into simulator for 2-hour Emergency Loss of All AC Power scenario to show what it is like in the Control Room during an extended loss of AC power.
    - Use of 2 domestic and one overseas case study has been used as part of SM qualifications to perform as a Shift Manager in Beyond Design Basis event scenarios, one with the Severe Accident Management Guide coordinator, one with the Ops Director, and one with the Plant Manager/Site VP.
- Flat Top Simulator and SMART boards have been used outside of training environments, such as in Work Control, Outage Control, Technical Support Centers, Emergency Offsite Facilities for walk through of plant evolutions.
- ACAD 07-002 was not required, but allowed for SM's to obtain input from crews on allowing for training for 4 hours on crew weaknesses.
- Training Mentor, typically a previously qualified SM, has been crucial in improving operator performance, in providing coaching to operators during critiques of simulator scenarios. This senior shift manager is sent to monitor observe performance during training and provides input during training timeouts to help crew in critiquing performance.
- Leadership 5-star critique used at Callaway in light of INPO 15-005, which grades to standards in the 4.0 critique. All crews are measured at Hatch and Callaway on timely performance of required actions.
- The Crew Delta process is used to identify areas of concern that the crews have had, which have included Reactor Trip, Stuck Relief, and Loss of Flow. The task is selected, along with the desired performance measure.
- During T-1, the Shift Manager is involved in determining training needs for the upcoming cycle.
- "Quick Hits" are used to practice high standards of controlling plant evolutions or monitoring indications closely during key actions to reinforce positive behaviors to crews.
- Survey Monkey is used for giving a monthly quiz called "You Make the Call" for EAL performance on making the proper Emergency Action Level Classification.
- "Practice Perfect" is used in training to show operators the perfect response to a situation, and then the crew is allowed to practice it in "Practice Perfect" sessions.
- Peers enhance Peer to Peer coaching to improve operator performance.
- Steam Generator Water Level Control Proficiency is emphasized, where there are 9 JPM's for the operators, using INPO 15-005 instruction being provided.

Q&A

Q1. Did Requal list need revision?

A1. Yes, you're right. The challenge is how do we fit it in. Plants need to identify where redundant tasks exist. Every Abnormal Procedure scheduled annually needs to be determined if prudent on that frequency. IER L1 17-5 requires tasks for operators to shutdown the plant to be evaluated on a 2-year periodicity. Farley, Hatch, and Clinton are reviewing task list for redundancy.

Q2. Were the 3 BDB tasks a part of the qualification card?

A2. No, scenarios that are "On Shift Excellence Models" were built separately for initial qualification. INPO 15-005 recommended for training on helping the Shift Manager to be successful in leading site meetings, and provide coaching to the Shift Manager for being a demanding customer for broken plant equipment to be repaired timely and for status updates to be provided.

Q3. Do any plants have a prescribed 4.0 critique for excellence for a Reactor Trip or excellence?

A3. Stations have 4.0 templates, but no perfect performance standard for critiquing crew performance on the perfect manner of responding to a reactor trip or for excellence for given situations.

Q4. With Delivering the Nuclear Promise, the Needs Analysis Process has degraded. Ad Hoc Training is being implemented instead. How are gaps being evaluated against processes?

A4. Training Needs Analysis is still being performed, which evaluates task, skill set of operators, and risk associated with improper performance of task, and whether a training solution is necessary or if an organizational process needs to be changed.

Q5. How do backshifts improve performance?

A5. Feedback has been received from SM's that some Shift Supervisors are not providing updates/briefs when necessary. Crew Notebook can be used for showing instances of when a proper crew update would be expected. Newly licensed SRO's are showing that they understand

when to use the crew updates/briefs, but this tends to slip with more experience on shift. Human Performance Simulators are being used for demonstrating proper leadership behaviors. Some plants have plant selective training documented by exception.

Q6. Why don't we account for On Shift Training conducted by the SM?
A6. On Shift Training conducted by the SM cannot be considered documented training as it is not considered a part of the SAT process. It can be anecdotal evidence of how the SM can help improve performance, but can't be used instead of the SAT process.

Event Review Process

Session Organizer and Moderator: James Bubba Edwards *(WCNOC)*

A working discussion on post-event reviews including self-critiques to identify crew performance or process gaps.

Cross-Linked Session: N/A
DNP Session: No

Improving Event Reviews

Sara Lange *(Ameron - Callaway)*, Bruce Hennigan *(Exelon),* Ron Gibbs *(STPNOC)*, *Tim Krienke* (*Southern Nuclear)*

Session Notes

- Discussing 4.0 critiques in plant and in training. Started from INPO IER L1 17-5. Stations not seeing trends, not hitting the mark, procedures not as robust as needed for Operator Fundamental weaknesses. Crews were culpable, but so was training.
- Had ability to catch in simulator, but relying on actual plant events to correct. Event critiques may not have been in depth enough. Crew self-critique process is being self-aware.
- Ideal Self Critical crew critique is the tool to get to perfect results. Need to use event, training critique to correct performance deficiencies.
- Teamwork fundamentals – many stations not being self-critical. Not as much non-represented plants data. Senior Operators may be reluctant to be self-reflective. Trainers have had lack of exposure on being effective communicators to help build self-identification as facilitating how to think through identifying what should have been done better, and identify gaps better. This skill needs to make it to the Shift Managers.
- Critiques have been encountered where the trainer says here are the gaps we had, then the trainer identifies the gaps, as well as Ops Management. Self-criticality should be what is expected and normal. Key phrases should be for identifying weaknesses.
- Crews may not have had the right tools to perform a Crew Self Critique. Administratively, there shouldn't be a burden of a lengthy checklist. Hit the main bullets, expand only on the applicable areas that were missed. Should be able to identify how to monitor critical parameters closely.
- When pilot crew is there, use them as go to for control group. Then next crew comes in, they can evaluate against the first crew evaluated. Not every parameter will necessarily need to be monitored, but the comparison should be made to previous weeks' crew compared to pilot group.
- Training was used to capture a monitoring weakness for a feedwater event. Shift Managers need to reinforce need to capture learnings.
- Self-criticality is difficult to get from Union operators, but just as long as it is used constructively to improve performance, and not necessarily punitive. Large culture change needed to occur. Need to keep from long stories going into critique. 5-star critique for plant and simulator can be different. The plant story may be more difficult to understand what may have happened before the event occurred. In plant, typically critique just one event; in simulator, it is for more than one event. Should break out alarm response and abnormal operating procedure to accurately describe what the expected response should have been.
- How are 4.0 critiques captured? For certain events, they are adverse to quality, some are not. Improvement plans are kept on databases on specific operator fundamental weaknesses. Some stations
- IER L1 17-5 discusses having proficiency topics for weaknesses.
- Need to ensure that we do not add additional processes and data trending. Improving self-criticality is intent, but data collection can be cumbersome. Documenting more performance analysis. Crew notebook is a performance analysis tool. This tool may be used in conjunction with the training analysis of operator performance. Crew notebook to address performance gaps, not performance management issues.
- Exam security can impact capturing details of events until the cycle is over, but the crew can have access to comments on the weaknesses from the scenario. No other crews can view data until end of cycle.

- Goal should be to get learnings from critiques from simulator and in plant events together. Can have training mentor help groom the crews on what data is necessary for capturing crew weaknesses at the Crew MRM's. Feedback on self-criticality of critiques should be sought out.
- Critique can be used to help improve JITT for evolutions. Training mentor will be involved in the critique process.
- Make sure that crew focus areas are provided to training for addressing noted operator fundamental weaknesses.
- In looking at previous cycle critiques, Ops Manager will go over with instructors on the list of all of the events that have ooccurred in the past cycle, and what the department is addressing to help over a lunch period.
- Working through the culture issues is something to be addressed to be adequately self-critical. Should consistently perform this process starting in ILT (Initial License Training). Can use performance improvement notebooks to address weaknesses for ILT students.
- Leadership in classroom is important for ensuring that ILT is receiving adequate management attention for addressing performance gaps. Being self-revealing, self-critical early helps to recognize performance gaps early on, even in training environment to monitor, be aware, make a plan to address, and then evaluate effectiveness of plan. The consequence of the intended actions needs to be communicated during critique.
- During ATV or E&A – drill to facts. Be specific, and identify clearly what the weakness areas were. What specific are of 'Teamwork Communications Ensure' lessons learned from training critiques are applied in the event, and compare to plant events if actions developed in training were effective to address performance gaps.
- Reinforce the positives. Show why perfect, and the behaviors that allowed them to do that. Determine the most effective way to facilitate the conversation on how to critique performance. Clearly define the delta by stating here is what happened, here is what should have happened, and why it is important. Critical failure acceptable criteria should be clearly stated if not met during critique. Need to clarify "meeting the objective" and what is determined "acceptable" performance.
- INPO has examples of good 4.0 critiques that were performed. These did have clear graphs of how monitoring can properly occur.

Key Learnings, Recommendations, and/or Best Practices

- Need to keep individuals from being defensive when being sufficiently self-critical, and to get back to the facts of what happened, not a large explanation behind what happened on 4.0 critiques.
- Should describe what actions "meet the objective" and what actions are acceptable performance

Q&A

Q1. What are we doing at end of shift briefs for 4.0 critiques for on shift to learn?
A1. At Callaway, 5 star critiques in simulator also used for in plant events. Off normal, transient cycling of feedwater valves. SM will find positive and negative items, and they will be monitored. Downpower are critiqued, events are critiqued. Critiques every week. End of shift briefs performed. These are used to determine if learnings are to be had. 5 star critiques performed for deltas, or if positive recognition needed. Shift Manager will typically lead the end of shift critique. Canned pre-job brief for weaknesses used with OE from learnings from events help with turnover. Brief sheets help with surveillances.

Tracking and trending of Operator Fundamentals critiques seem to be a weakness. Learnings between crews and feedback to training may not adequately exist. Feedwater transient event Operator Fundamental critique performance learnings needed to drill into positives more closely. Can also look at schedule for high risk events to perform a critique on.

Q2. If in exam security, how are critique comments captured in crew notebook?
A2. Make the critique generic instead of on specifics, may just decide to work on actions for the week to avoid exam security issues. Condition Reports using to track crew notebook.

Q3. Can specific gaps be addressed from review of crew notebooks?
A4. It is possible for training instructors to police weaknesses on the crew, however difficult to make the requirement. Some crews may not have the same weaknesses, so different weaknesses may need to be addressed with the instructors. Try having crew liaison rep to brief the training instructors on what the identified crew weaknesses are to look for. Shift Manager Supervisor should be the line representative for communicating the department focus areas for the crews.

Shift Manager Leadership

Session Organizer and Moderator: Bruce Hennigan *(Exelon)*

The Shift Manager's role as leader of the site for one shift at a time is unique and can be daunting. Shift Manager development must also be unique and should be designed to meet the needs of the individual shift managers as well as the site.

Cross-Linked Session: N/A
DNP Session: No

Shift Manager Leadership

Stephen Harris *(Southern Nuclear),* Bruce Hennigan *(Exelon),* George Pickar (*Southern Nuclear),* Shawn Hafen *(Xcel Energy)*, Jason Willis *(Talen Energy)*

Session Notes

- Shift Manager program based around the ACAD modules, and involve interview with Plant Manager / Site VP for qualification. Then attend seminar tied to Next Level Leadership. Expounds upon what did you learn while on crew as a Shift Manager. Development involved attend offsite CPE evaluations and INPO evaluations.
- Teamwork / Leadership Effectiveness skills and managerial skills when on duty in the middle of a major catastrophe has been added to qualification guidelines for shift manager program. Redesigned for individuals who have been a shift manager or are qualifying to become one.
- INPO 16-007 Best Practices document development is being discussed.
- Recognize high level overview of IER L1 17-5 of Shift Manager not being in the proper role to address crew performance issues.
- Shift Managers become elevated 5 positions above their rank at times, so ample training is necessary.
- No longer requiring waiting period for Shift Manager Seminar scheduling.
- SM to drive station to where it needs to go. SM needs to hold other departments accountable to minimize challenges to operating crew being encountered. The Leadership program will help give the newly qualified SM to have the confidence to be a demanding customer of the organization to help the station improve the site Operational Focus to ensure that clear dates and times are given. New to position SM given 12 months for 3 interviews with Plant Manager / Site VP to be critiqued on how the SM performed at running the daily meetings. Documented performance coaching can occur here.
- The 3 case studies are available on INPO website, and need to be completed with EOP coordinator, Ops Manager, and one with the Plant Manager or Site VP. These help verify that the Shift Managers know the appropriate communications to make when events occur. These help provide feedback on the proper behaviors to possess and display.
- At Susquehanna, development opportunities for seeing how Off Shift operates instead of just On Shift. Mentoring begins as a Shift Supervisor, and this helps groom individuals to a Shift Manager position. This has helped improve Shift Managers.
- Having rotation of Shift Managers to training, engineering, site management to understand how the rest of the site operates. Let the Shift Manager candidates see how the meetings are run, and let them try to perform this, and help groom them to instill confidence of them. During plant status call, higher level thinking to be communicated to the organization during the shift manager leadership training. People who become Shift Managers are the good Shift Supervisors, as they have been able to step out of role to effectively get organization involved.
- Shift Manager Summit was set up and attended by all Shift Managers to gain alignment across the fleet. This discussed who owns and operates the meetings. Took case studies, and used communication techniques training through fleet alignment.
- Xcel Energy has had interesting journey as a Special Focus plant in Prairie Island. Group of Shift Managers who had been in place for several years who did not have leadership traits they needed. Constant feedback being provided to SM. Touchpoint with SM's occurs prior to morning meetings. SM view CAP program with technical aspect, but to understand what items need to be brought up with the organization. The off going SM would be able to communicate need to challenge organization with feedback to oncoming SM. Different aspects: Can you lead the crew, or can you lead the site. Set up formal mentoring program. Specifically communicate weaknesses with Site Leadership to allow Site managers to mentor shift managers based on personalities or to help instill the desired traits in those shift managers. 0500/1700 Daily calls help in alignment of Shift Managers. This helps to force behavior change, and alignment of Shift Managers. Challenge from the leadership team is who provided coaching, shift manager or shift supervisor. It was seen how standards changed when shift manager left control room.
- Site Leadership Mentors are assigned Shift Managers after qualified. The SM Mentors are Site VP, Plant Manager, Ops Manager.
- Shift Managers should be allowed to rotate off shift to other organizations, but thought needs to be given on allowing adequate resources to perform this.
- Most organizations have Assistant Shift Managers.
- Duty Managers have been asked to provide SM mentorship, but not assigned to specific SM's based on weaknesses at some organizations.
- Feedback has been to provide rotation to SM candidates to be able to perform in site leadership meetings during off shift daily meetings. SM off shift for 2-3 weeks to get daily meeting exposure. Some stations keep SM candidates on shift while qualifying.
- Weekly Shift Manager phone call. 2 hour get together monthly for Shift Managers to align on improvement plans, and how to improve performance.
- Shift Managers are expected to be on calls with the Training Managers and Ops Managers.

- Ensure senior leadership team does not drive the meeting so heavily and let the shift manager discuss the issues before the site leadership team starts jumping on items that the shift manager did not cover for the morning calls.
- Palo Verde taking SM's off shift for a month to work with Ops Manager, and shadow Plant Manager for a few days, which gives them the opportunity to see off shift processes. STARS structure allows SM's opportunity to go to off shift and even to other facilities.

Key Learnings, Recommendations, and/or Best Practices

Continuing development for Shift Managers should occur. Start the pipeline early with the Shift Supervisors desired to become Shift Managers. Have Shift Managers do off shift experience to recognize how to respond to other members of site organizations to understand viewpoint of Engineering, Training and Maintenance perspectives. Shift Manager mentoring performed by members of Site Leadership Team to provide coaching on how to improve leadership performance. Allow Shift Manager candidates many opportunities off shift to qualify and get experience with daily meetings and with other organizations. Require Shift Managers to have experience with taking unit to cold iron status by assigning them Shift Manager on the outage unit. Ensure senior leadership team does not drive the meeting so heavily and let the shift manager discuss the issues before the site leadership team starts jumping on items that the shift manager did not cover for the morning calls.

Q&A

Q1. Based on IER L117-5, will anyone make changes to SM training plan?
A1. A Rec 1 industry group working to tie fundamentals to SM leadership, and identify new attributes for teamwork leadership effectiveness. Build observation tools with attributes covered. Ensure that the attributes are part of the SM training program. Mentoring module could be developed. Teamwork Leadership attributes will need to be evaluated on shift through 4.0 critiques or observation.

Q2. Will SM evaluate instructors?
A2. SM will be trained as part of IER L1 17-5 on how to review instructor performance. Will give annual review for trainer qualification. SM will ensure that the trainers are properly qualified on teamwork leadership effectiveness training attribute.

New Build Initial License Training

Session Organizer and Moderator: Gary Dudek *(Southern Nuclear)*

As an industry, we have not conducted cold-license classes for a very long time. Two U.S. sites are implementing that process now and bring incredible learnings for all of us through this panel discussion.

Cross-Linked Session: N/A
DNP Session: No

Initial License Exam Challenges

John Austin *(Southern Nuclear)*

Session Notes

- In 2008, the design wasn't finalized. Westinghouse provided the first lesson plans. On 4th revision of the baseline. Chinese plants making difference in design. ABWR plant was Gen 3.
- 2 ILT classes, 37 pass letters. ILT May 17th 2010 is when a student started license class, just got papers in March.
- NRC didn't know how to change, dec 17th, 2015, was supposed to have simulator approved for license exams. Kept pushing from simulator not approved. Westinghouse issued letters of human factors plant. 61 priority 1 issues in simulator that had to be addressed. Worked on human factors issues with impacts to the operators. IN march 2016, the simulator was approved. Did audit exam in April, exam in August 2016. Made decision with NRC on license exam. NEI cold license process. SCANA was allowed waivers. Hard to have OJT plan, but no plant components in place made difficult. SCANA was approved that needed correction by NRC.
- Turkey Point, Duke, SCANA decisions needed to be revised with the regulator later in the process.
- NRC wanted scenario based testing for 2 times for evaluation times.
- On Plant Reference Simulator, had to perform reactivity manipulation in CAS.
- Waivers for different experiences were needed.
- 240 hours control room time. 6 weeks on shift going through turnover, and daily work. After ILT 1, this job shadowing was built in.
- 6 months meaningful experience. Operating Safety Related equipment for 6 months required from other plants. Turbine building nearly put together, but not Auxiliary Building. 4 weeks of 60 hour weeks was used.
- OJT program from ACAD 10-001. Took about 19 weeks for all OJT.
- Had to get exemption for JPM's. Used flow loop trainer, murphy's alley, and at a desk showing how on prints for how to use drawings. 4 months' time frame for this.

- Waiver for 6 months' meaningful work experience licenses to be issued when completed. Want license classes staged.
- Looking to work with Region II on license transfers from SCANA. Requal plan on Monday was determined to be over at SCANA.
- OJT was started early in ILT at SCANA.
- 06-13A does not work efficiently today, are currently working to revise.
- Working on waivers for reactivity manipulations
- In initial license role at Vogtle 3&4, individuals cannot be advanced who have been qualified for 6 years. Soft challenges from Operations Manager perspective.
- AP1000 operation is much quicker than traditional plant operation. Operation key dynamics in the simulator takes on its own language with time and repetition. You don't understand how it looks and feels until 18 months in license class, and on shift. You can tell when stuff is off by talk. Individuals do not know what the new language of the AP1000 sounds like, and have a tough time understanding it. It sounds different, looks different, feels different from conventional nuclear plants. It took time as an Operations Manager to understand the language.
- Ops Manager needs to be involved with the new license program. The Ops Manager must set and enforce expectations and standards. People came from all over the industry, with BWR, PWR, and Navy, and everyone brings unique legacy knowledge unless one person stands up to make the call. Ops Manager is coming into training more often without operating the plant. Gaps identified in circle slash standards, but training needed to instruct one method. Shift Managers deviated on how they managed, and needed to be aligned.
- Standardized operating procedures for AP1000 will differ with PWR and BWR procedures, as the philosophy is different. Computerized procedure system looks at data in ovation, and marks off manipulations. The right concepts need to be aligned on philosophies from a fleet aspect.
- Baseload 7 individuals will need to learn baseload 8.
- Length of time it takes will differ for how to qualify.
- To startup unit 3, it will take 15 operators. There are 11 reactor operators. There may have to be SRO's operating on the plant. Need to have a strategy for staffing. Legacy
- Vogtle 3&4 individuals not a body shop. They are working on Baseline 8 procedures reviewed and approved for the plant. Using SOIT's, NSO's. 13000 Alarm Response Procedures require review by Operators. Pulling folks to Construction. Independent System Validations by showing that procedures can be used.
- 61 human factors requiring resolution. ISV to test human factor engineering issues resolved. Regulatory requirement, cant have people who have already seen scenario. Relying on SCANA to assist. Need to try to run 4 times.
- SCANA resource sharing was lost for procedure and Baseline 8 guideline development.
- Turbine building fire scenarios will rely on passive design. Appendix R fires will be based on reality. Operators are trained to get to the source of the fire.
- Operators are trained to protect the assets, taking into account the design of the plant.
- Operators can trick their way around a lot of situations, since they will try to avoid getting into a General Emergency situation.

Key Learnings, Recommendations, and/or Best Practices

Fire Protection response on non-passive feature of non-nuclear side of plant should be addressed in operator training.

Q&A

Q1. Did the simulation have to be run for both units?
A1. No, but it did and was run for both.

Q2. Are license candidates required on site for 6 months?
A2. Minimum number of hours at Vogtle 3&4 in Procedures, Engineering working with components is required.

Q3. Are RO's and SRO's being allowed to be qualified as instant
Q4. Yes, RO's per 06-13A are being issued waivers for reactivity manipulationsperformed on the simulator.

Q4. Non-License Operators training, what will it include?
A4. Have qualified with waivers. Flow simulators, and OJT at other plants is being performed and given at other plants. Has been performed for fuel handling practices, and breaker manipulations at Vogtle 1&2.

Q5. Any unique challenges for simulator team?
Q6. Simulator monitors are seismic related, and expensive monitors. The heat load is from the plasma monitors. It takes maintenance 4 hours to remove TV's. Changing plasma from LED's.

New Build Initial License Training – Ops Manager Perspective (No PowerPoint Presentation)

John Rasmussen *(Southern Nuclear)*

Session Notes

- In initial license role at Vogtle 3&4, individuals cannot be advanced who have been qualified for 6 years. Soft challenges from Operations Manager perspective.
- AP1000 operation is much quicker than traditional plant operation. Operation key dynamics in the simulator takes on its own language with time and repetition. You don't understand how it looks and feels until 18 months in license class, and on shift. You can tell when stuff is off by talk. Individuals do not know what the new language of the AP1000 sounds like, and have a tough time understanding it. It sounds different, looks different, feels different from conventional nuclear plants. It took time as an Operations Manager to understand the language.
- Ops Manager needs to be involved with the new license program. The Ops Manager must set and enforce expectations and standards. People came from all over the industry, with BWR, PWR, and Navy, and everyone brings unique legacy knowledge unless one person stands up to make the call. Ops Manager is coming into training more often without operating the plant. Gaps identified in circle slash standards, but training needed to instruct one method. Shift Managers deviated on how they managed, and needed to be aligned.
- Standardized operating procedures for AP1000 will differ with PWR and BWR procedures, as the philosophy is different. Computerized procedure system looks at data in ovation, and marks off manipulations. The right concepts need to be aligned on philosophies from a fleet aspect.
- Baseload 7 individuals will need to learn baseload 8.
- Length of time it takes will differ for how to qualify.
- To startup unit 3, it will take 15 operators. There are 11 reactor operators. There may have to be SRO's operating on the plant. Need to have a strategy for staffing. Legacy
- Vogtle 3&4 individuals not a body shop. They are working on Baseline 8 procedures reviewed and approved for the plant. Using SOIT's, NSO's. 13000 Alarm Response Procedures require review by Operators. Pulling folks to Construction. Independent System Validations by showing that procedures can be used.
- 61 human factors requiring resolution. ISV to test human factor engineering issues resolved. Regulatory requirement, cant have people who have already seen scenario. Relying on SCANA to assist. Need to try to run 4 times.
- SCANA resource sharing was lost for procedure and Baseline 8 guideline development.
- Turbine building fire scenarios will rely on passive design. Appendix R fires will be based on reality. Operators are trained to get to the source of the fire.
- Operators are trained to protect the assets, taking into account the design of the plant.
- Operators can trick their way around a lot of situations, since they will try to avoid getting into a General Emergency Situation.

Key Learnings, Recommendations, and/or Best Practices

To succeed, have a partnership between Ops Management and Training

Q&A

Q1. For hiring non-licensed operators, what were the requirements?
A1. Require experience at a nuclear plant, and a degree. Had a difficulty narrowing down who to select from a number of resumes. Were able to bring in operators from other classes. Selection process was very positive, as individuals were qualified with diverse backgrounds.

Q2. How many from Augusta Tech?
A2. 15 hires from Augusta Tech at Vogtle. Have an obligation and responsibility to monitor and provide feedback of training back to Augusta Tech. Dean asked to receive feedback from individuals feeding the pipeline. Much more comfortable with hiring local individuals.

Q3. What percent of college graduates attrition from Vogtle 3&4?
Q4. Too early to tell. There are a lot of degree guys who get bored in lower positions, and need to find other opportunities to put them in engineering roles. Brian at Comanche Peak worked with the issue. SOIT's from class will be able to perform Engineering functions at Vogtle 3&4.

Q4. Are there fire scenarios built in for scenarios?
A4. Fire, adverse weather, tornado response procedures are being incorporated in simulator scenarios. For greater than 15 minutes fire scenarios, there is an emergency action level program that is trained upon.

Q5. How do you keep employees motivated?

A6. Honesty helps keep the operators motivated. SRO's shouldn't be forced to be board operators, and vice versa. Discussion on where the project stands is what occurs. New plant build is not just at Southern, but for US nuclear industry as a whole. Communication with all hands frequently is what helps. No need to paint rosy picture, tell cold hard facts and be a leader, and make them in a position where they feel valued. If they are engaged with opportunities to help them feel value. Turned a Reactor Operator into a CAP coordinator. Operator in Licensing. Find what motivates people in your organization.

PERFORMANCE IMPROVEMENT

Finding Value in PI Processes in the New Business Landscape

Session Organizer: Reiko Perleberg *(Southern Nuclear)*

What does the Performance Improvement process look like in the new business landscape? Hear it directly from Danny Bost the CNO from Southern Nuclear and the industry executive sponsor for the NEI Corrective Action Program Efficiency initiative on what is and is not working in the areas of Performance Improvement.

Cross-Linked Session: N/A
DNP Session: Yes

Finding Value in PI Processes in the New Business Landscape

Danny Bost (Southern Nuclear)

Session Notes

- ~4600 MW capacity recently closed, ~10,600 MW capacity at risk of closure, and ~6500 MW announced to close.
- Success in the nuclear industry is maintaining the existing plants, building new ones, and creating supportive partnerships with renewables.

Key Learnings, Recommendations, and/or Best Practices

- Streamlining the CAP system and Cause Evaluations have allowed Southern Nuclear to reduce attention on the minutiae and achieving success.
- Coordinating and organizing/reducing oversight levels can allow the opportunity for great success in DNP.

Q&A

Q1. What is the high level industry leadership doing to reduce and improve the regulatory burden associated with NRC rulemaking?
A1. The high level industry leadership is focused on establishing a functioning and experienced NRC commission consisting of five individuals. Influencing the selection of the NRC commissioners is the best way the industry can be seeking support on reducing regulatory burden.

Q2. How close are we to the 30% DNP cost savings goal? How does the current status compare to expectations?
A2. The current endeavors are taking more time than expected, but cost saving is being realized. We're on the way to 30%.

Q3. What is the INPO role in supporting streamlining? Do we still need INPO?
A3. INPO is valuable and not going anywhere. INPO is a valuable part of the performance improvement process, and they are changing to support our changing needs. INPO is looking at changing the way they do evaluations to better use INPO resources.

Q4. How do we balance between PI and Owner Review (OR)?
A4. It doesn't matter as long as improvement is happening.

Q5. What tells you whether PI is working or not?
A5. Don't focus on our PI group and more check the individual groups to see how they are addressing problems at the lowest level rather than waiting for it rise to the PI group level or similar oversight level. If I need to check if the PI group is doing well, I review overall organizational effectiveness as an indicator of the PI group's success.

Q6. Are there any best practices for ensuring quality in the Non-CAP system established by the new efficiency bulletins?
A6. Not sure of anything currently out there, but need to find something that doesn't establish an additional level of review.

Q7. Is anyone looking at management/supervision decisions to ensure that the decisions are accountable and appropriate?
A7. Utilities have established accountability models that work to solve this issue, and there are many out across the utilities for folks to look at and choose from for their individual needs.

Q8. Do you feel that the DNP desire to change is present, intrinsically, at the lowest levels?

A8. Risk of closure is a good motivating for change, but talking to someone on the shop floor about DNP will mostly likely not get a positive response or the right action to be taken. Instead, we need to approach those lower levels slightly different and be very forthcoming with results from higher levels to the lower levels.

Q9. Can we get specifics of what INPO is monitoring at plants?
A9. We're monitoring almost everything to create a summarized integrated plant view that can be given directly to the plants.

Why Efficient Human Performance Saves Money

Session Organizer: Brandon Marlow *(Southern Nuclear)*

Learn how to implement the HU Investigation Checklist and discuss how it improves station efficiency by standardizing, simplifying and coupling multiple other processes into one simple form. Engage in a discussion panel focusing on First Line Supervisor (FLS) success related to the recent NEI Efficiency Bulletins (EBs).

Cross-Linked Session: N/A
DNP Session: No

Why Efficient Human Performance Saves Money

John Schaeffer *(Williams Power)* and Brandon Marlow *(Southern Nuclear)*

Session Notes

- Utilities are averaging several to tens of millions of dollars due to rework and lost generation due to inefficient human performance.
- It takes an order of magnitude more revenue to cover lost money due to inefficient human performance.

Key Learnings, Recommendations, and/or Best Practices

- Human Performance inefficiency is the largest driver behind events.
- We should be working in a manner that considers things non-urgent and important rather than working on important things in an urgent fashion.
- Standardization is tough across multiple sites, but necessary and important.

Q&A

Q1. Why is there no tool or process to help diagnose problems using the new HuP Checklists versus how we have previously trained our employees?
A1. Providing a generic aid will not meet standardization goals and instead, previous programs and training should be adapted for the new process.

Q2. Where does the HuP checklist go after being filled out?
A2. We're hoping the HuP Checklists will become a finalized document or we're attempting to use new technologies to turn these into a lifetime record document.

What is and What Should Never Be: First Line Leaders –Setting Ourselves Up for Success & EB 17-12

Chris Smith *(Duke)* and Sean Franklin *(Duke)*

Session Notes

- First line leaders are there to give direction and help support development.
- Good first line leaders set the standard and place service over self.

Key Learnings, Recommendations, and/or Best Practices

- First line leaders need to be focused on event prevention rather than event resolution/reaction.
- We're developing a group of first-line leaders across the industry to create a peer group.

Q&A

Q1. How much development of the peer group has been done?
A1. It has been discussed with INPO, currently collecting names, and hoping to begin formal solicitation in a few weeks. Also we have discussed with some utilities about internal peer groups.

Q2. Are you looking at long-term versus short-term objectives?
A2. Draft charter currently exists with short-term goals.

Q3. What can we stop doing or add value?
A3. We are required to be observing our folks and it is not currently standardized across the utilities and plants, nor are documentation requirements consistent. **How** someone is performing those observations is where we can reduce cost or add value. There is additional value for bringing maintenance crews in more quickly.

Q4. What do you mean by this peer group is supported by INPO? Where is the firepower for the peer group?
A4. Utility leadership needs to back the peer group. The group must be industry led and supported.

The 'How to' on Improving Organizational Effectiveness and Leadership Behaviors

Session Organizer: Marcia Lesniak *(Exelon)*

Ever wonder what your organization is missing that is keeping your organization from the next level of performance? Well here is your opportunity to hear what sets other organizations apart. You will hear from INPO and the industry on what are some simple tactics to improve organizational effectiveness, align leadership behaviors, and some performance monitoring tools to drive performance.

Cross-Linked Session: N/A
DNP Session: No

Organizational Effectiveness and some Performance Trends

Gary Waldrep *(INPO)*
Note: INPO presentations will be available through the INPO website

Session Notes

- A manager assigns and manages work. A leader is different and inspires.
- People bring issues to good leaders.

Q&A

Q1. What is an example of a behavior-based metric?
A1. Determine the gap, and where you want it to be, and then define the behavior that should drive you there; rather than the end result being the driver.

Q2. How do I know what I am creating is driving us in the right direction?
A2. We need to have milestones to assess how things are progressing, but on a macro-scale, we should see the gaps closing.

Q3. Has INPO developed tools that we can use?
A3. INPO has developed tools that we will provide to you or that you can obtain from INPO.

Streamlining the Performance Improvement Processes

Joellen Muntz *(Exelon)*

Session Notes

- Phase 1 – Standardize indicators across the board and across plants.
- Phase 2 – Create a database repository for standardized reports.

Q&A

Q1. What process are we using when the first data point has come in and things are not moving in the right direction?
A1. It should not lead to an exaggerated response, but instead should indicate more attention is needed. It may take training to reduce the knee-jerk heavy response.

Q2. Are metrics changed or adjusted for plants that are declining?
A2. No. Standardized metrics are important to the process.

Q3. What are your current indicators?

A3. We're going to standardized indicators for the whole fleet that will have customizable options.

Q4. How soon will the data be available once everything goes online?
A4. We want it to be instantaneous.

Industry Benchmarking – Open Q&A with the Industry's PI Leaders

Session Organizer: Reiko Perleberg *(Southern Nuclear)*

An open forum to ask all the questions of the PI leaders in the industry to get a pulse on what, where, and when, and how your peers are headed. It is a great opportunity to see and hear what everyone is doing around the industry. You will not want to miss it!

Cross-Linked Session: N/A
DNP Session: No

Open Q&A with the Industry's PI Leaders

Kevin Rackley *(TVA, Corrective Action Program Owners Group)*

Q&A

Q1. How are you trying to measure the effectiveness of a CARB outside of the typical self-assessments and metrics?
A1. TVA stated that they don't currently do anything ongoing and instead respond to outside assessments. OPG stated they have the manager level review and assess the CARB in real time and therefore assess the effectiveness continuously. Southern assesses on a monthly basis and provides ratings down to the individual plant. Columbia Generating Station has reduced the number of lower CARB levels and performs regular higher level reviews. Savannah River Site has a cross-departmental diverse team and that team looks at all action closures, grades them, and then has the ability to reject or reject with adjustment.

Q2. Do you track your WANO AFI's in CAP? If not, where do you track them?
A2. TVA rolls these issues up to the executive level and has removed them from their CAP system. INPO doesn't want AFIs in CAPs and expects them to be fixed when discovered.

Q3. How do you calculate your % CRs closed at screening? What is included? What are the criteria?
A3. TVA closes CRs at screening if it can be closed out by a corrective work order or some other system. Established programs and the ability to just issue a WO are utilized as the criteria many times.

Q4. How many have a separate work order entry system? Pros and cons?
A4. OPG, Columbia, and Susquehanna said yes. Having it separate reduces the burden on CAP.

Q5. How do you handle behaviors as a cause? Do you defer to another program or do you solve it within CAP?
A5. Solve it within CAP, especially if it comes from a causal analysis.

Q6. With EB 16-027b, how many folks have adjusted their IPA's/DRUM's? Are they relevant to other performance monitoring/assessment practices or activities?
A6. Columbia stated they have adjusted things, and they then use functional area scorecards to push down relevant information. Most have not done much for this EB.

Q7. Do you use another tool other than IPA or PIIM to address gaps at a department level?
A7. Susquehanna has replaced the PIIM with a report done three-time a year system. Some are trying to use CAP Level IV to cover some of this over.

Q8. Is anyone doing training to implement the new checklists?
A8. Training is coming for some, but no one is currently doing training. Roll-out included briefings and follow-up, but no training.

Using HU Tools? Prove it!

Session Organizer: Brandon Marlow *(Southern Nuclear)*

The team is working in the vault. You have confidence they understand the job and have all the physical tools necessary to finish the task, but you are not as confident concerning the "how" work will be performed. Come see how dynamic learning activities (DLA) to demonstrate their ability to apply HU Tools in a challenging setting.

Cross-Linked Session: N/A
DNP Session: No

How to Get it Right the First Time, Every Time!

Matt Minty *(Bruce),* Larry Bird *(Bruce)*

Session Notes

- Bruce found they were trending in the wrong direction around 2013, having a lot more HU events than they should have been
- They did an analysis to determine their Core 4 HU tools
- Bruce is seeing good progress since implementing the tools
- First challenge was how many people work at Bruce, it's a massive site with eight units
- Would always encourage you to do practice runs with DLAs (Dynamic Learning Activities)
- Running through a Hands on Experience: Circuit board activity
    - Assigning two people that are hands on, one person as a procedure reader, two people as observers
    - Starting with a PJB, need to complete a resistor installation maintenance test
    - Used effective communication to tell presenter that the title of the board was wrong
    - Communicated that PJB was poor, so now a more thorough PJB is being given
    - One of the connectors (3A) needs to be replaced with resistor (R1)
    - Previous shift connected alarm over night shift and did not test it
    - Alarm plays happy birthday, so that if it goes off in the control room they know exactly what it is
    - Resistor needs to be placed properly or the alarm may trip
    - This alarm is used for fueling, so if the alarm does work, fuel could be pushed too far into the reactor
    - We can use PU&A (Procedure Use & Adherence), peer checks, V&V (Verification & Validation) in this exercise
    - In step 5, the peer check should be used to make sure that happy birthday only plays one time. If it plays more than once it is wrong
- The system was put together incorrectly at another plant
- The procedures from the activity are available from the presenter
- The circuit boards are available online and come with hundreds of different configurations
- A large library of DLAs has been put together by Larry Bird for the CANDU owners group and may be shared with INPO
- You can see how easily people get tunnel vision while presenting
- Larry's vision is people can share DLAs back and forth
- Bonus DLA with counting train passengers
- All of these DLAs are in the online notes that will be sent out by Larry

Proficiency & Trajectory– Taking this initiative from theory to practical application

Session Organizer: Brandon Marlow *(Southern Nuclear)*

You will hear from INPO and Industry leaders about the meaning behind the term "proficiency", why it is an initiative we cannot afford to live without, and how you can help create a culture that values Proficiency at your station. In this interactive session, you will hear innovative ways to introduce Proficiency and brainstorm new ideas to help continue to shape and define this initiative for the industry.

Cross-Linked Session: N/A
DNP Session: No

Proficiency – From Theory to Practical Application

Kim Maza *(INPO),* Chantelle Hurst *(Duke),* and Lori Armstrong *(Dominion)*

Session Notes

- Operators struggle with the difference between qualification and proficiency.

Key Learnings, Recommendations, and/or Best Practices

- For infrequently preformed tasks, it is not necessarily to maintain proficiency. Proficiency can be established for the task when it does re-occur.
- We must allow our employees to state that they may not be proficient for a task, even if they are qualified. We must also provide support to the employee to ensure that they can become proficient and comfortable performing the task.
- Self-awareness applies to individuals, managers, leaders, and teams.
- Competence fades faster than confidence.

Q&A

Q1. Are we wrapping fitness for duty and self-awareness for fitness for duty into proficiency?
A1. There will always be aspects of fitness for duty that are stand-alone, but there is definitely overlap. The aim is not for proficiency to replace fitness for duty.

Q2. What do you do when employees are performing a task and the supervision doesn't exist to ensure that a task is performed proficiently? Do you define that as complacency?
A2. We need to ensure that we all understand the concept of proficiency and perhaps provide more oversight, coaching, or mentoring.

Q3. Is there a modified model for knowledge workers?
A3. Not currently, but the current model should work for knowledge workers necessitating additional milestones or checkpoints and being more attentive over the course of what might be a longer duration task for a knowledge worker.

Q4. Did you have a safe environment for bringing up proficiency concerns previously?
A4. It was very hit or miss - hence pushing for some of these efforts. Additionally, in some places it was a lack of consideration and folks just weren't even thinking about proficiency.

Q5. Are there roles, such as fire brigade, which should be exempt from proficiency concerns?
A5. There may be repetitive strategies needed to ensure that proficiency is maintained so that it does not become a concern.

Q6. What measures do you have in place to determine if the proficiency model is working?
A6. You never know the events you prevented. We want a simple program that doesn't need metrics to be measured.

Practical Implementation Resulting in Big Savings from the CAP Efficiency Bulletins

Session Organizer: Ludwig Thibault *(Thibault Consulting)*

Performance Improvement is under the spotlight in the industry on how they gained huge savings while maintaining effective Corrective Action Programs. Learn from the industry leaders on what it takes to effectively implement CAP-001 and CAP-002 regarding the dos and don'ts to get the results you expect.

Cross-Linked Session: N/A
DNP Session: Yes

Improving the Effectiveness of Issue Resolution to Enhance Safety and Efficiency

John Grabnar *(FENOC)*, Jim Schleser *(Dominion)*

Session Notes

- Users Group included 8-10 NRC members from regions in developing CAP-002. There were 8 examples in 2 user group meetings.
- Overview of improvement opportunity – plans for NRC involvement is a common question.
- First official feedback on NEI document to be obtained next week.
- Most stations are implementing INPO 16-007. Diverse CAP-002 team involvement. Initiative started January 2016 – titled "Retitle the Corrective Action Program". Focus on fix issue now – focus on correcting conditions. Determine actual scope of issues that should be in the Corrective Action Program. If Condition Adverse to Quality, it should be kept. Are issues not important still treated as not a condition adverse to quality?
- CAP-001 implements the CAP program that already exists.
- CAP-002 to change guidance to get nuclear to the next level.

- Condition Adverse to Regulatory Compliance is third element of items of regulatory compliance. CAQ+ is other issues of the Corrective Action Program in the scope of CAP not Adverse to Quality, not Significant Condition Adverse to Quality. Should not cause a safety culture issue, should not threaten oversight process that are covered by other regulations.

- Attachments not developed by CAP 002 group – made by Industry Working Group by MSPI group, for example. Checklists for reference, controlled by working groups.
- Approved processes include work management.
- In CAP, approved Actions. Outside of CAP, management processes.
- CAQ, SCAQ, CARC are aligned among CAP-002 members. Not agreed upon by NQA-1 group. In the new document, the definition is open to be aligned with Quality Assurance plan. Some utilities will have different QA plans until definition modified.
- Criteria 16 requires that the issue be identified and corrected through an approved process. If fixed on spot document and move on. If additional action is needed for extent of condition, it is not necessary for corrective action. Not a new concept, we differentiate between corrective action and additional management actions that are not corrective actions.
- SCAQ must be tracked in Corrective Action Program. CAPR can't be closed to Work Management Process.
- Intent not to limit or reduce issues identified. If single point of entry exists, it makes it easier to enter the condition. Can use an alternate process to identify conditions. Not the worker's job to determine where the issue needs to be corrected. If a light bulb in the parking lot, CAP should still be written, and the CAP screening committee ensures it is addressed in proper processes.
- Order from executive oversight – should not imply to workers that efforts are not to reduce number of issues identified.
- Consequence / Cause – no identification of apparent cause.
- E&A Root Cause – still needed.
- INPO 16-007 not intended to replace tools and techniques manual for evaluations. For significant conditions adverse to quality, there are 7 examples requiring root cause.
- Can use HU and OR checklist simultaneously. INPO 15-005 implemented the Leadership and Teamwork effectiveness checklist.
- For issues non power block, or meets appendix for condition not adverse to quality, do not need to use corrective action tracking system actions. If CARC, Corrective Action needed. N-CAP has non corrective action assigned.
- Appendix A provides several pages of examples.
- O&P issue checklist worked on. OR checklist developed to get at leadership and teamwork effectiveness attributes. Should be used during root cause for breakdowns of significant investigations
- Examples for Emergency Diesel Generator fails to Start during surveillance testing.
  1.) Identify the condition
  2.) Do amount of analysis based on Cause and Consequence.
      a. Based on if cause is ambiguous or clear, will determine if root cause or investigation is necessary.
  3.) Understand threshold for SCAQ.
      a. Should not be many performed each year
- Example provided for OSHA recordable event – would be seen as Non Condition Adverse To Quality. The example is soft example for unnecessary investigation as Condition Adverse To Quality.
- Example for Fuel Oil Storage Tank fitting leak – non CAP item.
- QA plan could make another government agency violation a condition adverse to quality. Should not be classifying issues higher than necessary. For cumulative impact, alignment was obtained on CAQ+ for NERC, OSHA, will fall outside of scope of CAP.
- Object of CAP-002 is only to use Significant Effort of evaluations for issues that meet significant condition adverse to quality.
- Example of one of two offsite power lines lost, requiring down power. Screened as a Condition Adverse to Quality. Equipment checklist could be used for investigation for documenting cause, and condition to be corrected. Could just say found branch, removed the branch to correct the condition.
- Different stations may still implement the NEI 16-07 differently based on difference in plant design.
- Per regulation, you correct the condition and cause based on NEI 16-07 consequence/cause.
- Not a 100 box item that will fall in general area. Generally, the correct area will be entered.
- Issued for industry review.

Key Learnings, Recommendations, and/or Best Practices

Some changes will need to be made to NEI 16-007 document before issuance.

Q&A

Q1. For equipment checklist, was there intent to combine equipment ACE and ICES report?

A1. Efforts underway to do this. For document focused on problem identification and resolution. The version used will give series of question to get to equipment investigation. Form is not finalized yet. Conscious decision to not include version with ICES reporting. Refer to ER working group who controls the checklist.

Q2. For Condition Adverse to Quality, why don't we relate to equipment failure?
A2. We may need more clarification. Appendix B, failure of a piece of equipment, may differ between plants.

Q3. Have root causes been from guidance or management discretion?
A3. A little of both has occurred with requiring emotional response requiring root cause. PI&R inspections will challenge use of RCE performed for Non Corrective Action Program issues with CAPR's.

What Success Looks Like…

Session Organizers: Reiko Perleberg *(Southern Nuclear)*

Do you know the difference between fixing an organizational problem and repairing a problem? Our speakers do, and you need to take advantage of their successes, noble failures, and continuing successes. If you are serious about recovering your organization's performance, you will want to attend this session that will get into the organizational drivers to turn your organization around.

Cross-Linked Session: N/A
DNP Session: No

Plant Vogtle Recovery

Darin Myers *(Southern Nuclear)*

Session Notes

- Vogtle 1 and 2 experienced a short and steep decline in performance in 2014 that they were able to identify quickly and mitigate. Recovery began in January 2015.
- As of July of 2015, Vogtle achieved the goals it desired and had arrested the decline and was on the rebound. This was a seven month recovery.

Key Learnings, Recommendations, and/or Best Practices

- Candor is extremely important in all assessments and recovery activities.
- Clear plans should align plant leadership with workers. Effective recovery is not possible absent of broad organizational alignment.
- Worker engagement in the recovery process is crucial for success; workers should feel as though they are an active participant in the process.
- Constant communication and cohesive messages are key to achieve organizational alignment and foster participation in the recovery.
- Recognition and reward is extremely important in recovery plans.

Q&A

Q1. Once you got green indicators, have you maintained that, or have you bounced back to yellow or red?
A1. After a short time of achieving green indicators, we assessed and reduced our indicators to the normal level and no longer track the additional indicators.

Q2. How did you deal with employees being worn-out from the recovery process?
A2. With employee buy-in, candor in discussion, and alignment between the lower and higher levels, folks were proud to have contributed to the success rather than feel worn-out from the process.

Organizational Performance Changes; CAP

Peg Lucky *(Entergy)*

Key Learnings, Recommendations, and/or Best Practices

- Focused, small number of corrective actions is better than a large number of low threshold corrective actions.

Q&A

Q1. How did you deal with employees being worn-out from the recovery process?

A1. Recognition and reward was important. Big celebrations at the end of the recovery were very important and helped employees manage their stress.

Q2. How did you target the important elements in the low threshold CAP program?
A2. The implementation of CAP-1 helped us reclassify items to better manage the less important elements and focus on those items required to be completed.

Q3. Was there an institutional issue with leadership that helped lead to the decline and how do we identify and overcome that?
A3. The recovery cause analysis identified that there were significant leadership issues. Now in our recovery plan, with the new leadership/management team, the leadership level has been more thoroughly involved and connected to the lower levels.

REGULATORY RELATIONS

Think Smart Think Digital: Digital I&C Regulatory Modernization

See Engineering & Equipment Reliability

Industry Regulatory Leaders Q&A

Session Organizer: Michael Meier *(Southern Nuclear)*

This is your opportunity to engage in a Q & A session with a panel of forward thinking industry and NRC leaders. It's a great opportunity to ask questions on issues covered in this conference or any topic you choose. The panel has executive expertise with a host of regulatory topics – from Part 52 licensing to backfit to decommissioning. Dialog is expected on the impacts of Delivering the Nuclear Promise and insights on the climate in Washington. This will be the most open-ended and likely the most interesting session at the conference, so please come and join us.

Cross-Linked Session: N/A
DNP Session: Yes

Industry Regulatory Leaders Q&A

Michael Meier *(Southern Nuclear),* Keith Jury *(Exelon)*, Pam Cowan *(NEI)*, Mike Johnson *(NRC)*

Key Learnings, Recommendations, and/or Best Practices

- Use the NEI website for talking points and position statements to align with industry positions.
- Plant licensing staff needs to be the first line of defense for the backfit rule. Make sure to "speak up" when a backfit issue is encountered.
- When utilities go through the LAR process, a robust management review process for RAI responses seems to reduce the need for subsequent RAIs.

Q&A

Q1. How did the SCANA announcement have an impact on Vogtle?
A1. None

Q2. What's the regulatory environment like for Vogtle 3/4?
A2. There is a very good relationship between Vogtle 3/4 and NRC. After the Westinghouse bankruptcy, NRC made resource plans for different scenarios as to whether the new nuclear plants would stop a portion or all of the new construction. Resources are being examined, especially in light of the commission deadline to combine NRR and NRO by 2020.

Q3. Is there any equipment that could be repurposed from SCANA to SNC?
A3. Not sure, but probably not significant.

Q4. When is NRC backfit training scheduled to be complete?
A4. Interim training: next few months; In-depth training: next year.

Q5. DCED – Design Compliance Enforcement Discretion Initiative. Why has the issue been shelved until 2018?
A5. Early on there was significant agreement that significant resources should not be spent chasing down compliance issues for non-safety significant items. NRC has not given up on the issue. The backfit issue resolution is expected to take care of some of these issues.

Q6. What is your (Mike Johnson) prospective for progress in digital licensing issues?
A6. Good progress is being made. 50.59 issues are a priority. The RIS should be issued in the October timeframe. NRC believes that it is not necessary for licensees to wait for the RIS to be issued to implement digital upgrades.

Q7. TSTF-505 4b for Vogtle has been in review for five years. What are lessons learned?
A7. Vogtle was the pilot, but didn't follow TSTF-505 to the letter. NRC is working with industry to revise their approval of TSTF-505. Five more reviews are in progress. Lessons learned will be applied to 50.69 application reviews. NRC is working on getting staff on board early in the process to bring staff that is traditionally deterministic up to speed. Putting discipline in the process for submittals and reviews is key to timely resolution of the risk informed submittals.

Q8. Did the NRC have a cost estimate to implement cyber security regulations?
A8. Don't remember the answer. There is a petition from NEI to reduce the scope of the rule.

Q9. How are we going to avoid the problems that led to the Design Compliance Enforcement Discretion initiative while the initiative is being delayed?
A9. NRC is looking at TIAA process to ensure that the results are predictable, reasonable, etc. Ultimately, the licensee needs the ability to deal with complex issues. The NRC is more receptive to elevate backfit/compliance concerns which may be generic to the headquarters level.

Q10. How do you balance issuing many RAIs vs. identifying what the licensing basis is?
A10. The line should be drawn at whether or not the information needs to be included in the safety evaluation. Some licensees are frustrated with the rounds of RAIs. When utilities go through the LAR process, a robust management review process for RAI responses seems to reduce the need for subsequent RAIs. NRC completes an internal review to understand the motivation for additional rounds of RAIs.

Advanced non-LWR Licensing Challenges - Transitioning Barriers to Bridges

Session Organizer: Amir Afzali *(Southern Nuclear)*

Nuclear energy is the dominant energy option for generating environmentally responsible energy while serving national security interests. Advanced non-LWR technologies expand the use of this unique source of energy by providing additional flexibility, such as replacing diesel generators in remote locations, and providing an alternative to fossil for process heat generation and seawater desalination. Yet deployment of these technologies has remained a major challenge in the US. Securing the required capital is necessary for deployment, but securing capital is challenged by uncertainties in licensing. The nation needs this barrier to innovation removed. This requires a licensing framework that strengthens the regulator, and provides improved certainty for reactor developers / investors. The distinguished panelists will provide their perspectives on removing licensing barriers to deployment of advanced non-LWRs in the US.

Cross-Linked Session: N/A
DNP Session: No

Licensing Advanced Reactors

Amir Afzali *(Southern Company Services)*

Session Notes

- Transparency, predictability, and fairness are the goals for an advanced reactor regulatory framework.

Advanced non-LWR Licensing Challenges - Transitioning Barriers to Bridges

Jim Kinsey *(INL)*

Session Notes

- Many of the discussions for advanced light reactors were issues during the Next Generation Nuclear Plant program. Generally, there is agreement on the future framework at a high level.
- Four areas of focus: the rules for LWRs, the rules for non-LWRs, the technology specific technical requirements, and the methodology for timely and efficient regulatory reviews.
- DOE is focused on achieving a well-defined regulatory framework in the near-future.
- The adaptation of the LWR-based General Design Criteria for non-LWRs will be released soon. This is a joint NRC and DOE initiative.
- Progress has been somewhat hampered by lack of resources/interest.

Key Learnings, Recommendations, and/or Best Practices

- Fuel qualification is a crucial concern for non-LWR licensing.

U.S. NRC Non-LWR Licensing & Technical Enhancements

John Monninger *(NRC)*

Session Notes

- There is a significant interest in non-LWR advanced reactors from a variety of entities. The NRC is working to ensure that the agency's regulations are not a barrier to the development of advanced reactors.
- The regulatory process should be flexible enough to accommodate differences in technology, yet maintain predictability of the licensing process.

- NRC's mission is the same for LWRs and non-LWRs. The only difference is the methods of regulations.
- The Implementation Action Plans for developing the non-LWR regulatory framework were developed without consideration of funding to provide a clear picture of the necessary scope of work.

Observations on the LMP's LBE Selection Process

George Apostolakis *(former NRC Commissioner)*

Session Notes

- Core damage frequency does not apply to every technology. The frequency-consequence evaluation criteria for the technology inclusive regulatory framework are based on dose at exclusion area boundary.
- The proposed regulatory framework is consistent with the Commission's observation that a PRA approach allows consideration of a broader set of potential challenges to safety.

Session Q&A

Q1. How is the dose determined in the frequency consequence evaluation criteria?
A1. Similar to the existing regulations 10CFR20 and 10CFR50.34.

Q2. Start-up companies have a hard time funding meetings with NRC. Are there any changes planned to the funding structure?
A2. NRC has a first meeting is free policy, but subsequent meetings have to be funded. By law 90% of the NRC's expenses have to be industry funded. Congress appropriated $5m in FY2017 for NRC advance non-light water reactor activities. It was recommended to work with the NEI Advanced Reactor Task Force and DOE to try to overcome funding issues. One consequence of the fee structure is NRR has little flexibility in their activities.

Q3. How does the advanced non-LWR regulatory framework incorporate the discovery of new information?
A3. New information would be evaluated against the frequency dose consequence evaluation criteria.

Restoring Regulatory Confidence in Risk-Informed: What Happened?

Session Organizer: Roy Linthicum *(Exelon)*, Ken McElroy *(Southern Nuclear)*

The U.S. industry has been actively employing risk-informed thinking for over 20 year and until recently, has made significant strides in risk-informing regulatory applications. Over the last several years, this momentum has stalled, in large part, due to a loss of confidence by the NRC in the industry's' tools and decision making process. This session will explore the potential reasons for this loss of confidence and explore ways to restore it.

Cross-Linked Session: Risk Management
DNP Session: No

Restoring Regulatory Confidence in Risk-Informed: What Happened? (Introduction)

Ken McElroy *(Southern Nuclear)*

Session Notes

- NFPA 805 is an example of a risk-informed initiative where the costs greatly exceeded the estimates. Fire PRA methods were too much in flux and the experience during the pilot plant process did not sufficiently test the process.
- Technical issues arose.
- TSTF-505 4b Vogtle LAR has been approved by NRC.
- F&O process caused a number of RAIs during NFPA 805 LAR reviews. The new process should reduce costs for TSTF-505 and 10CFR50.69 risk-informed reviews. NRC has weekly war room meetings for risk-informed LAR reviews with participation from all of the related divisions.

Key Learnings, Recommendations, and/or Best Practices

- A key lesson learned from NFPA 805 is to wait for the pilot plant process to be completed before submitting additional submittals.

Divergence in Risk Informed Thinking

Roy Linthicum *(Exelon)*

Session Notes (Risk Management KM)

- Risk models are still a valuable tool and there's a lot that can be gained from insights, but we are still seeking perfection. Conservatism can be a bad thing – can lead to the wrong insights.
- Peer review findings – some have been around for many years and have been ignored by the recipients but when a utility goes in for a LAR it comes back up as an issue and there's no real way to approach closure of out of date F&O's.

Session Notes (Regulatory Relations KM)

- NRC staff wants to approve all new methods, not only in fire but also seismic and internal events.
- Some utilities have done a poor job closing Findings & Observations.
- A lot of resources are wasted on non-consequential issues. One example is spurious actuation of new shutdown seals.
- Reg Guide 1.174 revision has been issued for public comment.
- NUREG-1855 provides an excellent methodology for assessing uncertainty.

Q&A

Q1. Why are there three pilots for the new F&O closeout process?
A1. NRC did an observation of an audit, and there were some concerns regarding independence. NRC feels that additional scrutiny of PRA quality is necessary for applications where

Q2. What priority does NRC place on the NextEra TSTF-505 4b applications?
A2. NRC is focused on NextEra's 505 applications and has weekly meetings to discuss risk-informed application reviews.

Q4. What was the cause of the 5 year duration for the Vogtle TSTF-505 4b LAR?
A4. There wasn't one cause, but NRC did receive a non-concurrence. Changing culture is a major issue for NRC where traditional reviewers need time to get used to risk informed initiatives.

Q5. Why do the utilities submit a pilot as opposed to submitting all plants at once?
A5. There is a Delivering Nuclear Promise initiative to get the industry to adopt TSTF-505 4b in mass.

Q6. Do you think 50.69 will be a smooth process?
A6. It depends. If a plant has a good peer reviewed fire PRA, seismic margins assessment SSEL, etc. then it will go smoothly. Plants with FIVE fire risk assessments may have issues. Licensees have taken different directions on the peer review closure process prior to the 50.69 LAR submittal.

Q7: Reg Guide 1.174 is being revised to provide better guidance for defense-in-depth and safety margin. Do you think it will improve things?
A7: Yes, we've had input from several stakeholders and we believe it will help. Another thing that is being revised in Reg Guide 1.174 is the region boundaries to blur the lines between the regions to emphasize the lack of a "hard" line in regulatory decision making.

Restoring Regulatory Confidence in Risk-Informed: What Happened?

Victoria Anderson *(NEI)*

Session Notes (Risk Management KM)

- Where we went right – we ultimately made the plant safer by providing insights to plant operations and licensing to improve plant performance and safety.
- Where we went less right – RG 1.200 for internal events worked, but for other models RG 1.200 wasn't ready. Focused too much on strict numbers and it was inappropriate for the application, such as RI-ISI.
- NFPA 805 – all previous points were found to be untrue. Original estimates of cost, time, and potential savings were incorrect.
- Where do we go from here?

Session Notes (Regulatory Relations KM)

- The PRA improvements in the 1990s and 2000s led to identification of plant improvements which have been very beneficial.
- Regulatory Guide 1.200 was intended to reduce regulatory resources spent on regulatory PRA reviews. Industry spent a lot of resources with not much benefit for some applications.
- The mindset where a specific value is the target goal in NFPA 805 has creeped into other applications.

Key Learnings, Recommendations, and/or Best Practices

Avoid numerical "cutoffs" in risk-informed regulations.

Risk Informed Regulation - What happened?

Rick Grantom *(CRG LLC)*

Session Notes (Risk Management KM)

- There is a lack of trust in some elements of our industry that don't and maybe won't accept risk. We learn, improve and innovate that may challenge institutional methods. Part of the reason for distrust is serious over conservatisms that don't match industry experience and that stopped trust from the utilities. Risk informed information can be applied everywhere – but we're hesitant to use it in areas that we haven't before (security, EP, etc.). Moving to a risk informed approach is even more essential than ever. Risk informed culture supports a solid safety culture.
- Generic approaches didn't really work as well as it should have. Process issues including reviewers who continue to hold up process for years in some cases, which takes this back to the trust issue. Risk practitioners and NRC reviewers are doing the best they both can, but there is a lot of colliding occurring. A risk investigation may have produced a much more cost effective solution to programs like FLEX.
- Conservative tests that produce conservative results that are incorporated into PRAs produce very biased PRA acceptance criteria that skew the PRA. Have to be careful. PRA is not a strict formula – it's knowledge, style, and experience.

Session Notes (Regulatory Relations KM)

- There is a lack of trust among people that do not accept risk methods. Trust works both ways. Conservatisms have led to mistrust on the utility side.
- Everyone should risk-inform their processes, including the regulator.
- The length of time it has taken to implement risk-informed initiatives has been on the order of 10 years, which has led to loss of institutional memory.
- Conservative tests incorporated into conservative guidance which is incorporated into PRA skews the results of a PRA.

Key Learnings, Recommendations, and/or Best Practices

- Always analyze the risk first.
- Regulatory applications are the only risk initiatives that have been implemented generically across the industry, so any future risk applications need to be implemented by the regulator or another path needs to be found.

Restoring Regulatory Confidence in Risk-Informed - What Happened?

Joe Giitter *(NRC)*

Session Notes

- Estimates to incorporate NFPA 805 did not look at cable routing, implementation, etc., and so the cost was underestimated.
- Rushes to meet deadlines of fire PRA models before pilot plant PRA models were completed caused frustration among NRC inspectors.
- Lessons learned from pilot plant PRAs could not be incorporated into other plant PRAs for NFPA 805 because they were all working in parallel and fire PRA methods were still very much in flux.
- There were warning signs with the pilot plants that there were issues with the processes.
- Looking forward, NRC will be improving processes such as F&O assessment to focus resources. Lessons learned now incorporate weekly meetings at NRC with representatives from each group to focus on accountability.

Key Learnings, Recommendations, and/or Best Practices

- Do not try to work on full implementation during the pilot process. Issues need to be identified, understood, and corrected before the program can be released for use across the industry.
- It is important that if there is a pilot process then it needs to play through completely before moving to full implementation.

Session Summary/Q&A

Key Learnings, Recommendations, and/or Best Practices

- From industry, noted that NRC is not "part of the team" as opposed to other groups who constantly communicate with the NRC on certain decisions. NRC has been engaged but maintained oversight on programs. Ability is there to increase trust between PRA analyst and regulator.
- Absolute assurance vs reasonable assurance causes us to make conservative decisions. Need to understand reasonable assurance. Numbers are not numbers, they are a range.
- Misconception that credit for risk management actions based on numbers and thresholds.

Q&A

Q1. DNP and efficiency – cybersecurity regulation puts pressure on potential users (10-20 million investment to comply) for digital I&C. What is the actual expense?
A1. This is another area where risk information should contribute. Need to use risk to adjust the scope to figure out what is critical. It is a wide open area that needs to be explored. When looking at risk informed initiatives, we're allowing licensees to make day to day decisions on the plant without NRC permission/intervention, so the risk impacts need to be correct and PRA quality needs to be high.

Q2. 4b applications – after getting Vogtle issue resolved, the rest will proceed quickly?
A2. Very focused – weekly meetings to discuss. Did issue RAIs. Short answer is yes. Objective is to review applications as expeditiously as possible.

Q3. What is the path for those applications that are "in flight" vs new applications?
A3. Most licensees will look at updates, application supplement to address gaps and RAIs will address remaining gap

Q4. Given successes and looking at lessons learned, what is the cause for why reviews took so long with many rounds of RAIs?
A4. No one cause. Realized that if we were moving forward with risk informed initiatives then everyone would have to come with them. It was painful process but many insights were gained from the extended review times.

Q5. 50.69 – do you think we have good alignment and structure in place to process these large number of applications and to implement?
A5. It depends. If you have a good internal events model and a peer reviewed fire model and a seismic margins safe shutdown, then it is easier. There are several plants with gaps and it will be a difficult task, especially if models were done as part of other programs like IPEEE but weren't peer reviewed, etc. Template for submittals to expedite process.

Q6. 1.174 revision –
A6. Trying to better define DID attributes. Supports idea that we don't want to focus too much on the numbers. Higher baseline risk = lower delta risk allowed. Don't interpret limits as hard stops/absolute limits. Changes making with 1.174 will help.

License Amendment Process and Process Improvements

Session Organizer: Jamie Coleman *(Southern Nuclear)*

Changes to streamline the License Amendment Request (LAR) process are ongoing per the DNP Efficiency Bulletin 17-08. These changes will increase efficiencies in LAR submittals and NRC reviews. NEI 06-02, License Amendment Request Guidelines, has been revised to incorporate an industry-standard LAR process. Effort to gain efficiencies with industry-coordinated/consolidated TSTF Traveler submittals is also being pursued. Maximum benefit can be gained by working together to submit travelers, ensuring that participation in generic Owner's Group projects is more cost efficient. This session will also discuss recent NRC process changes to include updates to LIC-101 and LIC-109, and a recent DORL letter

Cross-Linked Session: N/A
DNP Session: Yes

License Amendment Process and Process Improvements

Jamie Coleman *(Southern Nuclear)*

Session Notes

- NEI 06-02 Rev. 5 provides guidance for a more efficient LAR process.
- Type 1 LAR preparation follows NEI 06-02 preparation, while Type 2 and 3 are supposed to follow the traveler.

Key Learnings, Recommendations, and/or Best Practices

Refer to conclusion within the presentation.

LAR Submittal and Review Processes

Lance Sterling *(STP)* ***Unable to Attend, Presented by Jamie Coleman***

Session Notes

- Tech spec task force or owners group may coordinate submittal and review of LARs to adopt the same NRC accepted generic change. This process improves accountability for submittal and review schedules.
- The joint coordination is a great opportunity to have cross-utility reviews of LAR submittals.

Operating Reactor License Amendment Process Overview

Eric Benner *(NRC)*

Session Notes

- NRC has changed their RAI process to require approvals and root cause for second round RAIs.
- Last year three internal metric goals were enacted for the 2017 fiscal year: resource estimate adherence, schedule adherence, and acceptance review schedule adherence.
- In 2016 a regulatory issue summary was issued to identify planned licensing actions. This information is somewhat limited due to uncertainties for planned submittals in the six-month to two-year timeframe.

Key Learnings, Recommendations, and/or Best Practices

If industry sees something that looks inconsistent or out of scope, NRC management is receptive to immediate feedback.

Q&A

Q1. Is NRC tracking how many RAIs are avoided due to management review process? It would be valuable to share.
A1. NRC is not tracking RAIs that are vetoed by management. Having the draft SER side-by-side with the RAI is where the most efficiency is gained. When a second RAI is issued due to NRC staff missing an issue, they are asked how they can avoid the situation in the future. There is a behavior change that occurred due to NRC reviewers expecting RAIs to be scrutinized at a high level.

Q2. Is there a management directive on use of precedent?
A2. Yes, licensees reference applicable precedence in the LAR. There is a general expectation that NRC reviewers bring experiences to the process. Sometimes the use of precedence relies on the skill of the craft.

Q3. Are there any planned improvements for first-of-kind NRC reviews?
A3. Yes, NRC is ensuring applicable disciplines are being trained for 10CFR50.69 issues.

Regulatory Issues Task Force – Regulatory Performance Dashboard

Jim Barstow *(Exelon)*

Q&A

Q1. When is a good time to have a pre-submittal meeting?
A1. The process steps don't necessarily have to be conducted in the same order as presented in NEI 06-02. It's ok to have two pre-application meetings depending on the complexity.

Q2. Was there a pre-application meeting for the Duke FLEX AOT extension LAR?
A2. There wasn't time for a pre-application meeting in this case. Emergency Service Water pump allowable outage time was extended based on availability of a FLEX pump. There is an efficiency bulletin aimed at promoting a similar concept. NRC was interested in how the licensee would achieve cold shutdown if the FLEX pump had to be used during the AOT.

Q3. What are the ground rules within NRC for incorporating FLEX equipment in LARs?
A3. Credit for FLEX started in the oversight area (SDPs, etc.). NRC has a working group to look at credit for FLEX in regulatory activities. They are also looking at use of FLEX in risk-informed applications.

Select Owner's Group Topics

Session Organizer: Jack Stringfellow *(Southern Nuclear)*

The PWR Owners' Group Chair will provide an overview of the PWROG and the BWROG missions and how they operate with emphasis on the value to the industry. The Chair of the PWROG Materials Committee will discuss various materials related issues and the Chair of the PWROG Procedures Committee will discuss collaboration with INPO related to planned INPO review visits regarding Abnormal Operating Procedures (AOPs). The PWROG and BWROG plan to develop a standards document for AOPs like that which exists for Emergency Operating Procedures to provide a consistent industry standard and assist our members in preparing for the review visits.

Cross-Linked Session: N/A
DNP Session: No

2017 UWC Owners Group Topics

Jack Stringfellow *(Southern Nuclear)*

Session Notes

- The executive management group, a subset of the executive committee, can challenge PWROG programs. Programs which are challenged by the executive management group are subject to an Executive Committee review.

PWROG Materials Committee Overview

Heather Malikowski *(Exelon)*

Session Notes

- The Materials Committee has been actively involved in several materials issues, especially reactor internals issues related to extended operation of plants.
- Regulator is concerned about the uncertainties in neutron fluence monitoring for the Reactor Vessel. They have also challenged licensees that the nozzles are limiting for the P-T limit curves. The PWROG is submitting an evaluation that the vessel curves are bounding for NRC approval.
- PWROG is working with EPRI to demonstrate SCC monitoring is adequate for PWR stainless steel pressure boundary components.

PWROG Procedures Committee Overview and Recent Activities

Susan Sallade *(Exelon)*

Session Notes

- PWROG has created SECURE Setpoint Software to automate site-specific setpoints.
- The time sensitive actions for BDB have been rolled up in the Time Critical Action Program. Time sensitive actions are not required to be reevaluated unless certain triggers are met.
- PWROG is issuing a BDB Emergency Procedure Integrating document that provides guidance for implementing the 10CFR50.155 rule. The guidance is intended to generate consistency among sites.

Q&A

Q1. What is the impact of the Westinghouse bankruptcy on the PWROG?
A1. No impact from Westinghouse bankruptcy, since funded by the members. However, members are in a budget crunch right now.

Q2. What's the timetable for merging the risk committee between the BWROG and PWROG?
A2. The two risk committees are meeting together already, but there's no set date for integration. There still a lot of benefits from working together even before the committees are officially integrated.

Q3. How is the BDB event response being addressed by the PWROG to avoid excessive work?
A3. It is not the PWROG's intent to impose excessive requirements on industry and understands the industry's financial position.

Q4. Is the utility in the UAE joining the PWROG?
A4. Yes, they have joined.

Second License Renewal: Delivering the Nuclear Promise from 60 to 80 Years

Session Organizer: Andrew Taylor (*Sargent & Lundy)*

Operation of a facility for 80 years is a key element for realizing its full value. By the end of 2018, thirty-four units will have passed the 40-year mark for plant operation. Thus, one-third of the U.S. nuclear power industry will soon be eligible to apply for a second license renewal. This session brings together NRC, plant operators, and an A/E firm with issues and solutions regarding Second License Renewal (SLR), including:
• New NRC & industry guidance
• Research in aging of materials
• Lessons learned
• SLRA procedures and training

Cross-Linked Session: Business and Economic Performance
DNP Session: Yes

Second License Renewal: Delivering the Nuclear Promise from 60 to 80 Years

Andrew Taylor (*Sargent & Lundy)*

Session Notes (Regulatory Relations KM)

- In January 2014, NRC published a paper describing the four major challenges for license renewal.
- Dominion is working with EPRI to update MRP-227-A
- DOE and EPRI are studying concrete aging issues. These concerns are not limited to the nuclear industry as much of our infrastructure (bridges, etc.) involves concrete.
- The one time inspections occur over years 50-60 of the license.

Session Notes (Business and Economic Performance KM)

- Oakridge led a concrete aging mechanisms study that can be applied to the SLR.
- Use of a license renewal team engaged in leadership roles for current SLRA discussions taking place with NRC, EPRI, and NEI.

Second License Renewal: Delivering the Nuclear Promise from 60 to 80 Years

Steve Bloom *(NRC)*

Session Notes (Regulatory Relations KM)

- There are two letters of intent, from Peach Bottom and Surry, for Subsequent (or Second) License Renewal.
- Reactor vessel internals, cables, and concrete are key areas of concern for further research. NRC is collaborating with EPRI and DOE. As new information comes to light, the Generic Aging Lessons Learned NUREG will be updated.
- Region inspector will accompany SLR audit team, but no inspection will be conducted.

Session Notes (Business and Economic Performance KM)

- Cables and concrete have not had as much research done after the initial license renewal; this creates the need for new research to be done for SLR.
- The NRC is attempting to reduce their schedule to 18 months for site reviews by reducing staff performing on-site audits and attempt as much work as possible from in-house.
- 71-02 process has been removed from site audit to reduce time on site.

Key Learnings, Recommendations, and/or Best Practices

- Look at precedent, especially previous NRC RAIs, to avoid receiving RAIs from NRC.
- Include all information requested by NRC staff during the pre-application meeting. The meeting should occur at least a year in advance of the submittal. Some information takes a lot of time to collect and it may be too late if the meeting occurs just before the application is submitted.
- Take advantage of the clarification calls to ensure a common understanding of the intent of the RAIs. Peer reviews from other licensees who have previously gone through the process can also be helpful.

Second License Renewal: Delivering the Nuclear Promise from 60 to 80 Years - Dominion

Craig Heah *(Dominion)*

Session Notes (Regulatory Relations KM)

- The two pilot plants are communicating monthly to ensure consistent submittals.

Session Notes (Business and Economic Performance KM)

- In order to have information available for the NRC at any time is to create portals that will provide adequately detailed documentation: basis documents and supporting information

Key Learnings, Recommendations, and/or Best Practices

- Industries and NRC are going to use the FLEX portal model of posting information online to facilitate easier reviews.

Second License Renewal: Delivering the Nuclear Promise from 60 to 80 Years - Exelon

Albert Piha *(Exelon)*

Session Notes (Regulatory Relations KM)

- Clinton license renewal effort will begin in 2019. Clinton is the last Exelon plant to go through license renewal.
- Peach Bottom is planning to take exceptions for reactor head bolting and medium voltage cable.
- Three vendors involved in the Peach Bottom SLR.
- Environmental assisted fatigue calculations have been a source of additional unbudgeted costs.
- NRC performs independent OE reviews.
- NRC requires an effectiveness review for the aging management program effectiveness in exchange for not revising 10CFR54, the license renewal rule.
- Buried pipe is a challenge.

Session Notes (Business and Economic Performance KM)

- Scoping and screening has been completed for Peach Bottom site. AMPs are required; currently 25 out 49 are complete.
- The number 1 OE item is AMP effectiveness review.
- The GALL-SLR and GEIS guidance is comprehensive, clear and has been developed based on learning from first license renewal, research, and operating experience

Key Learnings, Recommendations, and/or Best Practices

- Crucial to have at least one SLR team member on-site for a successful project transition.

Q&A

Q1. In the list of priorities among the significant issues, what is the most important?
A1. For Peach Bottom the vessel is fine, concrete looks good. Piping is probably the greatest concern (raw water). Cables are second.

Q2. How are utilities going to treat cables?
A2. Testing and inspections will occur according to the aging management program. If there are issues, then the site will look for the most cost-beneficial fix.

Q3. Is NRC going to impose increased inspections now or during the SLR operating period?
A3. In the GALL for SLR, NRC has asked for more inspections due to insufficient knowledge base. EPRI has looked at BWR concrete pedestal and NRC is reviewing. The industry needs to perform a gap analysis (plant specific) for MRPP-227

Q4. Peach Bottom wasn't one of the first license renewal applicants. Why did they decide to be the pilot?
A4: Local community support is excellent. Performance of the plant has been great.

Q5. Surry wasn't one of the first license renewal applicants. Why did they decide to be the pilot?
A5: Surry is in a regulated area and the regulator was very interested in SLR.

Q6. What is the ballpark estimate for cost of SLR?
A6: Maybe $30-$40 million. It is less than a COLA, but we can't provide specific numbers.

Q7: Who sets agenda and what information needs to be discussed during pre-application meeting?
A7: Both sides set the agenda. Multiple meetings are ok. Any plant specific information or deviations should be discussed.

Q8: Have any extra (new) TLAAs (Time limiting aging analyses) come up so far?
A8: Too early to say.

Q9: How unique was Crystal River's concrete problem?
A9: Opinion is that the situation was unique. A lot of plants have performed similar steam generator replacements that had to go through a temporary hole in containment. The root cause is thought to be a locally sourced aggregate for the concrete which was insufficient.

RISK MANAGEMENT

Challenges in Implementing Risk Insights Across the Fleet

Session Organizer: Anil Julka *(NextEra)*
Participants: Victoria Anderson *(NEI),* Fernando Ferrante *(EPRI)*, Gene Kelly *(Exelon),* Joseph Giitter *(NRC)*
Room: Talbot B

The U.S. industry has been actively employing risk-informed thinking for over 20 year. Recently with the emphasis of delivering the nuclear promise (DNP), it has become important to improve knowledge of risk informed applications. Too often all the groups are not familiar with the risk informed framework making it difficult to implement across the fleet. With varying degree of knowledge form site to site, it is often challenging for governing and oversight organizations to implement. Achieving the benefits of risk-informed approaches requires an understanding of the strengths and weaknesses of the deterministic and probabilistic approaches and openness to the technical value brought by the different perspectives. The benefits of implementing risk insights needs to be over communicated and made part of the strategic initiatives for the fleet with implementing body at each site.

Cross-Linked Session: N/A
DNP Session: No

NEI Engagement in Assisting Utilities with Risk-Informed Initiatives

Victoria Anderson *(NEI)*

Session Notes

- Overview of risk informed licensing applications available to utilities. Risk informed applications vs. risk based – use any insights as a small part of the decision making process to influence a change/decision vs. using the PRA directly to calculate information to be used in applications. Status of some of the different RI applications:
    - NFPA 805 – many plants are still transitioning so full implementation is not yet complete.
    - Risk Informed Tech Specs (RITS) 5b – NEI is helping utilities expand surveillance frequencies once the RI application is approved, which is why this application is also not fully implemented across the industry.
- There are barriers to full implementation including immediate implementation of other programs like Fukushima response. NEI is working to remove these barriers and assist with implementation of programs.

EPRI Developments on Risk Visualization and Communication

Fernando Ferrante *(EPRI)*

Session Notes

- Risk communication is about making the tools integrate seamlessly.
- Phoenix is the unified software platform to help the visualization process and share with those who are not as familiar with it.
- Current version of Phoenix is a fully integrated program that has features that were available in individual programs now available in one platform.
- Different types of reports can be created that can be shared and distributed with organizations outside of the PRA group to communicate risk insights. Looking forward to the next year, planning to incorporate more charting capabilities for key contributors to risk grouped by user definition. This is still in development and needs a better look since it is essential to communicate the results that risk professionals calculate to other organizations in a simplified format.
- The following questions need to be answered: what has changed, why it has changed, what decisions should be made as a result of this change, etc., to present this information in a way that's meaningful. PRA can provide a lot of results, but facilitating a search for an answer with outside groups is the challenge.
- Risk insights are more than a number – need to understand what went into the calculation of the number and how does it relate to the design of the plant. Need to be able to provide information that helps other groups. Decision assistance can show delta cases vs. base case to help inform decisions.
- Can look at operator actions.
- Looking to provide mobile visualization for use.

Communicating Risk Insights ... more than just a number or color

Gene Kelly *(Exelon)*

Session Notes

- PRA has helped plants be safer because we're using risk insights to make decisions. We are not cutting corners or sacrificing safety.
- The challenge is that not everyone understands is what risk insights are or where they are located and what they mean.
- If you use PRA to make engineering and operational decisions, then PRA becomes more important to the operation of the plant and the decision making process. Some of the solutions appear obvious, but the risk informed studies may make different conclusions – such as people and procedure improvements rather than redundant or extra equipment.
- Many challenges are faced, but probabilistic thinking is encouraged. Time sensitive risk significant operator actions are taken from the model and used by operations to influence training and procedure improvement – success story for communicating PRA!
- Should I give them a number, or use words? Do I use colors? There are pros and cons of communicating in certain ways. Need to be careful – example: using green is still accumulating risk, so it may not be the full story.
- Exelon tool called RiskVis available to all personnel to look at importance measures, etc. and have had limited success in using it as a communication tool. Model Roll-out – many other programs to look at following a model update, but this is an opportunity to communicate what changed and why to the organizations.
- Bring site risk engineers to PHC meetings to talk about risk insights to the committee.
- It takes time to win people over in the probabilistic world – we have our own language and need to listen to those outside the PRA community to figure what is important to communicate and how to do it.
- Ease of access is also very useful in communicating.

Opportunities for More Effective Leveraging of Risk Insights Within the NRC

Joseph Giitter *(NRC)*

Session Notes

- Focus has been that DBA criteria have been met – now wanting a different perspective. Ensuring that the DBA criteria were met and everything less severe would fall underneath that umbrella and safety would be met. Regulator still wanted to ensure compliance with DBA.
- NRC holds workshops/PRA classes. RI Thinking Workshop addresses the gap with NRR, office of research, etc., and is led by senior technical staff across the agency and go through scenarios where they apply risk insights and make a decision.
- At NRC, trying to build PRA expertise in the NRC outside of the PRA group. It is a work in progress.
- It is procedure and process focused, so it's important to add risk insights and applications to internal procedures.
- There was a certain distrust of PRA in the past, but we're starting to see in reviews that teams are working collaboratively to result in more streamlined and efficient reviews.
- Can non-RG 1.200 compliant PRA's be expanded to help bring risk insights into the deterministic reviews?
- How do you determine what risk significance is? Relative risk ranking of items in the plant; if there are SSCs that meet the risk significant criteria, then a more detailed review is required, if not, then a more limited review is warranted to make it more efficient. Leveraging risk insights, etc., and can potentially find other programs (e.g. 50.59) to complete a change under. This can result in regulatory effectiveness improvement.

Session Summary/Q&A

Q1. Changing NRC policies to focus on risk - are we also taking a look at branch technical positions with artificial restrictions?
A1. Yes, there is complete management support to help reduce those restrictions.

Q2. RI thinking workshops – are they mandatory?
A2. Voluntary, but many people are interested in it. Some people may never be open to risk informed thinking. May be required, or highly encouraged, for all managers to go through this training

Q3. Any move to get education for non-technical folks in politics, etc.?
A3. NEI has drafted information for these types of groups for risk-informed regulation and looking into opportunities for education for those on Capitol Hill. Develop very focused training for lawmakers to show them how NRC is making the decisions from a risk perspective.

Q4. How long does Phoenix 2.0 take to solve a model?
A4. More on the hours scale, but is different site to site.

Q5. How are you going to incorporate error bands into Phoenix display? What is being done in risk space to help outside folks understand error bands (factor of 10, 100, etc., vs. 100% safety margin factor)?

A5. The tools are intended for 2 different audiences – can see relative comparison. Tools should be more informative to not hide information. Graded approach to looking at Defense in Depth and safety margin based on individual risk and we need to communicate that. Models enable us to identify potential weaknesses and fix them.

Q6. Thoughts on complexity of implementation of RI applications?
A6. Risk is valuable because of the flexibility it provides. Letting PRA be PRA and regulations adapt to it rather than the other way around needs to be considered.

Q7. What about organizational issues that need to be addressed to help communication?
A7. Some fleets have one engineer at each site to implement applications. Having multiple people at site may not be efficient to not be centralized. Communication strategy may involve other groups working with PRA engineers to provide plant insights.

FLEX in Plant Operations

Session Organizer: William Webster *(Dominion)*

The nuclear industry developed mitigating strategies and procured portable equipment in support of regulations and orders following the beyond design basis earthquake and subsequent tsunami that led to the Fukushima accident in March 2011. These strategies and equipment provide an additional layer of defense-in-depth with additional flexibility and diversity to permanently installed plant equipment. Under the NRC order EA-12-049, plants have implemented a series of FLEX strategies specifically designed to mitigate an extended loss of power event at the site. This equipment can also be used to develop additional strategies to reduce plant risk and improve operational flexibility. This session will share how sites have implemented additional mitigation strategies using FLEX equipment and other portable equipment. These strategies have been used to support regulatory requirements, TS AOTs, and have been credited in PRA models to demonstrate reduced risk from the additional defense in depth.

Cross-Linked Session: Operations and Ops Training
DNP Session: No

FLEX in Risk Informed Operations

William Webster *(Dominion),* Randy Bunt *(Southern Nuclear),* Michael Powell *(APS),* Gary Dudek *(Southern Nuclear)*

Session Notes

- Utilize the FLEX strategies, equipment, connections, and encourage out of the box thinking with this equipment for unique scenarios.
- Quantitative streamlined assessments to identify what benefits can be gained and what order of magnitude FLEX credit can provide.
- NEI 16-08 purpose is to look at FLEX and incorporation into strategies as a benefit to the site. Must go through strategies to evaluate all aspects of it and whether it will work for a site.
- Addressing unintended consequences such as damaging the permanent equipment when being used during outages, etc. – don't want to establish strategy to save a little bit of money but damages the permanent equipment. Also cannot use FLEX equipment for something beyond what it was licensed/designed to do. Need to also address Maintenance Rule issue of FLEX equipment. There may be consequences from NRC, INPO, and MR.
- Hazards evaluation must take into account several factors that tie into arguments of how, when, where, etc., to pre-stage equipment and this all needs to be documented.
- Must think differently to take advantage of FLEX equipment for outage risk reduction.
- Gravity fed service water system drove risk very high. Flood shields were placed around joints, etc., but flooding potential was a still a large risk. Would lose AC and DC power which would cause several losses of control to important equipment. Remote monitoring panel installed to restore power for control. HEPs were incorporated into model and took flooding scenarios decreased by an order of magnitude.
- North Anna seismic risk – GMRS can be up to 5x the magnitude of the SSE. FLEX can be used to recover from a seismic event. Equipment credited for small leaks assumed to occur following a seismic event and recovery from relay chatter that would take out EDGs.

Q&A

Q1. From a procedure standpoint, has Ops discussed having FLEX equipment addressed in normal operating procedures rather than AOPs/EOPS?
A1. Ideally looking to get there. Pre-conditioned to staying out of the MR – but that doesn't change how the equipment will be treated. Will enter Ops maintenance procedure from alarm response procedure. During outages, a lot of portable equipment is already pre-staged to get time margin.

Q2. Was thermal hydraulic used as a basis for timing?
A2. Yes, for depletion of emergency tanks, etc., to establish timing.

Q3. What type of limitations do you have to assume on this equipment?
A3. Certain probability of failure for the equipment and it was accounted for in the model.

Q4. Experience with cost benefit analysis and it didn't make sense financially but was a good candidate for risk reduction?
A4. Some items are not done for cost benefit. The flooding scenario was a huge contributor to risk so it needed to be reduced as the NRC was questioning it. Sometimes portable equipment or other strategies are so cost prohibitive that a different strategy must be established to better address the risk. NEI 16-08 addresses both cost and risk reduction.

Q5. Where do you evaluate potential impacts on other plans (security, emergency, fire, etc.)?
A5. For Surry, assumed normal protocol and would have to take that into account. Cannot make same assumptions as with FLEX and would have to incorporate that into information.

Hatch use of Portable Equipment to Reduce Risks in Shutdown Modes

Randy Bunt *(Southern Nuclear)*

Session Notes

- Don't take out HPCI/RCIC too early in outage to have them available and pre-stage FLEX equipment incorporated into procedures to account for risk.
- FLEX deployment time of 10 hours was chosen as a line in the sand.
- Outage safety assessment used to get credit for pre-staging.

Q&A

Q1. Has the panel experienced ideas coming from different parts of the organization to incorporate FLEX for use?
A1. Yes, accepting ideas for using FLEX equipment for help to expedite tasks without compromising risk or safety.

Enhancing Management of Risk

Michael Powell *(APS)*

Session Notes

- Key components were analyzed and received benefits from analysis from risk perspective.
- At 25% FLEX mods design, looked at risk and determined what mods (FLEX or otherwise) could be modified to reduce risk. It's not uncommon to be in yellow risk for RCS during outage, but utilizing FLEX equipment, yellow windows in many areas changed to green. Do a lot of vertical/horizontal slice reviews to ensure PV stays in green. Pre-staging gives time margin. Some situations have not been credited because there's no HRA to support it. FLEX equipment is not in the PRA, only in configuration risk management model for use in a4, but not in 1.200 model. Pre-deployed equipment is tested and documented for performance during LOOP.
- Evaluation process has to be broad to include in analysis and may require additional needed items (fire watches, briefings, walkdowns, special protections, etc.) in order to credit equipment.
- FLEX cabinets are easily identifiable, at easy to access places and heights, in order to simplify process of hooking up equipment.
- Importance of some equipment may have to be re-evaluated for training rather than "skill of the craft".

Q&A

Q1. This equipment not used in the 1.200 model?
A1. Not currently, based on current talk at NRC, but it may be worth discussing if this qualifies as a model upgrade requiring peer reviews. The answer to the issue isn't clear and needs to be discussed.

Q2. Has the cost been accounted for?
A2. Utilities spend an average of 40 mil per unit. Didn't spend too much more than any other utility. Stayed operationally focused which assisted with cost.

Realizing the Promise of 50.69 Risk Informed Component Categorization

See Engineering & Equipment Reliability

Restoring Regulatory Confidence in Risk-Informed: What Happened?

See Regulatory Relations

Applications of Seismic PRA

Session Organizer: Vish Patel *(Southern Nuclear)*

Several US utilities have developed Seismic Probabilistic Risk Analysis (SPRA) models. While there may have been several drivers for developing SPRA models, one of the major drivers was NRC Fukushima orders. The US utilities have either submitted risk insights from the SPRA models to meet the NRC Fukushima order or are in the process of submitting this information. Other utilities may be contemplating to develop SPRA models to support various Risk-Informed applications but might be discouraged due to high development cost. The purpose of this session is three-fold - explore ways to develop seismic PRA models more economically without significantly compromising risk insights ("Seismic Smart"), explore various applications of SPRA models, and hear NRC's perspective.

Cross-Linked Session: N/A
DNP Session: No

SPRA-SMART: Structured Manageable Advanced Risk Techniques

Walter Djordjevic *(Jensen Hughes)*

Session Notes

- The 20 stations that have performed SPRAs are mostly due to regulation. There are benefits of having SPRAs at plants. Looking forward, SPRA is a great tool to have. Looking to potentially make seismic models more "compact" which will reduce cost and make the overall model smaller. With fragilities, can potentially look at screening based on caveats that may get met. To utilize 50.69 benefits, need full seismic PRA since SMA is static list from nearly 25 years ago and may not be comprehensive.
- Model importance vs. Seismic capacity. Want to screen high seismic capacity, low model importance SSC's, and focus on high model importance, low seismic capacity.
- SMART approach was created to not spend money on creating models with rugged or otherwise unimportant to CDF SSCs to save money and be more efficient. Interim quantifications help determine what SSCs are most important as the process continues. SMART approach is not a shortcut and does not deviate from standard, it just streamlines analysis, walkdowns, etc. 50.69 graded approach to include screening approaches. There should be more information on whether this will be a viable approach in approximately a year.

Risk-Informed and Performance-Based Framework for Seismic II/I

Parthasarathy Chandran *(Southern Nuclear)*

Session Notes

- Seismic category II components include anything that could fall or impact safety related components. A risk informed approach is suggested to lay out a systematic process in seismic design of II/I. Need to refine the process so that design process can be simplified and so that potential non-important components that don't affect category I components aren't classified as category II unnecessarily.
- What are we really getting out of seismic PRA? Potential benefits for programs like 50.69. For DNP, a more systematic approach will produce a cost benefit.
- Permanent Condition is a component that is placed in the plant for a longer period of time. Temporary is anything placed during an outage or normal maintenance. Can result in reduction in costs, dose, and outage duration.
- Risk informed approach would create focus on items that are important from a seismic standpoint. It would identify high seismic importance areas and simplify analysis.

NRC Perspectives on Seismic PRA

C. J. Fong *(NRC)*

Session Notes

- NRC supports the use of SPRA based on 1995 PRA policy statement. RG 1.174 can help to change licensing basis. NRC has endorsed Addendum A, but has not endorsed Addendum B.
- Part 5, Code case, may provide interim guidance and will be included in next revision of RG 1.200. SPID is endorsed only for Fukushima response. SNC currently has justification in for accepting Addendum B in lieu of Addendum A and is still under review.

- F&O closure process – can be used for seismic PRA (Fukushima response or LARs, etc.) and options are not mutually exclusive. FLEX in seismic PRA – high level should be included in model because FLEX is part of as-built, as operated.

Session Summary/Q&A

Key Learnings, Recommendations, and/or Best Practices

- Plan for SMART approach is flexible – can incorporate certain parts with partial information that is risk informed.
- Seismic PRA can be better. It comes down to peer review, regulatory review, etc. SMART approach is not a shortcut, it's a more informed way to approach it.
- If you remove components, then you have to re-validate. Update (no removal of components) to SMA did not require more than verification of path.

Q&A

Q1. Can this be done for <$500,000?
A1. We don't know yet. There's an interim stop point at list compilation point and use this informed SEL to apply 50.69 without full seismic PRA development and come back at a later time to continue.

Q2. Timeframe to get in front of NRC staff?
A2. Not determined yet.

Q3. For risk informed applications, have we looked into updated Fukushima SWEL for application for 50.69?
A3. The SWEL only got a representative sample, found essentially nothing and spent a lot of money. We did prove that we maintain our plants probably.

Q4. Use of FLEX – talking about portable equipment?
A4. Yes, specifically talking about portable equipment. Does not cover getting equipment in from regional centers. Interim guidance so that licensees can take credit for it.

Q5. Any thought of using part 10 of standard?
A5. You can do that in the integrated approach, but may spend as much money as on SPRA.

Q6. 50.69 space, may have SMA that yields conservative results – is it possible to do limited SPRA to focus on chosen systems to categorize in 50.69?
A6. Depends on the system, but answer may be no because you may be lacking interaction. You can't just take a part of the model out and not worry about boundary conditions.

Q7. Could the II/I design process be done for snubbers?
A7. Can't take out a seismic restraint without re-analyzing.

Q8. For outage scaffolding, most plants have procedures, but beyond that what is considered temporary loads like heavy weights on floors, etc.?
A8. Still designed for heavy load in compliance with design basis

Characterization of Risk and Safety Benefits of Advanced Technology Fuel

Session Organizer: Owen Scott *(Southern Nuclear)*

The nuclear Industry is currently looking at various designs of new Advanced Technology Fuel (ATF) to reduce risk and improve safety of nuclear power plants. Before committing substantial resources for development and fabrication of new ATF, questions that need to be answered are how much safer will a plant be with ATF and can the benefits justify the costs? This session will discuss how PRA models can be used to quantify reduction in risk and provide insights into which characteristics of the various designs would yield the most benefits for a particular plant. A process to develop a new PRA model with success criteria based on an ATF design, which would provide a look at the risk profile and contributors to plant risk with the new fuel, and how this new PRA model could be used to evaluate the incremental cost savings from Risk Informed applications using the new ATF-based PRA model compared to the cost savings using the current PRA Model, will also be discussed.

Cross-Linked Session: N/A
DNP Session: No

4 AREVA ATF

Robert Sanders *(AREVA Inc.)*

Session Notes

- Chromium coating helps to prevent high temperature oxidation – oxidation energy is approximately three times decay heat energy.
- Doping of fuel allows for greater grain sizes which allow slower releases from grain boundaries and gap region. Substantially less noble gas release.
- In severe accident space, it depends. Results will be different. If analysis yields fuel temperature >2600 degree, case is terminated and that is considered a failure.
- With non-ATF fuel, high hydrogen production which may prohibit cooling by AFW, with ATF, this issue does not occur and injection can continue. Have to have water injection at some point.

Assessing the benefits of accident tolerant fuel for nuclear power plant risk and safety

Stephen Hess *(Jensen Hughes)*

Session Notes

- In order to be viable, ATF must have several characteristics including physical properties, economics, performance, and post-use storage/disposal. Totality of picture is focus and all aspects are equally important.
- If fuel is perfect, what is the next limiting component? Still cannot go to infinite time due to limitations of other equipment.
- Current evaluations have focused on SBO events with loss of power at both beginning of event and later (due to battery depletion, etc.).
- There are benefits to this type of fuel because it has been optimized, and may have improved the end result from TMI. No matter what, must get water injection at some point.
- Things like FLEX are critical. ATF helps crucially. Still must maintain coolable geometry per ECCS criteria.
- From an asset standpoint, crediting only saving the core and not protecting the asset, there will be issues.
- Small benefits like changing clads is more achievable but not as beneficial as new fuel types. 10-20% benefit with ATF whether or not FLEX is credited. Many changes possible in PRA when incorporating ATF such as success criteria.

Industry Activities for ATF Deployment

John B. Williams *(Southern Nuclear)*

Session Notes

- Looking at different ATF technologies, each has their own benefits.
- New clad materials prevents zirc-water interaction.
- New fuel pellet type for more extreme tolerances.
- SNC is part of DOE advanced fuel timeline.
- Industry is working to move timeline for ATF to the left due to retirement of plants.
- Use margins gained by new fuel to provide cost benefits to our fleet.
- External Affairs task force – lobbying efforts to ensure funding is available to complete on time.
- Qualification task force looks at all requirements for fuel and how we would qualify new fuel to current standard.
- Safety Benefits Task Force looked qualitatively at potential safety benefits of ATF, now looking at quantitative analysis.
- Only looking at severe accident benefits before, but results were not as expected and therefore broadening scope – normal ops, transient conditions, DBAs, and how margin can be extracted from those scenarios.

Accident Tolerant Fuel: Westinghouse Activities

Ray Schneider *(Westinghouse)*

Session Notes

- Physical benefits of ATF will translate to economic benefits.
- Theoretically could become the strongest component in the core.
- Looked at different What-If cases for ATF vs. current fuel types, including the TMI scenario.
- EPZ reduction because fission products are contained in the fuel and do not have to worry about release.

FeCrAl ATF Economic Impact (for BWRs) Plan & Results

Francis Bolger *(GEH)*

Session Notes

- This alloy has high neutron absorption. In today's occurrences, we don't want dryout to occur – if it were to occur, what's the most limiting case for a BWR. Looked at from a fuel rod standpoint. AOO impact looks at different parameters to establish if FeCrAl fuel is more sustainable. Can potentially be used at lower operating temperature and will have a cost benefit.
- EDG requirements could potentially change with ATF. Changes in maintenance, surveillances, can classify one or more EDGs as nonsafety, etc. Planning maintenance on EDGs is most limited and area for most potential improvement with ATF. Multinode model to look ambient temperatures and heat transfer. Not much more coping time available on a long term SBO with loss of injection at t=0.
- Need to ensure that ATF has ability to be withdrawn from core – potential issue that geometry may still be coolable but material is not strong enough after the event to continue operation with high confidence.

Session Summary/Q&A

Key Learnings, Recommendations, and/or Best Practices

- EPZ could potentially be reduced to OCA.

Q&A

Q1. Metallic fuel – what are the downsides?
A1. Swelling is most important issue.

Q2. Envision any changes with noble gas types? Same types of radioisotopes?
A2. Uranium silicide pellets have reduced noble gas production. No gap releases with new cladding. Fission products should be nearly the same.

Q3. Level 3 analysis?
A3. Feasible benefits were analyzed – elimination of EPZ would not be pursued. Experts from a recent panel did not feel that the extra couple hours would justify eliminating the EPZ. ATF could potentially lower risk significance of components which may move components in RISC3 in 50.69, which would help with procurement. PRA doesn't drive 50.69, so components will still be important even if risk insights lower significance. Need more than a couple hours for appreciable CDF change. PRA doesn't drive results. NEI task force was established to look at EPZ reduction and the political pressure is to not change EPZ.

Q4. When finally do full core load, does a PRA/licensing engineer to look at? Minor tweaks to PRA with maintenance and not upgrade?
A4. Some concepts success criteria can change. Crediting FLEX as a methods change would lead to crediting ATF as a method change. Disagreement among PRA professionals, regulators, and others on what is and is not a methods change.

What's Next in Probabilistic Risk Assessment (PRA)?

Session Organizer: Stuart Lewis *(Jensen Hughes)*

PRA has become an important tool in managing day-to-day risks in the operation of nuclear power plants and in addressing a wide variety of safety issues. As we continue to implement a range of available risk applications, it is not too early to start considering what new challenges for PRA lie just over the horizon. The next big thing for PRA may be an important new risk-informed application that builds on the experience of the past two decades. Drawing on insights from the vast array of existing PRAs and risk applications may well offer an opportunity to risk-inform the models themselves, making it possible to develop, maintain, and apply risk technology more efficiently. Furthermore, the increasing use of risk information makes it essential that important insights and a proper understanding of the role of uncertainties be extracted and presented in a manner that can be acted on effectively by decision-makers. This session will explore these potential developments and the challenges to be met in pursuing them.

Cross-Linked Session: N/A
DNP Session: No

Future of Risk Technology

Fernando Ferrante *(EPRI)*

Session Notes

- It's important for the present to think about where we've been. We've come a long way from where we are and how it was accepted before. Important to keep in mind the history.

- Initial PRA efforts got a lot of criticism, but now we have more data, know the gaps we need to address, resources are infinitely better, models are getting more complex, regulatory applications that are being used. We are in a good place. We tend to over emphasize the negative.
    - Always at a crossroads, ongoing struggle
    - PRA doesn't have to be THE (only) tool to do everything – can be more flexible and take the insights in a different way and using it better.
- Requirements came at different times, different models, varying levels of conservatism, different treatment, etc.
    - Are we doing this correctly? Do we have the right tools?
    - The numbers do matter but are we losing something else by forgetting where the information comes from.
- Most risk initiatives have been regulatory driven, but the future should see more tools coming out as licensee driven.
    - 50.69 is integrating application that bring seismic analysis with other tools that incorporates risk insights but was regulatory driven. More initiatives need to be licensee driven.
- Need to have confidence in the model assumptions.
    - High wind vs TMRE model – what does it mean? Is one better? Level of heterogeneous models varies.
- PRA-lite – something between nothing and a full PRA that's acceptable for applications.
- Need more efficient PRAs , not just faster computed PRAs.
- Risk insights can assist with DNP.
- Methodologies and tools:
    - WASH-1400 set the stage for what we use today.
    - As we put more and more things together, it becomes more challenging.
    - Looking towards future, have to step away from concerns – how do we go back and lok at a different paradigm and how can that help address the level of conservatism.

The Evolution of PRA: An NRC Perspective on What's Next

Joe Giitter *(NRC)*

Session Notes

- Areas where we've traditionally used PRA:
    - All overlap – Safety/Regulatory, Other
    - Safety/Regulatory – include NFPA 805 and results improved safety, despite the challenges.
    - Other: other reasons exist for why a site would have wanted to do a PRA.
- Adding fuzzy lines as boundaries to illustrate aggregation issue of RG 1.174 table. If you're in region I, it prevents utility from pursuing a risk informed applications.
- Fire CDF – sometimes greater than Internal Events CDF. Seismic may be significant contributor. Talk about efforts in realism which may reduce CDF. Incorporating FLEX into PRA model may have ability to reduce CDF.
- Fire CDF may be high because it was difficult/cost prohibitive to do detailed cable tracing and conservatisms had to be made that potentially gave higher CDF results.
- CR-6850 used for NFPA 805 had conservative numbers. Intended to be used as screening. Most licensees stuck with heat release rates and got conservative results, but realistic heat release rates are much lower.
- Look at low hanging fruit – fire ignition frequency (bin 15) of electrical cabinets and how they're characterized. Lower voltage electrical cabinets have lower frequency. Could do binning based on frequency of cabinets which may lower fire CDF.
- Shutdown seals brought down the CDF for sequences like SBO.
- Seismic PRA – 50.69 requires consideration of seismic risk. If licensee has seismic PRA, including a lot less components in RISC1 category.
- Crediting FLEX in risk-informed decision making:
    - NRC credits FLEX in many programs such as SDP, MR, NOEDs, Risk Informed License Amendment Requests, etc.
    - NEI Guidance 16-06:
        - Tier 1 – qualitative assessment
        - Tier 2 – semi-quantitative streamlined assessment
        - Tier 3 – modeling mitigating strategies equipment in a PRA
    - Will help address risk aggregation issue, at least for some accident sequences.

What's Next for PRA?

Stuart Lewis (Jensen Hughes)

Session Notes

- Discussion on how to improve our methods to make things easier to do in the future.
- There are things we have to overcome in order to move into new areas and move forward with this technology.
- Quantitative health objective – results from SOARCA study shows orders of magnitude of margin between risk level and NRC safety goal.
- If plants are operated in a way that protects the investment, then protecting the health and safety of the public is highly assured.
- EPRI looking into risk informed cybersecurity to determine what assets need to be protected from a cybersecurity standpoint.
- Have a better understanding of the consequences of an accident so the concept of risk informed EPZ may be plausible.
- Look into risk informed operations for protecting the asset and risk inform the way operators are trained
    - RIHAs are starting to be added to training programs
    - Focus on things that are really important.
- There may be things we can do to make models smaller and more efficient rather than coming up with technology to solve bigger models faster.
- Focus more on insights.
- PRAs spend a lot of time looking at results of what's modeled, but how often do we step back and check if we're missing anything?
- Effective communication needs improvement to show how important things are.

What's Next for PRA? Leveraging Existing Insights

Gene Kelly *(Exelon)*

Session Notes

- Look at "elusive" insights of PRA, extending methods to things outside of nuclear.
- When we say risk-informed, the idea sometimes scares people off because of regulatory implications.
- Tornado Missile Risk Evaluator (TMRE) can be done with site personnel, cost-effective.
    - Using risk to solve a deterministic problem.
- Suction Strainer – 12 issues on strainers for BWRs. Would have been very expensive to solve deterministically, but risk informed solutions was much more cost-effective.
- Digital I&C utilizes risk insights to identify impacts and determine importance.
- Cut sets look at functions and can derive insights rather than only looking at importance measures.
- Battery load shed example:
    - Initial thoughts – add more batteries for extended loss of power
    - Looked at FLEX
    - Final answer was to not add batteries because must get power to the battery chargers
    - Answer for each plant was a little different
- If we are going to build new things – think about things because it may not be reasonable from a risk perspective.
- Extensions to other business units to apply this type of decision making to other industries.

End of Session Discussion

- The road doesn't end with the current risk informed initiatives.
- We don't have the tools yet – challenge the industry to get better tools.
- Challenge ourselves – there is a vision.
- TMRE has no fault trees/event trees but can still be used for risk evaluations.
- Need to be able to make PRA and risk decision making simple.
- There was a need for the standard, but risk insights need to have technical justification and quality.
- Looking to use risk insights with non-RG 1.200 compliant PRAs in licensing reviews:
    - Have to change the culture and find the middle ground
    - TMRE is a good example.
- Deterministic working with risk – Palo Verde EDG as an example.
- Opportunity in seismic PRA issue with 50.69 – almost 30% of plants don't have way forward. Either full pedigree PRA or SMA, need something in the middle that still has a high pedigree with risk insights without the major costs.
- One of the important things we have to do as an industry is make the effort to figure out what the middle ground is and whether it's fair for risk insights:
    - What is the framework that can be provided as the backbone to make this a trustworthy product/process.
- 50.69 will be revisited periodically to verify categorization and we have the information and need to utilize it in the best way possible.

- Emphasis on keeping models up to date.

SUPPLY CHAIN

"Billions and Billions, and Nothing to Wear" - Leveraging Risk Based Decision Making for Effective Inventory Management

Session Organizer: Greg Keller *(Rolls-Royce)*

Inventory levels are considered to be 'excessively' high throughout the industry. With each outage or capital project, procured materials, parts and components are scoped, designed and ordered but not always with the full input from the organization which can result in delays to schedule, increased costs, re-order or dispositioning to inventory. The more significant impacts could be challenges to safety or plant operation if the errors go undetected. In the fast-paced work environment of the plant activities, legacy and un-used items can make it to inventory and, over time be a key contributor to unnecessarily high volumes of inventories. This session will present an executive level overview of inventory management from the perspective of leadership engagement, risk based decision making and methods, and strategies for full supply chain governance models. When combined, the strengthened management of the supply chain can drive improved inventory management, higher equipment reliability and reduction of impacts to plant operation.

Cross-Linked Session: Executive and Leadership
DNP Session: No

Leveraging Risk Based Decision Making for Effective Inventory Management

Bill Frye *(Duke Energy)*, Jim Ripple *(Southern Nuclear)*, David Garcia *(AMMI Nuclear)*, Ryan Gilchrist *(STARS)*, Marc Tannenbaum *(EPRI)*
NOTE: This was a session in which multiple authors presented using the same presentation

Session Notes (Executive/Leadership KM)

Speaker: Jim Ripple *(Southern Nuclear)*

- Things to consider with inventory management – what is the cost of inventory to companies and industry now and what will that cost be at a later point in time?
- Inventory in the industry is growing every year with no end in sight for most but somehow there is still belief that there are not enough inventories.
- In order to control inventory to have a balance between equipment availability and costs, we must have engagement throughout the organization to have accountability and shared responsibility at all levels.
- There are competing priorities between plant operations and maintenance personnel and supply chain/inventory management personnel. Operations and maintenance tend to focus on conservative stocking levels to ensure plant reliability but may not consider costs associated with those stocking levels.
- In the past, supply chain personnel were not held accountable for excess inventory, they would only be held accountable if they were on critical path. It was believed that a mechanic not having all the necessary parts in the field was unacceptable. As the industry approaches middle and end of life operations, we still have 90% of the construction leftover inventory. The mechanic having every part necessary is still high on the priority list but efforts to manage cost have increased in priority.
- Two unrealistic estimates of sinking funds exist:
  1. How much you'll be able to get for excess inventory; and
  2. Unrealistic estimates for how much equipment value the utility is able to write down over remaining operational years of the site.
- Computerization of planning activities and predictive preventative maintenance growing in the industry, there is more focus, interest and potential capability to better manage inventory. Part of this electronic inventory management involves using predictive inventory analysis models rather than the industry's past track record for reactive inventory analysis.
- Excessive inventory is a misuse of financial resources and is an even greater issue when interest rates rise. Implementation of new technologies (i.e., computer systems for inventory management) can contribute to duplications. Managing the number of projects placed on 'hold' for design changes is another key contributor to inventory. Engineers should consider the use of existing parts when redesigning or upgrading systems when new components are not necessarily required. Current industry-wide, multi-utility programs are in place to facilitate the pooling of nuclear facility equipment. To have success with these programs, full site staff should be engaged with the transfer of equipment to another plant to ensure a smooth transaction to promote use of the inventory sharing programs.
- The key to effective inventory management is to engage executive management to help them to understand property inventory management.

Speaker: David Garcia *(AMMI Nuclear)*,

- David asked what are risks that you lose sleep over as a supply chain contributor:
  1. Losing suppliers
  2. Stranded equipment
- David provided his insight as – 'Is the inventory that we have on our sites still in a useable, safe operating condition?'
- Key principles of INPO 14-005 document guiding principles for industry component suppliers. It is up to nuclear industry supply chain professionals to assure that multiple tier suppliers in the supply chain understand how the component they are supplying is being used and to properly define the component's safety significance to the system.
- Case studies from painful experiences were presented and discussed. The idea of the case studies was to show how creative thinking and effort on the part of the buyers can help to create new nuclear industry suppliers that are properly trained to provide nuclear quality products.

Speaker: Marc Tannenbaum *(EPRI)*

- Sometimes a second look should be taken at requests for components and supplies to really address what is being requested from operations and maintenance. If a work order is requesting the repair of a 'leaky valve' we need to move away from the mentality of ordering an entire new valve with all new supporting hardware that will produce a lot of extra inventory to only ordering the repair parts required to address the real issue of the work order.

Speaker: Ryan Gilchrist *(STARS)*

- We should challenge the industry to perform on a more 'just-in-time' ordering.

Speaker: Bill Fry *(Duke Energy)*

- Vendors should engage more with utility customers to assist with inventory management. This could help utilities to understand what equipment is readily available through the vendor and don't necessarily need to be stored on site by the utility. This would assist with moving the vendor/utility partnerships in existence today to a new level that is mutually beneficial to both the vendor and the utility, not just the vendor.

Session Notes (Supply Chain KM)

- 6.5 billion total inventory in the nuclear system. It's growing every year, and no sign of stopping.
- If we want to control inventory, then we have to get levels of management and executives on board with skin in the game. The others have to be incentivized to make things better. Once MGMT is in you do many things below the surface.
- 10 years ago, this was already a problem. Now we have twice as much, same problem. We want people to be able to do their jobs.
- Competing priorities. Conservative stocking levels because you don't want to run out. Then when they are not used they stay there.
- As a regulated plant we get a return on the inventory, but it has a cost because you still have to pay for it. It uses up financial resources.
- Despite the high levels, we still don't have all the right pieces we need. Where do you accept the risk of not having the inventory?
- All the leftovers from construction were put into the warehouse and kept. Hoarding was a natural instinct for the industry. We did not consider time as a factor because 40 years was so far away.
- The world changed when merchant generation entered the field. Having too much was considered good because no one would yell at you for that.
- Shorter outages make it harder.
- Digital is also a challenge, we can't always fix it. AP1000 could last for 100 years.
- Companies are establishing sinking funds for dealing with inventory once our plants hit end of life. Unrealistic estimates: how much you can get for the part? How much can you really drive inventory down?
- 70% of inventory is static, and probably needed. You might only use 5% but it can save you in a tight.
- Merchant is a dangerous world to live in. 154 is now competing, which is different from previous years. Stuff sitting in a warehouse isn't worth much on the company's books.
- Optimization models can help identify needs and make us better.
- Stranded costs to shareholders, what is going to happen when the plant shuts down? Who does that cost affect? If they can't reach out and touch, they don't trust that it's really there.
- Need all levels of managements skin in the game. By tracking work planning we can learn who has the most returned inventory.
- Better education and training can help them be more "right size".
- Inventory has a cost, even if not's until later.
- Bottom line is we are misusing our resources.
- Static inventory is inventory that hasn't been moved in a while (3-5 years).
- Computer system upgrades cause multiple entries for the same item which leads to confusion and overbuying.

- RAPID saves in crisis mode.
- SEER is a buying of excess built along RAPID channels of communication.
- CPM to be program of reserving parts for an in-case basis but not a firm hold on the parts.
- NSCSL is for coordination of the upper levels of management.
- PIM holds hard-to-find, long-lead time parts.
- Joint ownership of parts to spread costs.
- Be careful with min/max to sanity check the computer models.
- There must be distinction between what is really important (50-100) and those that only seem that way (500-5000).
- If everything is a critical spare, then nothing is a critical spare.
- We have to breakdown silos between plants within a system. Sharing multiple plants inventories is a simple but effective strategy.
- It's hard to clean out duplicates, but needed.
- What are the dangers we face:
- Loss of suppliers through going out of business or mergers of companies?
- How to get rid of stranded inventory in a cost-beneficial way?
- What does all this new ideas and old ideas mean to nuclear safety? Are the parts in deep storage still good? Are our PMs effective?
- Do all our suppliers know the safety significance? Have we really passed on the significance to our higher tier suppliers? How good is the dedication process that our suppliers are using? How do we verify that they really understand?
- If you've gone out and checked a supplier, but haven't used them in a while recheck when you return to them with business. By mentoring a sub-supplier, backlogs can be reduced by creating a new Safety Related supply.
- Misapplying the Safety Related designation caused problems that led to higher costs and more delays.
- Lack of information gets people lost and hurts the process.
- If Tier 2 and 3 want to be Tier 1, they can help alleviate single supplier issues.
- Large scale projects that are non-nuclear can teach us. They are just as big as us.
- There are technologies out there that can help keep projects in line.
- One costly handoff is taking design and transferring it to manufacturer. New technologies can integrate this into one platform. This generates drawings and designs that are easier to handoff.
- Get others in the boat with you. Need others with skin in the game. You have to know what you have and what you need before you can realistic goals.
- RFID equals more control of parts, location, and resupply. Saves costs due to faster turnaround.
- Get executives involved! We need to take a second look at orders to make sure we get what is actually needed.
- Do our suppliers understand our schedules and forecasts to help us get it right?
- Addressing future inventory is also a challenge to be addressed. Very little ordering in our industry is automated, how do we get more Just-In-Time.
- Contingency parts require a high level of plant knowledge to question and resolve.

Key Learnings, Recommendations, and/or Best Practices

- Having excessive inventory uses up financial resources (cash) that could be used elsewhere at the site. More focus should be placed on having the right equipment, not just having a lot of equipment.

Q&A

Q1. Werdann (Renuke Services) – With the nuclear promise we look at our stranded assets. Is the group working to address the unintended consequences of the Delivering the Nuclear Promise initiative on the industry suppliers?
A1. No, but that is something that should be considered.

Q1 – Just-In-time?
A1 – It lacks applicability because we don't order most things on a regular schedule. It's a partnership between utility and supplier.

Q2 – Nuclear Promise, what about the vendors and suppliers? How do we not create problems?
A2 – Unintended consequences of the nuclear promise can be significant. We don't want to drive out suppliers.

Supply Chain Online and Outage Excellence, Accountability and Communication

Session Organizer: Bill Frye *(Duke)*

Having the correct part at the right time for the correct application is key to schedule adherence, outage performance and equipment reliability. How is this consistently accomplished at a high level? It takes communication, coordination and collaboration in several different

areas. Supply Chain is at the center of this process because the work cannot be done without the necessary materials. Supply Chain must have a well-developed, robust program in which the Team is engaged, aligned and motivated (INPO 15-005 LE 4 and LE 5) to ensure nuclear stations are successful at maintaining safe, reliable and high performing plants. Several elements make this happen, but developing a strong relationship and coordination with other work groups is one of the keys to this success. Transferring ownership to the "doers" goes a long way in developing sustained results. Duke Energy's Catawba Nuclear Station will present their best practices that resulted in a strength from INPO.

Cross-Linked Session: N/A
DNP Session: No

Supply Chain Online and Outage Excellence, Accountability and Communication

Burt Broughton *(Duke)*

Session Notes

- Support thinking outside the box.
- Supply Chain's opinion is valued in the work management process.
- Example: Buyer was looking for filters for polishers. Wanted to one in August and October. The buyer challenged if we will have resources due to sharing for outages. This led to further inspection to make sure the schedule is sound.
- The relationship between Work Management and Supply Chain was the key to this success at CNS.
- Use creative ways to motivate and bring people together.
- Systems training allows Supply Chain personnel to better understand site issues and respond quicker to issues.
- The warehouse becomes part of the success by knowing if something doesn't look right in stocking.

Q&A

Q1 – Is there a scorecard with QA that allow you to judge your supplier?
A1 – Yes, the database is shared with each individual supplier.

Q2 – No reschedules for inside of the T-10?
A2 – If work is taken out after T-10 then it counts against. If SC says they can't get the part, then usually it is removed from the schedule.

Comment1 – Expediting internal work to the vendor is important to keeping up with schedule.

Q3 – If someone holds the part at risk and it doesn't get there who takes the hit?
A3 – It hits the measure for Work Management but not supply chain

Q4 – How much material is waiting for receipt?
A4 – They have gone away from setting equipment to be waiting for approval, more is done in advance to keep receipt going.

Q5 – A team of 3 goes to the T meetings, how many are in SC?
A5 – All people in the org are material analyst qualified at the site (6).

Q6 – How did you start with the improving relationships?
A6 – Give a voice to the analysts and let them speak up. Once they establish credibility, it changes the relationship.

Q7 – At T-6 you have zero parts holds?
A7 – Yes, no caveats on the metric.

Counterfeit, Fraudulent and Suspect Items (CFSI)

Session Organizer: Jim Ripple *(SNC)*

Counterfeit, Fraudulent and Suspect Items (CFSI) is a continuing issue within the nuclear industry supply chain. The CFSI potential cost impacts on the operation of the stations is tremendous if the prevention of CFSI is not addressed in the supply chain processes. The session provides the recommended organizational involvement to strengthen the supply chain processes for the prevention of CFSI. Learn from an SME involved in CFSI issue for over 20 years, insight from past instances within the nuclear industry worldwide that highlight the immediate impacts to Licenses' of CFSI discovery; costs when nuclear facilities are shut down; costs to correct conditions affected by the CFSI discovery; costs to determine extent of condition prior to restart of facilities. The ripple effect and potential costs for other Licenses' when during an investigation (initial CFSI discovery) identify sources of the CFSI materials/components that maybe utilized by many of the other nuclear facilities. The prevention of CFSI

entering the supply chain, methods to enhance the supply chain processes, flow down of enhanced CFSI processes, modifying contract terms and conditions identification of those involved, are intended as Cost Avoidance.

Cross-Linked Session: N/A
DNP Session: No

Prevention, Detection, and Control of Suspected Counterfeit and Fraudulent items

Marc Tannenbaum *(EPRI)*

Session Notes

- Shipments have changed from large to small.
- Counterfeit items are now shipped using existing paths like FedEx.
- Commercial grade items are often faked to look safety related grade. Can appear in all kinds of places.
- Investigations spread at a rapid rate. Can be done over very small and inexpensive items.
- Be an informed buyer, know about your suppliers.
- Communicate issues so that all utilities can fight this together.

Key Learnings, Recommendations, and/or Best Practices

- EPRI has a Self-Assessment Checklist for anyone who is concerned about their plant, facility, etc.

Q&A

Q1. Contracts have been seen that a utility may sue a supplier if a contractor cannot.
A1. This is a legal issue that a variety of entities are pursuing.

Counterfeit and Fraud

Roger Moerman *(Atkins Global)*

Session Notes

- Hold suppliers accountable to the contract as written.
- Quality Assurance is a pay me now or pay later situation.
- Regulatory impact and oversight can become severe.
- Testing and verification of electronic components will get more in depth and expensive.

Key Learnings, Recommendations, and/or Best Practices

- Any language utilized needs to be reviewed and approved by corporate attorneys.
- Are you passing requirements all the way down the supply chain?
- Prevention, not inspection is the best way.
- Management needs to be trained on this as well.

Warehouse of the Future

Session Organizer: Bill Frye *(Duke)*

Implementing RFID technology has decreased in cost and applications previously prohibitive of this technology are now feasible. In addition, advances in IT have similarly progressed along with the computerization of work management processes such that a tipping point has thus been reached that will allow the application of these technologies to further automate the warehousing function. This presentation will discuss how the use of RFID technology will allow the closing of traditionally manned issue counters and toolrooms and allow for unmanned and essentially virtual warehouses at jobsite or Maintenance locations. Headcount reductions in Supply Chain, minimization of tool room losses, and efficiencies in Maintenance labor utilization are significant (over $1 million per year per site possible) with payback easily within 12-18 months.

Cross-Linked Session: Technology and Innovation
DNP Session: No

Warehouse of the Future

Jim Ripple *(Southern Nuclear)*

Session Notes (Supply Chain KM)

- The warehouse can be likened to a fortress that guards the parts. All the craft sometimes feel like they have to beg for whatever is inside. These walls have to be knocked down.
- The original warehouse concepts are from the 1950s and bringing it into modern is a challenge. Think of grocery store as an example. Scanners brought about speed and change. Now you have self-checkout with is even further. The next step is not even having a formal checkout through tracking.
- This allows us to move spots from the warehouse to maintenance. This allows more time spent turning wrenches. For others, it is just a cost savings of fewer workers.
- With RFID much of the information is automated. The concept of virtual warehouse allows control of items in staging areas before work. Parts are not out of inventory until scanned so even in a staging area parts are still in inventory. This helps prevent early reorders of parts. Also, if there is an emergent need you can go get the parts staged. Traceability is vastly improved. It can track people doing what they're not supposed to.
- VUE technology allows a full inventory to be taken of the warehouse in a few hours. It manually takes 3-4 weeks.
- The warehouse becomes something of a pass-through because issue counters are no longer necessary. Delivery of parts and mobile warehouse stations reduces travel time lost.
- Materials do not have to be received and checked if they never left Supply Chain control. It's about combining availability and control.
- You don't have to tag every bolt in a box of 100. Sanity will prevail.
- Financial and Design Engineering are, so far, the largest issues in implementation. Fighting with all of the other entrenched priorities of the plant was a significant issue.

Session Notes (Technology & Innovation KM)

- This system, while streamlining the warehouse experience, also can help prevent tools from being misplaced or lost. Costs for replacement tools can exceed 500 thousand dollars per site. Another example is tools awaiting decontamination, knowing which tools are waiting and clean tools are left can be beneficial. Using this technology also allows a full audit of warehouse contents in a few hours, instead of several weeks.
- Materials that are taken from the warehouse, to the job site, must be inspected and confirmed that their condition is new as expected. But parts can be staged within the warehouse for contingencies, and if these are not used, they are known to still be in satisfactory condition since these parts never left warehouse control. RFID can also be used to guide calibrated tools. IF a tool requires a recalibration after a single use, the tool can be electronically locked out until the proper calibration is performed.
- Pictures slide – the tool area is unmanned on the right, no waiting for issued tools.
- Most difficult part of implementation was resistance to change at an organization level. Also scheduling – changes to add portals is not on priority list and estimates for installations can be over-inflated. Upper level management can ensure priority of this change. System ROI is noted in about 1 to 1.25 years, and is then earning for every following year of the plant with minimal maintenance and reoccurring costs.
- Jim started out with a discussion of the "change formula" which describes how people can resist change. This is relevant to the changes implemented by SNC for their warehouse with RFID. There were established employees who had resistance to change, but now that the RFID system is established, they accept the change. Part of the RFID work was to make it easier to access the warehouse and acquire the needed parts and tools. Other warehouses were benchmarked as part of the effort. They discovered that the current system, prior to upgrade, had not changed much at all from the operation in the 70s and 80s. The warehouse is typically staffed by employees who have spent significant time in other roles in the industry. Parallels to UPCs used in supermarkets and stores – no register operator needed to type in prices or even scan in products. Scenario of walking into a store, grabbing a product and being automatically checked out, with an account on file. This technology can be applied anywhere – but needs the correct change management.

Key Learnings, Recommendations, and/or Best Practices

- Payback is there. For Southern Nuclear – 1 million per unit, payback takes less than 2 years.
- People tend to like the way things are now, change can be tough to implement.

Q&A (during presentation)

Q1. Are you on the plant LAN?

A1. Southern Nuclear has wireless throughout the plant. IT was a good assistance. By separating the system from MAXIMO we can survive any downtime by the system.

Q2. There is always an RFID champion in the project, is that you?

A2. Rusty Broxton is the Southern Nuclear champion. You definitely need them. Farley had success because of embracing by the Plant Manager and Work Management Director.

Q&A (after presentation)

Q1. Can you tag security weapons?
A1. Yes, because we can encrypt anything that needs to be hidden from hostiles. Can also prevent people from taking things they're not qualified to use.

Q2. Do you expect to see time savings and how much during outages? How much more accurate?
A2. As long as people do right by the system then we should have significant savings. The accuracy of the system is high but dependent on people not trying to cheat the system.

C1. This also allows us to track plant tools issued to contractors and others who might walk off with tools. This allows for instant accountability for anyone who uses plant tools. Supply Chain runs the tool room but does not have the budget for tools (Maintenance does)

Q3. Who puts the tag on? Where does the tag go after part use?
A3. Warehouse personnel and the tag is removed once used and deactivated.

C2. This also allows us to save on labor because supplemental personnel can be released early from FME and RP tasks for tools. RFID is organic and takes into consideration that program and process evolve. Enlist help from SMEs to keep it up and running. This keeps critical processes running smoothly.

Q4. Who handles upgrades, etc?
A4. Supply Chain. Work Management also wants to try this on Work Orders.

Q5. Do you see this process eventually reaching the vendors?
A5. We want to eventually have the vendors put the RFID tags on parts before they ship them to us.

Q1. Can tracking of contingency parts be improved?
A1. Yes, contingency parts can be tracked in the mobile system. A virtual system can be used to track how materials can be checked out and used on the job.

Q2. For parts and "stuff", who puts the tag on and does it stay working.
A2. You remove the tag after installation, so the installed part does not show up. For tools, the tag will be examined and replaced if damaged or not functional. The tag can also be applied to the tool or part packaging.

Unintended Consequences of Well Meaning Initiatives

Session Organizer: Greg Keller *(Rolls-Royce)*

The DNP initiatives are well meaning and expected to bring large savings to the nuclear industry. However, some of the initiatives may also have unintended consequences outside of the utilities themselves. Such consequences could include driving suppliers from an already diminished supply base either away from the product lines currently supported or dropping their QA qualifications. This could cause utilities to expend significant design and procurement costs in replacement products, extend shutdown periods, and exacerbate obsolescence issues. This is a panel discussion.

Cross-Linked Session: N/A
DNP Session: Yes

Unintended Consequences of Well Meaning Initiatives

Frank Helin *(Energy Steel),* Greg Keller *(Rolls-Royce),* Craig Irish *(Rolls-Royce),* Tad Gray

Session Notes

- Greg Keller: During the nuclear renaissance that failed in the early 200s, there was a drive to find new suppliers because the supplier base was not ready to handle the load. Electro-switch may or may not have had quality issues but the industry got on them so bad that Electro-switch left the group. Now we still need the parts but they are a commercial supplier now.

- Frank Helin: The nuclear promise is contradictory in ways. We want more suppliers but then create the preferred supplier program. Without knowing all the rules, suppliers can't make good decisions. This preferred supplier list falls short of the open innovation process. The old concept of having one big supplier to do the work was a preferred supplier without trying to. Some companies are going to leave the nuclear business because of lack of work that makes it worthwhile.
- Greg Keller: Just because commercial grade is cheaper doesn't always help.
- Tad Gray: Manufacturers have QA programs, and that cost is fixed. Just because utilities don't buy QA parts, that doesn't change costs. Taking PMs out and declassifying parts causes the potential for expediting parts. This pushes back on the supplier and costs the utilities more because of expedited orders. 30% increase in expedites over the last 2 years. Expedites don't just help the vendor, it costs them too and can create the us versus them mentality.
- Craig Irish: Less suppliers in the market will raise prices. Buying less safety grade parts means that companies have to raise prices.
- Greg Keller: The publicly held companies have a struggle to stay in the business because of fiduciary duty.
- Tad Gray: Utilities tend to buy the same item but have different requirements. This means they are all different parts. This makes it hard for suppliers to have inventory and the plants as well. Common standards help multiple utilities work together too.
- Craig Irish: Working together is never more important. Nuclear as an industry is not high on the list for suppliers that sell to multiple industries. We need to keep people in the industry. It used to be good to supply nuclear but now it's harder on all sides. They're going to go the successful industries to make sales.
- Greg Keller: Commercial grade. There are no bearing companies that allow commercial grade surveys. This is not just utility and supplier, regulators are also an issue. For a new vendor a NUPIC audit is a catch-22 because you don't have the customer base to support an audit.
- C1: The utilities feel overwhelmed by the number of audits that have to be done and want to reduce number of vendors.
- Reverse engineering will become important, replacing individual parts in a whole. Reverse engineering is not a cost savings, just cost avoidance. It doesn't really help because of non-recurring engineering fees.
- C2: There is a lot of engineering that goes into reverse and the NRC doesn't like it either.
- Tad Gray: We are working to revise the EPRI guidance on reverse engineering. The NRC was more rigors in the process to make sure that our standards are kept. This left the industry saying opposite things at the same time.
- Greg Keller: Reverse Engineering allows you to maintain equipment and not replace it. It's still risky because it may operate the same.
- Tad Gray: There are extreme cases where it may be a cost savings but that is actually rare. It is a tool we need but reliance on it a danger. This is not a panacea to the industry.
- Frank Helin: Rebid the component because the suppliers still have the old specs. If it goes into a different plant, then there's another set of engineering that is required. China is implementing with common sense that we no longer have. Replacing 40 year old parts in a perfect manner is not possible, and wasn't perfect back then either. The original specs weren't written by people who actually did the work. We are creating problems for ourselves and makes it harder for suppliers to meet.
- C3: Cyber security will introduce new costs. Every utility is putting together its own cyber security plan which makes supplying parts difficult.
- Greg Keller: Experts aren't always right either.
- Tad Gray: A paradigm shift in what we're trying to accomplish is needed.
- Greg Keller: There is a move afoot to make reverse engineering more difficult. It's an equivalent item not a copy. That makes a new item, which you would have to have design control over.
- Tad Gray: On the mechanical side it is easier than electrical. Making sure the rigor is in place takes a lot of work. It is more complex after going through the NRC grinder. As a supplier we understand and agree with the rigor, but the utilities don't like it. If we make the cost go up, then you don't really avoid cost. This stuff isn't new. Other industries have been doing this for a very long time. Airplanes are based off military technology for example.
- Craig Irish: Outside of the US there is less adversarial relationship between supplier and utility.

Q&A

Q1. What is the solution?

A1. In our environment, the utilities try to impose programs but that doesn't help anyone. A lot of the solutions are to go overseas. The technology is being transferred and not being manufactured in the US. Suppliers raise their standards to the most demanding customers. Also, a bad inspection can ruin a suppliers business.

Q2. What is it like to break into nuclear?

A2. Spent 2.7 million dollars to create a program for nuclear. Selling isolation valves to replace gate and globe valves. The obsolescence mentality needs to change. There is a need to move on from old tech. Duke can now replace linear valves with ¼ turn valves because they were willing to change. The fact that it is so difficult to transition to new technology is ridiculous. There is better equipment out there but getting it into the plant is a nightmare. The willingness of suppliers to make old stuff will also decrease because it's not cost effective.

Q3. How much of your business is nuclear?
A3. 15% but most is in China not here.

Q4. What would be the result of disbanding NUOC?
A4. Not much. A database of sharing intellectual property and picking winners and losers doesn't work out. It creates more problems than it solves. When we can have common sense specs, great. Otherwise it doesn't help. The industry push to call anything costly or difficult obsolete is a workaround that hurts the supplier.

Q5. Who has a non-US nuclear business? Talk about supporting EDF (Electrice de France) from France
A5. EDF is investing in the vendor so the vendors can keep in. They support standardization to allow for purchases at larger volume. One design change and it's ready for all of them.

Q6. Driving in down cost, utilities want to commoditize everything. Suppliers try to show value in everything. How do we bridge the gap?
A6. We need to tell each other the truth up front. Does a supplier stick with a part or toss it over the fence.

Q7. Why do parts go obsolete?
A7. Vendor goes out of business. Time passes by and no one makes it.

Contracting Best Practices

Session Organizer: Jim Ripple *(Southern Nuclear)*

How many times do parties write contracts where the true intent is not captured, or the parties walk away with contract gaps or two very different understandings? This breakout session will focus on some Contracting Best Practices and a "Repeat Offenders" list of clauses that result in real-time disputes and retrospective audit findings. The session will provide valuable insights for novice contract drafters and seasoned CPOs alike.

Cross-Linked Session: N/A
DNP Session: No

Contracting Best Practices

Brandon Zimmerman *(Southern Nuclear)*, Eric Peterson *(Southern Nuclear)*, Markley Ward *(AMS-PAR)*

Session Notes

- Costing savings start at the very beginning of the process, not just at the bid process.
- The utility has its own templates because of the special nature of nuclear. Use of standard contracts help facilitate work and limit negotiation. Helps us be efficient too.
- Use of standard exhibits allows you to plug-and-play costs. Ensure dual execution of contracts.
- The idea of damages enforces pressure on both sides to do what you said you would do.
- Milestone payments allow you to pay as you receive value. This includes startup and proof of success.
- GSA is only a starting point, does not have lodging taxes, rental car, or local quirks. Per Diem has many quirks that have to be worked out. What matters is the contract.
- What overtime, holidays, double time are is also part of the contract negotiation process.
- Delays can occur on both sides and each side has to do their duty to resolve them.
- For disputes, you want to make sure that contracts do their best to solve their own issues.
- Re-work happens most often during an outage, setting up re-work in the contract better helps alleviate high stress. When you provide rates and etc, define them.
- Note the date of reconciliation.

Key Learnings, Recommendations, and/or Best Practices

- Establish certainty standards and metrics
- Communicate clearly and document everything.
- Audit your contracts.
- Always seek to improve.

Q&A (during)

Q1. If we have a service provider, they have a standard rate sheet. It says what they expect, when it's sent to legal it is still in a bid stage. Can the per diem data be included on a PO?
A1. Yes, until it is signed nothing is set. Yes.

C1. If you have one company doing multiple jobs, make sure that language exists for one job impacting the other.

C2. A Farley learning is that vendor drawings may not be in the contract and this had to be rectified. Milestone payments or deliverable ties were implemented to make sure drawings don't impact the process.

C3. During outages, any extra work goes to OCC manager and they have to power to approve. Otherwise it falls to the project manager.

C4. Whenever you have a vendor do work, or their work is stopped you cannot always move them to other jobs because the contract may not support that.

C5. Don't be burdensome with size of contract.

C6. Is this a managed task or staff augmentation, now a very important factor.

Contract Forensics/Supplemental Supplier Contracts (In-processing)

Session Organizer: Jim Ripple *(Southern Nuclear)*

Contract Forensics (Efficiency Bulletin 16-19) is a DNP initiative which is focused on the prevention, identification and post-identification best practices regarding the prevention of financial mis-billing that may not be contractually permitted. The first part of this session focuses on the industry's struggle regarding contract administration, as well as best practices regarding the use of in-house and third party auditors and what to do with the auditor's report. The second portion of this session will address Supplemental Supplier Contracts (Efficiency Bulletin 16-26d) which provides the contract changes needed to implement the In-processing DNP initiative. This session will also include a discussion of implementation challenges experienced to date and a roadmap for the future.

Cross-Linked Session: N/A
DNP Session: Yes

Contract Forensics/Supplemental Supplier Contracts (In-processing)

Brandon Zimmerman *(Southern Nuclear)*

Session Notes

Contract Forensics

- It is much easier to prevent incorrect payments than it is to rectify incorrect payments later. This was identified at the end of 2016 and is now in the implementation phase. The computer software that can be used (AP software) is still not sophisticated enough to do all the work. It is still a large time investment to chase down all the incidents, due to false positives.
- The bulletin did not contain standard contract language because it wasn't ready at the time. Contract compliance audits are more in-depth and require more data. Fixed-price is difficult to audit, while T&M has better qualities to audit. Don't be too hands-off in settlement negotiations. Leaving it to the auditing firm can have repercussions.
- If there is a grey area, then your contract isn't clear enough. Learn from it and fix it. Don't get comfortable with the results of the first year's return. Both you and your supplier will get smarter and fewer errors will be found as time goes by. Southern Nuclear audited in 2017 and found an overall recovery rate of 0.001%.

Supplemental Supplier Contracts

- EB-16-26d was Blue category due to labor and local laws. EPRI STEs allow for standardization of training and using equivalency determinations to avoid duplicate task specific training. EB 16-26d holds a bi-weekly phone call that anyone can participate in. This allows for group solving of issues that might rise for individuals.
- The licensee is responsible for testing integrity which can lead to NRC issues. The logistics can be cumbersome depending on the computer resources of local union halls or other gathering points. Becoming a proctor is difficult and the exposure potential for people not directly associated with the utility. Letting others train proctors that we don't get to perform oversight, exposure increases exponentially. Taking the training to the workers is another idea in the works. Full implementation is not yet feasible but all are expected to continue to work toward it. INPO/NEI help is needed for the larger suppliers.

Key Learnings, Recommendations, and/or Best Practices

- If you're not auditing your contracts, you're paying too much.

Q&A

Q1. Are we looking to train the invoice individuals to reduce on the front end?
A1. Yes. Training and coaching will be provided.

Q2. Can Southern Nuclear improve its training to the contracts manual to help those who implement the contracts?
A2. Yes, the training was recently updated and is on deck for implementation

C1. The AP system has the way to catch duplicates but the problem is that the people who approve invoices may not bill the right internal accounts while the right vendor gets paid.

Q1. Who pays for training when they are not working for the utility yet?
A1. There is no standard answer due to anti-trust. Utilities all work it out for themselves.

TECHNOLOGY AND INNOVATION

Seamless Digital Environment for Nuclear Power Plants *one new presentation*

Session Organizers: Bruce Hallbert *(INL)*, Ken Thomas *(INL)*

Through the U.S. Department of Energy's research programs, Idaho National Laboratory is developing advanced digital technologies to enable the long-term operation of light water reactor fleet. A common theme in recent developments is the incorporation of analytics to provide real-time actionable intelligence in critical plant functions. Three such technologies are presented in this session.

Cross-Linked Session: N/A
DNP Session: No

Outage Improvement Through Analytics

Shawn St. Germain *(INL)*

Session Notes

- Data and analytic technologies can be used to support nuclear power plant outages.
- Slide 2 lists the specific technologies that can be used.
- Text mining can be used to analyze procedures for inconsistent steps, high risk evolutions, or other threats to nuclear safety and operability.
- Slide 3 shows an example dashboard with key performance indicators.
- Slide 3 includes a burndown curve is shown for various outage tasks, and can be compared to previous outage performance. This curve can also be augmented with confidence factors to quantify the probability for work task time estimates.
- Slide 5 shows the Palo Verde upgraded and modernized Outage Control Center.
- Slide 6 shows a 3D model of a brand-new OCC, while Slide 7 shows the completed OCC.
- An online electronic work package that can be seen on the network can provide a real-time update to a supervisor for a process. This would alleviate an example where a supervisor approaches a work area for an update, and the worker is gone. Status can be always available and up-to-date

Key Learnings, Recommendations, and/or Best Practices

- Various technologies can be used to improve outage productivity. These technologies can allow for more streamlined communication, more data, better data tracking, and better representation

Q&A

Q1. Installed WIFI can present cyber security challenges. How are these dealt with?
A1. The technology typically moves information or data, but not plant controls. Later implementations that may be related to controls may require additional scrutiny.

Q2. How can procedure data be converted to the system?
A2. A third party application, provided by Curtiss Wright, was used to translate the data.

Computerized Operator Support System

Ken Thomas *(INL)*

Session Notes

- Operators receive a large amount of data, much of which is difficult to monitor proactively.
- The Computerized Operator Support System (COSS) can aid with that. This system is like that used in aviation, which alarms pilots when plane paths are near, allowing the pilots to adjust course proactively.
- The demonstration on Slide 11 simulated a break in the Chemical Volume and Control System. The Volume Control Tank (VCT) level decreases. When the VCT is low, the COSS can pull the procedure to address the situation. The COSS can also give the emergency classification and direct the operator to follow procedure to stop the leak. The COSS can also validate that the leak was stopped.
- The demonstration scenario on Slide 11 is deliberately chosen. Typically this scenario is limiting such that the operator will not have time to diagnose and react the issue, and would instead be forced to shutdown.

Key Learnings, Recommendations, and/or Best Practices

- The COSS provides a streamlined representation of data and can direct the operator interactively as a transient occurs. The operator can react quickly and efficiently, avoiding an adverse plant state or forced shutdown.

Q&A

Q1. How long does it take for a working system to be installed in the control room or shift managers room?
A1. The COSS was implemented in Braidwood (Exelon), using plant data, in about 1 week.

Analytics for a Seamless Digital Environment

Ann Orr *(APS)*

Session Notes

- Palo Verde needed a technology "lift".
- Ann's team went offsite and asked the question "What should be the worker of today, with known technology?".
- The team also leveraged the work done by Ken Thomas at INL.
- It was noted that Catawba uses a similar system with Ipads in the field. Capital costs were relatively low.
- The software code DOMINO was used as the infrastructure, which only required a $40k license fee.
- DOMINO also has good scalability, allowing Palo Verde to expand their project over time.

Key Learnings, Recommendations, and/or Best Practices

- Technology can provide linked data to multiple users, which can be used for equipment reliability tracking and allow maintenance to track anomalies in operation and address these in order of priority.

Q&A

None

Big Data / Artificial Intelligence for Nuclear

Session Organizer: Vincent Williams *(Southern Nuclear)*

There is an enormous amount of data that is being generated at our nuclear facilities that could be harnessed for performance insights, improve performance, cost reductions, safety improvement, and many other benefits. In this session, we will look at some of the solutions already in place as well as capabilities in this area.

Cross-Linked Session: N/A
DNP Session: No

Industrial Big Data Analytics : A Case Study in the Nuclear Industry

Nagi Gebraeel *(Decision IQ)*

Session Notes

- Big data is all data, including social media and purchasing data. Industrial big data is data specific to equipment.
- Decision IQ worked with Southern Nuclear Operating Company (SNC) in the Monitoring Challenge. The challenge required Decision IQ to analyze the data without additional aid or input from the SNC plant site.
- On Slide 7, data in various forms is shown. The left side is simple data, while the right shows flow feeds and a temperature gradient. The flow feeds and temperature can be expressed as a matrix of color number and brightness.
- Data analysis requires good quality data. Incorrect data will yield incorrect results.
- The live demo was shown outside of the presentation and is not shown in the included presentation.

Key Learnings, Recommendations, and/or Best Practices

The live demo was shown outside of the presentation and is not shown in the included presentation.

Q&A

Q1. Are there any assumptions from other analytic tools to be integrated or validated?
A1. Since this work was proposed under a contest, additional interaction with SNC was not permitted. The goal here was to focus on data only how data alone affects the analytics?

Q2. When getting the composite health index, how much data is needed to train the algorithm?
A2. This varies per algorithm, and the accuracy of predicting without false positives. Certain cases could only require a week of data, while others could require 6 months. You only use the data you need to get valid predictions, thus when the predictions are accurate, you have enough data.

Data Analytics and Co-Innovation with GE Predix

Joan Knight *(Exelon)*, Eric Mino *(GE)*

Session Notes

- In this project, Exelon and General Electric (GE) took a strategic approach to analytics.
- Exelon could provide the implementation plant, while GE could work on the software to Exelon's specific needs and specifications.
- The software is PREDIX, which was developed as part of a simplification project. The simplification project examined various software systems tracking data used across the company.
- Some systems could generate large amounts of data in a very short period (i.e. 5 GB in 4 hours).
- The large amount of data spread across multiple platforms required an integrated system.
- PREDIX integrates by compiling data from these other software systems into one system.
- PREDIX can also use cloud computing to analyze large amounts of data quickly. There was no available system for this, which drove GE to create PREDIX.
- PREDIX performs Asset Performance Management (APM), which will be completely deployed for nuclear in 2018.
- PREDIX will eventually do both risk analysis for systems, and risk mitigation analyses.
- A single site overall risk score can be determined. PREDIX can be made to interact with other third-party data codes.

Key Learnings, Recommendations, and/or Best Practices

- The GE PREDIX system allows for the compilation and analysis of large amounts of data to perform Asset Performance Management, risk determination, and risk mitigation.

Q&A

Q1. How was the PREDIX business case developed?
A1. Various GE groups (Engineering, Digital, Finance) and Exelon were consulted to understand what the tool would do and how it would affect current operation.

Analytics Injection into Traditional Processes: Inspection and Inventory Use Cases

Theresa Sutter *(Curtiss-Wright)*

Session Notes

- Curtiss-Wright began examining analytic injection in 2012, but the industry was not yet ready to implement. From there, a grass roots approach was used and the focus was on specific data sets.
- The Nuclear Industry generates a lot of data – but it is not always used to get the "story" of what is going on.
- Curtiss-Wright would change that. Their data analysis instead uses that data and available technology to address upcoming inspections, identifying areas that should be focused to reduce and eliminate NRC findings. This is done using Subject Matter Expert (SME) knowledge and past Corrective Action Program data.
- An example is a plant outage – the software could optimize outage planning, which usually took a highly skilled and experience individual many weeks.

Key Learnings, Recommendations, and/or Best Practices

- The Curtiss Wright analytics use existing and easily compiled data to improve inspection and outage results, without the need for complicated custom dashboards or complex visualizations.

Q&A

Q1. Going forward, how can companies influence workers to abandon Excel spreadsheets or other tools for compiling and trending data.
A1. All the data of the past cannot be retranslated; however, changes can be made to procedure and guidance to store data centrally going forward with no siloed database.

Digital / Wired Worker

Session Organizer: Chris Comfort *(Southern Nuclear)*

It is crazy, that in today's age, plant personnel are carrying paper and antiquated tools into the plant. With today's tools and technology our workers should be empowered to utilize these resources to improve performance, increase safety, and reduce our overall costs. In this session, we will look at some technologies that have already started this shift as well as a look into the future of what is possible.

Cross-Linked Session: N/A
DNP Session: No

Mobile Merged Reality and Virtual Interaction

Evans Manolis *(Help Lightning)*

Session Notes

- Mr. Manolis started with an interesting story regarding an appliance repair. After getting phone service, a repairman was dispatched. But he didn't have the right part! The product and service provided by Help Lightning would have solved this problem, because the repairman could have viewed the problem before leaving.
- This technology can be applied to the nuclear industry for field repairs. Merged reality allows two videos to be combined, and a remote user can virtually use their hands to guide the person in the field, revolutionizing repairs.'
- Understanding Terms:
    - VR – Virtual Reality, all computer generated.
    - AR – Augmented Reality, real image altered with a computer image.
    - MR – Merged Reality – two real images merged – what Help Lightning does.
- An average field service trip costs $428 – the Help Lightning can eliminate that and allow quicker responses to the customer, a complete resolution, and an improved customer experience. No new or specific device is required; just use an mobile device (smartphone, Ipad, etc.) Industry experience has shown that First Time Fix Rates (FTFR) can be greatly improved.

Key Learnings, Recommendations, and/or Best Practices

- Help Lightning could be used in the nuclear field by worker to ensure quality repairs are performed while reducing dose and time spent. Problems can be diagnosed remotely, without delay or a lengthy trip.

Q&A

Q1. Can you merge more than two videos i.e. have three users for example?
A1. Today you cannot, but a future release will allow this.

Wireless Sensors and DAS-Leaky Wire Update

Ryan O'Hagan *(AMS Corporation)*

Session Notes

- Exelon is taking a novel approach to the Nine Mile Point upgrade by installing wireless sensors.
- Exelon did a pilot project with EPRI at the retired Zion station. This study showed that Distributed Antenna Systems (DAS) can provide 2.5 times more coverage compared to WIFI. The WIFI signal is reflected easily away from areas and is degraded by dense material present on a nuclear site.
- There are two ways to transmit data: A leaky wire used to get signals in tough to access areas. The cable has holes in the insulating jacket, which allows for signals to be sent and received. DAS can be placed as needed without additional wiring and setup costs.
- The DAS implementation at Nine Mile point is about 3 million vs 8 million for a similar WIFI distribution.
- WIFI needs more access points, because of the signal degradation.
- The Modular Remote Distribution Units can transmit at different frequencies, serving a variety of data means.
- Battery of typical DAS sensor lasts about 2 years, and can be located virtually anywhere within the typical nuclear plant.
- Nine Mile Point to be fully implemented by 2018 and is the first of a kind.
- It was noted that Callaway has used this wireless system for vibration will be using it for oil analysis.

Key Learnings, Recommendations, and/or Best Practices

- Wireless sensors can provide a rugged and cost effective data solution for nuclear plants without expensive and time consuming Design Change Packages or Plant modifications.

Q&A

Q1. What is the cybersecurity issue and how do you comply with it?

A1. This is used for performance monitoring data only, not safety related signals. Also, plant personnel confirm all anomalous signals – they don't direct the plant on solely the results of the wireless sensors.

Q2: Did you look at the wattages with respect to ex-core detectors. There may be electromagnetic interference.
A2: They perform on-site qualification testing to study impacts.

Q3: Do other industries use the wireless systems for control?
A3: No, other industries don't, and nuclear especially does not.

Digital Transformation through Continuous Improvement

Chris Moustakas *(DevonWay, Inc.)*

Session Notes

- Devonway is involved in performance monitoring, and has been in nuclear since 2005. They are typically known for process improvement. Paper may be useful for some processes, and is very simple. Digital replacements must also be easy to use, like paper.
- Staffing resources have drastically increased in this single BWR example. Digital replacements can reduce this. The Electronic Work Package (EWP) can aid this and be combined with the Help Lightning and wireless sensors
- Slide 5 notes:
    - C = change
    - D = dissatisfaction
    - V = vision
    - F = ease of first steps
    - R = resistance
- Any change must overcome resistance and have value. Many innovative solutions have not got a pilot or beyond the pilot stage due to resistance to change.
- Continuous improvement is a gradual manageable change.
- The yellow in Slide 7 signifies typically where the nuclear industry operates. There are some disadvantages however, to EWPs.
- Paper work packages can be laid out so that all parts (procedure, reference, precautions) can be seen. There are possibilities to improve this over single screen devices, such as something similar to Google Glass. It has the ability could be to overlay images to glasses like google glass.
- EWPs could contain logic in the procedure itself, such as if a deviation of an asset exceeds a certain value, the worker can be prompted to different steps. Currently, these EWPs are not online, but are instead checked out and then back in upon work completion

Key Learnings, Recommendations, and/or Best Practices

- EWP can reduce staffing levels and provide improved work management.

Q&A

Q1. Do you have to be online?
A1. No, the EWP is checked out, and then can be re-integrated into the network with the results upon the workers return.

Warehouse of the Future

See Supply Chain

Robotics, Unmanned Aerial Vehicles (UAVs) and Remote Systems

Session Organizer: Chris Comfort *(Southern Nuclear)*

The use of automated tools such as robots and unmanned aerial vehicles (UAVs) are starting to play important roles in many industries. Within Nuclear these technologies are starting to become more prevalent and provide many benefits such as reducing dose, improving safety, and reducing costs. This session looks at some of the ways that technologies like this have recently been used as well as a vision of what may be to come.

Cross-Linked Session: N/A
DNP Session: No

Southern Nuclear UAV & Robotics

Chris Comfort (SNC)

Session Notes

- There are 3 UAVs in SNC UAV "fleet".
- The DJI Phantom 4 is fastest, and was used for overhead surveillance at the Vogtle 3 and 4 site.
- The DJI M600 was used for Stewart County to perform an environment impact assessment for a prospective new nuclear site.
- The DJI Inspire 1 was used for the inspection of containment dome at Plant Farley.
- Wind conditions are important when using drones, as the drones can be difficult to control in high winds and may accidently impact important structures or be pushed in undesirable areas.
- Prior to using drones, the NRC inspector on site was consulted. Inspector supported use. SNC considered Electromagnetic Interference and signal issues. A 2.5 feet boundary was employed for safety related equipment. Since containment dome inspection was performed, concrete easily covered this zone.
- More Lessons learned: Use best available camera, lower winds bring longer battery life, and easier to get steady picture
- Can see high resolution, each pixel = 2 inches on the ground, can use to measure item size and spaces, see inventory management portion Slide 5.
- Need to build culture of using robotics. Plant Hatch RP condenser False Bottom inspections, cracks and anomalies. BWR condenser is radioactive and is confined. Robot acquired for 20k, also can be used for radiation surveys, and leak identification.
- Hatch condenser false bottom inspection – no dose, no injuries to personnel.
- Can live stream inspection to other engineers and get better pictures with the drone.

Q1: There are allegations DJI was sending data to China, was this considered from cybersecurity perspective?
A1: Vehicle control taken was considered. Videos were not safeguards information, so no issue could be with open transmittal. DJI drone supposedly restricted from nuke plant use, airport, prison, and fires by DJI, but drone worked at Farley.

Key Learnings, Recommendations, and/or Best Practices

- SNC has used unmanned aerial drones to complete inspections to meet NRC obligations, and is working toward using UAVs to support containment dome ASME inspections.

Q1: Dome inspection credit taken for drone inspection?
A1: Yes, but this was an obligation to NRC, not ASME. The ASME inspection is coming up, and will validate drone results with 2 third party vendor results.

Duke Energy's Use of Robotics

Aleksandar Vukojevic *(Duke Energy)*

Session Notes

- Duke has a specific group/manager for UAVs, and a flight coordinator.
- The AEROVironment PUMA was used by a contractor. Large amount of data was recorded by the PUMA.
- Duke also has their own drone fleet. Two DJI drones are shown on slide 5.
- Drones are a couple thousand, camera payloads are the more expensive item.
- 30x camera can see a car license plate a mile away – incredible clarity for the expense.
- The Blue and red show slightly different results from different day surveillances. This is done to ensure consistent results. (Volumetric Measurement Slide)
- Elios is a swiss built drone, which costs $25k, and can bump against objects because of protective cage.
- Duke has been using 2 Endeavor drones for two years. The Endeavor was initially built for the US military. It has an extendable arm with 22 different attachments.
- Washing arm attachment is being used in the washing slide.
- Duke has been using augmented reality since 2014.
- Augmented Reality Glasses can cost from $500 to 5k.
- The drones used the cellular data network to transmit back to management office. No cybersecurity issue, but could be if plant information network used.
- The NAO robot can talk to worker and mark procedure steps as completed and provide guidance.

Key Learnings, Recommendations, and/or Best Practices

- Duke has been using a variety of aerial and ground drones to do surveillance, with good results.
- The endeavor drone, in addition to inspections, can also perform certain tasks using a variety of attachments.

Storage Tank Inspections

David Cislo *(AREVA)*

Session Notes

- The nuclear industry needs a better way to inspect tanks. The Normal way = drain tank, insert worker. This takes time and requires a worker to be in a confined space.
- Different tank construction and design require differences in the inspections performed.
- Some drawings of installed tanks are representative. There are no true as-built drawings. This can cause changes in inspection scope and method.
- The Newton is 350 lbs.
- Newton can be used to build a virtual mode of the tank, and electronically mark locations that should be regularly inspected.
- Netwon is used in a tank that is full of fluid with no draining required.
- Sediments may require cleaning of the tank. Sediments can affect visual inspections, robot can spray it was or blow it away with an attachment.
- Draining a tank requires a temporary tank for holding the fluid, another inconvenience.
- Diesel tank inspection upcoming, cannot drain it, need explosion considerations.

Key Learnings, Recommendations, and/or Best Practices

- Using drones for the inspection of storage tanks is more cost efficient and safe compared to traditional inspections, with reduced impact to site.

Q&A

Q1. Problem with turbidity of water?
A1. Tank was cleaned prior to the visual inspection to ensure inspection can be completed.

Q2. Coated inspections can be done?
A2. Can be done, modify the ultrasonic testing to deal with coating thickness.

Q3: Ever inspected a BWR torus?
A3: No, but there was a system to apply a coating on the torus and to do repairs.

New Technology

Session Organizer: Chris Comfort *(Southern Nuclear)*

What is over the horizon when it comes to technology? This session is focusing on technology that has not or is just coming available to the nuclear industry. The technology presented will provide new solutions and help us, as an industry, think about what do we focus on next.

Cross-Linked Session: N/A
DNP Session: No

Dynamic Natural Convection

Henry Kaczowka *(NuVision Engineering)*

Session Notes

- DNC = Dynamic Natural Convection
- Bypass line condenses steam, does not deplete inventory on secondary side, PWR focused but can be applied to BWR as well.
- Diagram on Slide 3 shows tap on Main steam line, startup value is de-energized to open on loss of off-site power.
- Injector is in the pressurized system, does not take water from a pressurized source. Positive pressure produced by expanding sonic wave, allowing injector to act as a pump.
- Steam generator pressure is maintained and system will work at various steam generator shell side pressure.

- Simulation 1 – RELAP5 simulation on Russian reactor design in Ukraine. Base case where no safety systems work upon loss of power. First 3 hours cooling via inventory in SG. Then SG dries out, natural circulation in the primary loop stops, pressurizer safety valve opens, in 12 hours the core melts.
- Simulation 2 – Introduce DNC to system. No safety systems again, but now DNC installed. Secondary side is cooled, which cools primary and core. Fuel melt averted.
- Chosen heat sink size determines how long system works, could be in lake or service water pond for indefinite cooling
- 72-hour cooling requires about 54k cubic feet. 5k cubic feet is a residential swimming pool.
- Could use condensate heating tank as the heat sink, which would give about 90 hours cooling.
- Injector cooling water mass flow test results – mass flow of cooling water was within about 1% of prediction.
- Working with Idaho National Lab.

Key Learnings, Recommendations, and/or Best Practices

- The NuVision Engineering Dynamic Natural Convection System can provide reduced core damage frequency and a reduction in safety qualified equipment for loss of power scenarios using minimal moving parts.

Q&A

Q1. How is the valve work? Pneumatically or electrically?
A1. Spring holds the valve shut, solenoid allows valve to open upon loss of power, or could be actuated manually if wanted.

Q2. Safety related system?
A2. Not yet determined, but could be applied beyond design basis accidents.

GENIUSLINK & Fuse: Crowd-powered Manufacturing

Lisa Ralph *(General Electric GENIUSLINK)*

Session Notes

- GEGENIUSLINK group focuses on non-conventional business models and initiatives.
- Traditional ways of approaching business are not sufficient – the current average Fortune 500 company lifespan is only 14 years.
- Crowd – Power = your expert team that can be built up of a variety of individuals.
- Gig Economy – Freelance or short term contract workers, may be 40% of workers in next two years.
- Using these folks is crowdsourcing, and companies need to utilize this “liquid” workforce.
- GE can link you to these individuals to perform a variety of tasks and previous projects have been run by GE using the crowdsourcing model, which can reduce time to market and bring innovative solutions.

Key Learnings, Recommendations, and/or Best Practices

- Using the GE FUSE technology allows companies to leverage problem solvers all over the world to solve problems that are not feasible to solve in house.

Q&A

Q1. How do you reward your problem solvers? The winners of the project proposals?
A1. Part of the program management is part of designing the problem to craft the question to the solution. There is an awards strategy with a variety of price structures commiserate to the amount of work performed.

Q2. Would GE take ownership of Intellectual Property?
A2. Depends on the award given and GE is cognizant of this issue and would consider flexible solutions.

Q3: Are the awards already laid out in advance of the problem?
A3: Yes, the competitions can be found on GEGENIUS link website. NDAs can be signed to allow additional consultation by GE.

Modular Remote Monitoring System (MRMS)

Gregg Ott *(AREVA NP)*

Session Notes

- Wireless systems do not have good penetration and range, especially in the nuclear industry environment.
- The MRMS uses battery powered and inexpensive components to provide signals that can be used without modifications for cables.
- Not simply the same as a Distributed Antenna System, but can be incorporated as part of that to do direct surveillance.

- The MRMS system can reduce manpower via this remote monitoring and maintenance.
- System was initially developed for remote cybersecurity monitoring. Anything with a standard sensor output can be monitored.
- The sensor does not directly transmit the data; rather the sensor data is translated by the endpoint technology.
- LoRA = Long Range. Range of Gateway/Repeater is about 16 km in normal air, and can penetrate the containment.
- Installed at the Flammanville site in France. A single Gateway covers the entire site.
- A Distributed Antenna System could carry the LoRA network.

Q&A

Q1. How do cybersecurity groups view this solution?
A1. Significant interest in using for monitoring, but not for tamper detection. Some are resistant to wireless networks, but this system can have encryption and be a critical digital access.

Q2. What was the process for installing the system at Flammanville?
A2. First, survey the site to determine optimal gateway placement for full site coverage. After that, there is the design modification package which is specific to the application. Installation time and effort is also very minor.

Centralized Monitoring

Session Organizer: Chris Kerr (*EPRI)*

Recently the industry has seen a shift towards centralized monitoring for nuclear assets. In this session, the focus is on the implementation of centralized monitoring for nuclear assets and how the data is being used for improved performance.

Cross-Linked Session: N/A
DNP Session: No

Advanced Plant Monitoring - Path Forward

Michael Taylor *(EPRI)*

Session Notes

- EPRI has been involved in plant monitoring for years, mostly in fossil generation, but now getting into nuclear.
- Phase 1 is catching nuclear up to fossil units in terms of on line monitoring.
- M&D Center – Monitoring and Data Center.
- The Online Monitoring Guideline can guide utilities based on the amount of scope they are willing to engage (large and small)
- PMBD = Preventative Maintenance Database Document
- Go from preventative based maintenance to condition based maintenance, replace things that are needed based on sensor responses

Key Learnings, Recommendations, and/or Best Practices

- EPRI is providing the reports and standardized design change packages to utilities to implement monitoring in nuclear plants with various scope.

Duke Energy Online Monitoring

Howard Nudi *(Duke Energy)*

Session Notes

- Duke has implemented online monitoring on the fossil plants in fleet
- Harris, Robinson, Brunswick nuclear plants
- Onconee, McGuire, Catawba nuclear plants for plant site acronyms
- System works on fossil side for cost avoidance – centralized approach to monitoring of parameters

Key Learnings, Recommendations, and/or Best Practices

- Direct monitoring of various plant components has already been proven to meet Return on Investment for Duke and can be applied similar to nuclear plants.

Plant Data Monitoring

John Petriccioni *(Exelon)*

Session Notes

- Exelon approach is to use all type of sensors at different frequencies for specific monitoring (i.e. vibration at on frequency, rad detection at another)
- Different sensors at different protocols makes it more difficult, industry can band together for single protocol and use on large scale.
- APR = Advanced Pattern Recognition
- APM = Asset Performance Management

Q&A

Q1. Is DAS tied into the Exelon network?
A1: No, DAS is not on business network, is sent to the GE PRISM cloud, it is not used for plant control and plant operating conditions are not changed based on DAS.

Q2: Prognostics in the future? Does PREDIX do this?
A2: Yes to both. GE is helping Exelon and they are working closely with GE to implement prognostics.

Q3: Plants have analogue sensors mostly, are you looking at installing reference only digital instruments to get more data from a single sensor (i.e. pressure temperature flow)
A3: Exelon is working with Duke and EPRI to collaborate on different sensors to avoid replicated testing. There aren't any specific decisions for a particular digital gauge. Sensors can be expensive, so there is a balance in the number of sensors and sophistication of sensors employed. Battery life should also be considered – cannot make a new maintenance issue with frequent sensor battery replacement.

TOP INNOVATIVE PRACTICE AWARDS

Best of the Best: Technical Specification Change Utilizing FLEX Equipment - Harris Nuclear Plant

Duke Energy

Team: Sarah McDaniel, John Caves, Rob Isbell, Tom Scattergood, Jason Lanier
Presentation given by: **Sarah McDaniel**

Session Notes

- 12 technical specification sections were impacted.
- Risk-informed LAR met the intent and FLEX ESW pump was credited to cool the affected train emergency diesel generator & other loads.

Key Learnings, Recommendations, and/or Best Practices

- The regulator's approval of the operating license amendment based on reliance on FLEX equipment can be a precedent that others seeking extension of completion times for maintenance activities. The concept presented is very innovative that helps with safety, cost savings and operation.

Q&A

Q1. How long did it take you to get LAR approved?
A1. October 2015 application sent to NRC, received RAIs after 6 months. Vibrations in the pumps were the concern. Continued brainstorming with vibration in pumps. Finally, it was approved in 10 and half months. Replacement was done during normal operations.

GE Vendor Award: TRACG-LOCA Methodology

Exelon

Team: Jim Tusar, David Knepper, Benjamin Lambert, John Massari, Travis Bement
Presentation given by: **Travis Bement**

Session Notes

- Implemented Transient Reactor Analysis Code (TRAC) – GE for LOCA Analysis.
- Implemented at Nine Mile Point 1 (savings of $3M) and Oyster Creek (savings of $2.5 M).
- Improved thermal limit margins help with costs related to fuel cycle and operations. Improved PCT and oxidation margin.
- Submitted in 2011 and approved in 2017.

Key Learnings, Recommendations, and/or Best Practices

- This new innovative method helps remove overly conservative assumptions and helps with costs related to fuel cycle and operations.

NEI TIP Award: Ultra-High Pressure Cavitation Peening for Alloy 600 PWR Reactor Head Primary Water Stress Corrosion Cracking Mitigation

Exelon

Team: Brad Lanka, Benjamin Youman, Edward Wrigley, Gary Hagermann, Jack Feimster
Presentation given by: **Brad Lanka**
NOTE: Please contact Brad (Bradley.lanka@exeloncorp.com) to obtain this presentation

Session Notes

- Insights presented from the Exelon Reactor Vessel Head Peening Implementation to protect from stress-corrosion cracking using ultra high pressure jet.
- Preserves the asset against potential future repairs or replacement. Proactive approach to mitigate stress-corrosion cracking.
- Test results show peening doesn't impact NDE results (doesn't damage heads). Implemented on 4 RV heads during 2016 and 2017 refueling outages.

- Refer to YouTube video: https://www.youtube.com/watch?v=AU65pVz3AWg or contact Brad Lanka at Bradley.lanka@exeloncorp.com for more details.

Key Learnings, Recommendations, and/or Best Practices

- This is a proactive approach to mitigate stress-corrosion cracking which preserves the assets against potential future repairs or replacement.