

# A glimpse at the culture behind a successful valve outage

*By Sarah Bradley - Editor-in-Chief, Valve World Americas*

Though the views on nuclear power vary across the world, the topic is always an interesting point of debate. With the changes in regulations since the events at the Fukushima plant following the tsunami in Japan in 2010, the anticipated nuclear renaissance has taken a backseat while current reactors begin working to instate the new guidelines. The LNG boom has put additional pressure on the utilities, with plants such as Kewaunee Station in Wisconsin deciding to close its doors and Germany outlawing the energy source as a reaction to Fukushima. Meanwhile, plants in the southern United States have moved forward with new build approvals and continued license extensions and China is significantly more active in the nuclear sector. As with many energy sources, nuclear power has been subject to scrutiny, but the industry still continues to thrive in much of the U.S. and many believe it to be a significant “clean” energy solution with a promising future.



Valve World Americas had the incredible opportunity to pay a visit to the valve team at Cooper Nuclear Station in Brownville, Nebraska during the plant’s scheduled re-fuelling outage to discuss their experience in valve maintenance, the challenges they face during an outage and the importance of bringing in a skilled supplemental workforce. A 810 Megawatt boiling water nuclear reactor plant and the largest single-unit electrical generator in the state, Cooper Nuclear Station is located on the borders of Missouri and Nebraska, two hours south of Omaha.

With management services provided by Entergy, the station is owned and operated by the Nebraska Public Power District and

has been in operation since 1974, currently employing roughly 730 full-time employees, supplying customers primarily in Nebraska, with excess power sold for use in Iowa, Kansas, Missouri and the Dakotas. The plant consists of a General Electric BWR/4 series reactor, a Westinghouse turbine generator, has a Mark I containment system and in 1998, was the first American plant to load nuclear fuel containing uranium that had been provided by the Megatons to Megawatts Program, in which uranium removed from nuclear weapons of the former Soviet Union was turned into low-enriched uranium and then to fuel. Cooper Nuclear Station recently extended its operating license for another 20 years, through to January 18<sup>th</sup>, 2034.



During this outage, Cooper Nuclear Station is planning to complete all scheduled and emerging maintenance jobs and the re-fuelling process in about a month. Finishing a site record 524 day breaker-to-breaker run with no unscheduled repair issues between the previous two outages forcing the unit off-line, Chief Nuclear Officer (CNO) Brian O’Grady is confident that the outcome of the current outage will also prove to be a success. This is especially important as the plant prepares to extend the current interval between outages from 18 to 24 months. O’Grady believes that supporting the staff is imperative to the smooth operation during outage times.

“That is where the rubber meets the road, where the human is touching the plant,” said O’Grady. “That’s the most important thing that we plan for, that has to be done right, scheduled right, trained right and the procedures have to be followed properly. There are so many things in a nuclear plant that have to be done properly and that is also where that up-front planning comes in to play. It’s the meticulous planning that gets you flawless execution.”



The plant has some particularly challenging maintenance jobs on the roster in preparation for the extension of outage intervals and will also be addressing some aging issues with equipment and parts throughout the plant.

"We are replacing four main power transformers and all four drywell fan coil units. We are doing both reactor recirculation pump seal replacements. We are replacing all the main steam line hangers and doing Appendix R modifications where we are re-wiring 28 MOVs. We are repairing bypass valves, doing main turbine inspections, and a reactor feed pump turbine inspection," said Outage Manager, Mike Tackett. "We are also upgrading to some digital components this outage so that we are able to maintain the plant with parts into the future. And of course, we are shuffling the core and putting new fuel in the vessel, but that is just a small list of the many tasks we are doing this outage."

"There are a lot of challenging maintenance jobs. The unique part of an outage is that the equipment you are working on, you don't normally work on during the cycle. There is equipment that you don't normally touch, because basically they run for the whole cycle and we don't take them down for maintenance," said Assistant Maintenance Manager, Matt Hug.

## Preparation versus Execution

Advanced preparation is critical to the successful completion of maintenance during an outage period. With the number of scheduled and emergent issues that arise, lack of preparation can prove to be detrimental to staying on schedule; this can cost plants millions of dollars due to the inability to return to operation on time.

"Preparation is so much what separates the great plants with the short outages from those that just can't seem to get it done. You try to use as much of your ability to predict what could go wrong and make sure that you have everything covered," said Motor Operated Valve Program engineer, Duane Weninger. "After you do a few of these, you learn that something that you would never think could go wrong, will go wrong and that's something you have to try to anticipate."

Ensuring the proper equipment and parts are stocked in-house is also vital to the successful completion of maintenance work. As part of the outage preparation process, parts required for planned maintenance projects are considered, referenced, ordered and stocked in advance in order to avoid any foreseeable, preventable delays. Applied to valves, nearly 100% of all parts needed for scheduled valve maintenance are pulled pre-outage and staged in a locked cage by valve team personnel to ensure they are the correct part, are pre-inspected, and are ready in-hand upon pre-job briefing.

"Proper preparation will save you a lot of headaches during an outage, when you don't have time to spend researching an emerging issue. The last outage, as a lesson learned, our new feed water heater level control valves – 16 basically brand new valves started having issues with the actuation, so we ended up working on 12 of the 16 valves, and parts became a big issue," said Air Operated Valve Program Engineer, Rhoel Tierra. "We spent months building data sheets by cross-referencing the vendor part numbers to our part numbers, preparing contingency work orders with all the potential spare parts that we would need, getting all the spare parts ordered and poring over the preventative maintenance plans. It became a labor of love

and it's paying off so far - we haven't had to scramble to order emergency parts for any of the valves that we have gone into."

"Our procurement people actually have a critical spares replacement program that they put into place and we verified and tracked every part that was going to be needed for the outage as one of our Outage Milestones. Part of the program identifies critical spares that are automatically re-ordered items to keep in stock. We have been able to procure and have every part that we needed onsite before the outage even starts," said Maintenance Manager, Jim O'Connor.

Despite the months of preparation that all departments in the plant undergo, it is often impossible to anticipate all the issues that may arise. Emerging issues are something the valve team is all too familiar with. As valve problems may not be apparent until the work itself has commenced and the equipment has been dismantled or opened up for service, the valve team has learned that the unexpected is often the norm.

"At times, especially during an outage, you are going to have discovery work that goes beyond what was originally spec'd for the outage. If you aren't overly prepared for the stuff that you know about, then you get overwhelmed by the emerging issues that come up. We always joke that it's 90% prep and 10% execution for an outage," said Valve Team Supervisor, Kyle Bantz. "We go so far as to draw maps to valves and mark up our prints months in advance. We started in April marking up our Clearance orders. They're all organized by system and those are the things that we do to help speed up work. Those are administrative burdens that a supervisor doesn't have to deal with while we are in the heat of battle in an outage. That facilitates being able to handle emerging scope coming at you."



Bantz also stresses the importance of ensuring that the maintenance performed during an outage is detailed and properly executed. When a project is rushed or a worker is satisfied with a makeshift solution, the plant will suffer in the long run.

"The most important thing is that they're raising the work expectations towards perfect, because that is what's going to allow for a two year cycle and help avoid problems on-line. I don't want to have to come in here on Christmas Eve to fix a leak because we have something pass criteria, but it wasn't perfect. I can rely on my team and appreciate their professional opinions and I will support them all the way," said Bantz. "I knew this outage was going to be very difficult because we are aiming for the 24 month duration of the cycle. We started a long time ago trying to work on little details and break down different system windows into their own little projects and attack those one at a time. We needed to do that so that we would have the efficiency to be able to do 27-day outage and our time will not be spent sorting out issues with scope that we already know about and we can focus on emerging issues. If you're floundering because you're not prepared, it's almost impossible to be successful."

## Secrets to Valve Team Success

The valve team in a nuclear plant has a very large work scope during outage time. The immense number of individual items that require attention can sometimes be daunting and require a great deal of attention. The valve team at Cooper Nuclear Station has learned from their years of experience, the necessity of streamlining their work through organization, cooperation and proper leadership.

"The main ingredient is leadership and Kyle has provided that, along with many others. Having qualified, well-trained technicians, good tools, a good schedule and lots of upfront planning has given us the positive results we have seen. The quality of the maintenance is proven in that the plant runs the whole cycle without issue," said Brian O'Grady. "The performance is all about the people. Everybody has the same valves, it's the people that make the performance."

"I started out at ground zero and came up through the ranks, so as a supervisor I understand all the fine details of the technical work," said Kyle Bantz. "Now I think that everyone in management would agree that we are at our pinnacle for valve performance at Cooper."

With the substantial work organized for the outage, the number of supplemental employees brought in to aid in the efforts has been increased from approximately 900 during previous outages to 1200 reinforcements to support the increased workload. For the valve team, approximately 94 supplemental valve maintenance personnel including valve and actuator technicians, diagnostic testing personnel, supervision, project management and engineers were brought in from CRANE Nuclear to provide services. The services provided to Cooper this outage included pre-outage services such as planning, training and scheduling support, outage services inclusive of valve and actuator maintenance, repair, modification and refurbishment, AOV and MOV testing services, engineering support, project management, and quality control.

"Years ago, when plants were new, there was no valve maintenance needed because the valves were new, but as the plants age, the maintenance and testing requirements have

changed. You have a much bigger scope and trying to get a 30 or 27 day outage accomplished is impossible to do with the number of valves we have. We brought in 94 people to support us, because you have to have a vendor come in with training and background that can get it done on time," said Work Week Manager and Outage Back-up Valve Team Lead, Jeff Jones. "You are trusting your plant to them and you want them to be trained, qualified and have experience."

"Supplementals are part of the CNS team for the outage. We can only be as successful as we are as a team. If we don't set them up for success, when they're gone after the outage, it's the people who are here permanently that will have to deal with any issues of poor performance. With our valve team we integrate our supplemental workers and in-house people so that they work together to make sure that they are following our standards, following procedures and work instructions," said Assistant Maintenance Manager, Matt Hug. "The good working relationship with the vendor is important, whether it be coming on-site and understanding your equipment, what we expect and what we are supposed to get out of them, ways to improve the efficiency of the equipment itself or improve the longevity of how long the equipment lasts in our applications. Having a supplier that is there to support you when you need them is so important, but also being there to celebrate in our successes is important too."

Bantz insists that the vendor relationship is one of the most important focuses in attaining success in an outage. Developing a bond and having the reassurance of support from vendors and supplemental employees brings a level of confidence in the quality workmanship essential to successful outage maintenance.

"The relationship with the vendor is not just important, it's critical. I have vendors that I could call in the middle of the night and I know they would help me. A lot of that has to do with just a personal ownership over this plant and the outcome of this outage," explained Bantz. "We brought CRANE in and have used them for several outages. They are a big part of our success. The CRANE guys overseeing the work call everyday and it's not hokey, it is a call genuinely concerned about how we are doing and how they can help. We kind of adopt our support people as honorary members of the valve team."

Support between in-house departments is also critical to successfully maintaining the schedule while still protecting the quality of the work being performed. Operations Manager, Rod Penfield believes that organizing support work between the valve team and operations department has resolved past issues of disjoint between the groups. By assigning operators to assist the valve team by removing interferences and hanging clearance tags for the valve team, many delays previously caused by waiting for the tagging process have been avoided.

"The tagging process has to be pristine and it has to be followed to strike a balance between keeping everyone safe, yet having the system allow you to be efficient in the workplace. To do this we implemented Test and Maintenance tagging that we adopted from the Entergy fleet. That was a tremendous improvement, because it allows us to turn a valve over to the valve team and they control the breaker and control switch. It allows them to lock the breaker, do maintenance and when they are ready to test, move right into testing rather than impact our resources to roll those tags. It's a tremendous gain for both the valve team and operations, because we used to spend countless hours on rolling tags, which has now been eliminated for almost every MOV," said Rod Penfield.



"Also, in the schedule we tried to lag the completion of the tag out to the start of the work, so that we allowed for more time than required for the work. That way if we were running behind in the tagging process it didn't impact the valve team resources. We have a Tag Out Calculator that gives a rough estimate of the time needed to work on a certain component from start to finish and that helps us put a more realistic duration on the work."

## On the Horizon

The future of the workforce is an important focus in the nuclear industry, as in many other energy sectors. With a substantial percentage of the workforce maturing, many in the industry fear the experience gap to be a great problem for the industry and have voiced concern about the knowledge retiring with workforce.

"The industry is facing some major challenges right now. We are looking at a workforce demographic that is working against us. There was a time when the industry wasn't hiring young people for decades, so now we have a large group that is ready to retire and a large group of new ones coming in and not a lot in between," Brian O'Grady explained. "We are going into the school systems to talk about the benefits of nuclear power and we are also partnering with a local community college. Southeast Community College has a two-year program for the different disciplines that work in a nuclear plant - the operators, the maintenance workers, the radiation protection techs. For engineers we look to the University of Nebraska at Lincoln's four-year degreed engineers and we have been hiring out of those populations of students."

While the future looks promising for Cooper Nuclear Station with their impressive online performance, successful outage processes and the extension of their operating contract well into the coming decades, most at Cooper are also optimistic about the nuclear power industry as a whole. Despite costly regulatory orders coming down from the Nuclear Regulatory Commission in the United States as a result of the events at the Fukushima plant following the tsunami in Japan, most believe that the initial costs to implement these precautionary measures will be offset by the industry's positive outlook as an important viable energy source.



"We are now looking more at some things that in the past we had determined were way beyond design basis accidents and now we have to re-look at those things to see if there is anything we can do to make the plants more safe, should one of those things that you think could never happen, possibly does," explained Mike Tackett. "It is going to cost the plants a lot of money, but in the long run it will be safer."

"The industry is going to change. The Fukushima orders are coming down and that is going to be a significant financial impact to all the nuclear plants, especially the BWR4s like Cooper. I still think nuclear power is going to be viable, but that is on the heels of Kewaunee Station deciding to shut its doors. I think it is going to be on a region to region basis. Based on the nature of the energy sector in this region, with Nebraska being a public power state, I think that bodes well for us," said Rod Penfield.

*Special thank you to Business Line Manager – Nuclear Services, Timothy Teske of CRANE Nuclear and Cooper Nuclear Station for supporting this opportunity. "It has been amazing to watch the valve team evolve under Kyle's leadership into one of the premier valve organizations we have worked with," said Tim Teske. "That is not possible without strong leadership and support from the very top all the way down to the valve technicians; it is very clear the valve team at Cooper just 'gets it!'"*

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