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# **Watts Bar Nuclear Plant Unit 2 Completion Project**

## **Thirteenth Quarterly Update to the Estimate to Complete May - July 2015**

**Published August 2015**

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**Nuclear  
Construction**

**Table of Contents**

Section 1 - Executive Summary .....3

Section 2 - Background.....4

Section 3 - Quarterly Performance .....4

    Safety .....5

    Quality .....6

    Cost .....6

    Schedule .....7

Section 4 - Reserve Management .....8

Section 5 - Known Risks .....8

Section 6 - Project Oversight .....10

Section 7 - Project Organizational Health .....11

Section 8 - Going Forward .....12

## **Section 1 - Executive Summary**

The 13th quarterly update of TVA's Estimate to Complete (ETC) for Watts Bar Nuclear Plant (WBN) Unit 2 focuses primarily on the activities from May to July, 2015.

Performance during the quarter continued to be consistent with the ETC, and project targets continued to be met for safety, quality, cost, and schedule.

Significant progress was made in operational testing of plant systems, as the Hot Functional Testing (HFT) was started in June and has progressed well through July. The loading of ice into the ice condenser baskets was also completed in this period, and preparations are underway for the Containment Integrated Leak Rate Test (CILRT) and the Integrated Safeguards Test (IST) upon the completion of HFT.

The Nuclear Regulatory Commission (NRC) Commissioners delegated authority to the Director of Nuclear Reactor Regulation (NRR) to issue a license to Unit 2 once the remaining work, testing, and associated inspections are complete. The Operational Readiness Assessment Team (ORAT) inspection was completed in June with no significant issues and with a conclusion that the procedures, programs, and people were essentially ready for dual-unit operations.

Some challenges mentioned in the previous quarterly report remain. The project team continues to focus attention and resources to look ahead, to anticipate issues and plan contingencies, and to collaborate with the plant operating staff to continue safely progressing toward unit operations. Primary challenges include:

- Testing Unit 2 systems that share components with Unit 1 without jeopardizing the safe and reliable operations of Unit 1;
- Completing the release of plant systems for pre-operational startup testing during a compressed time period while maintaining safety and quality standards;
- Completions and testing of systems in shared spaces, higher than expected equipment failures and repairs, and productivity issues during startup testing;
- Addressing regulatory and licensing issues.

### **Quarterly Summary Points**

**One lost time incident was recorded after over 33 million man-hours**

**Performed activities in a manner that resulted in a Quality Control acceptance rate of over 98 percent**

**Met cost and schedule expectations set forth in the ETC**

**Released 7 more plant systems for startup testing**

**Released 6 more systems to Operations**

**Substantial progress in operational testing and regulatory inspections have reduced the probability and potential impact of several risk areas**

## Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, May - July 2015

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### Section 2 - Background

In August 2007, TVA's Board of Directors approved resuming construction to complete WBN Unit 2. However, the project did not subsequently meet expectations for schedule or budget.

In August 2011, a new management team performed a root cause analysis of the issues responsible for the schedule and budget problems and developed a revised ETC for the project.

The revised ETC is based on a range of values for both schedule and budget. As part of its effort to develop the ranges, the team considered risks and obstacles that could hinder meeting project expectations.

On April 26, 2012, the TVA Board of Directors approved the budget and schedule shown below to complete Unit 2.

Watts Bar 2	Aggressive	Most Likely	Upper Range
Completion Cost	\$4.0 Billion	\$4.2 Billion	\$4.5 Billion
Commercial Operation	September 2015	December 2015	June 2016

*Note: More information and additional details about the cause analysis, as well as the process that was used to develop the revised ETC, can be found in the Executive Final Report on the ETC posted on this link: [http://www.tva.com/power/nuclear/pdf/wattsbar2\\_executive\\_etc.pdf](http://www.tva.com/power/nuclear/pdf/wattsbar2_executive_etc.pdf)*

### Section 3 - Quarterly Performance

The project continued to meet overall targets for safety, quality, cost, and schedule in the three months from May to July 2015.

Among the significant accomplishments this quarter were the completion of ice loading in the ice condenser system and the start of HFT. This test brings the reactor coolant system and the secondary systems (main steam, feedwater, and condensate) to full operating temperatures and pressures, demonstrating readiness for power operations of the major components, piping and supports, and the process controls. This testing will be completed in August, and will be followed by the CILRT and the IST. The CILRT will demonstrate containment integrity by pressurizing it to design basis pressures and verifying leakage rates comply with requirements. The IST will be the final demonstration that plant safety-related systems can provide their intended functions by injecting simulated accident signals and observing proper response of the Emergency Core Cooling Systems and their support systems.

The CILRT will increase pressure inside the reactor containment to design values in order to demonstrate its capability to "contain" the energy and radiological release from a design basis accident.

Substantial progress was made toward obtaining a license for Unit 2 operation. The NRC Commissioners delegated authority to the Director of NRR to issue a license once the remaining work, testing, and associated inspections are completed. The ORAT inspection was completed in June with no significant findings and a conclusion the operating personnel, programs, and procedures are essentially ready for dual-unit operations. The NRC also issued the dual-unit operating licenses to the plant operators.

## Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, May - July 2015

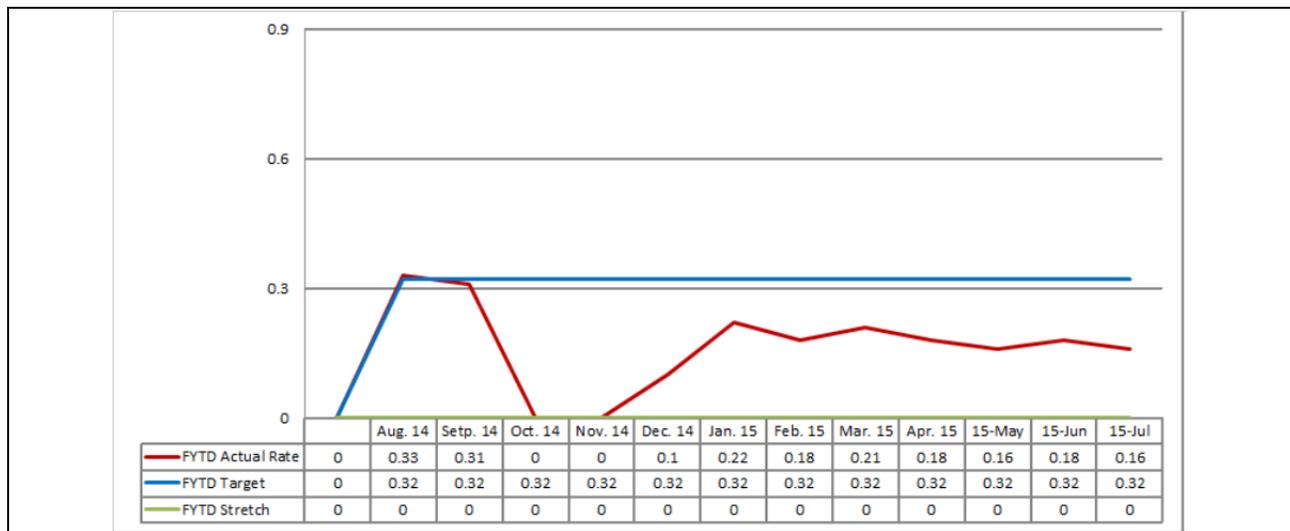
In addition:

- Seven additional systems were turned over from construction to startup for component and pre-operational testing.
- Six systems were released to operations following completion of testing
- Briefings and tours were provided to stakeholders such as federal, state, and local officials, and the Watts Bar Community Action Panel held its eighth meeting since being formed in 2014.

### Safety

Safety is the highest value and the overriding priority for TVA and WBN. During the months of May-July 2015, the Unit 2 WBN Team incurred a lost time accident (LTA) clock reset on June 1st after over 33 million man-hours without such an injury. The reset occurred due to an injury that occurred in January which required subsequent surgery. The project continues to maintain focus and drive safe work practices while the emphasis transitions into operational testing of plant systems.

### Watts Bar Unit 2 Recordable Injury Rate



Unit 2 workers continue to identify potential risks and stay safe by:

- Maintaining awareness of changing plant conditions as systems are turned over to the operating unit;
- Using the Tri-lateral Safety Alliance intervention process when necessary to prevent teammates from engaging in behaviors that put themselves and others at risk; and
- Closely monitoring low-level safety incidents and communicating those among project personnel, along with safety experiences from across TVA and the industry.

#### Between May 2015 - July 2015

- Over 1200 interventions were performed by craft safety teams and the Tri-lateral Safety Alliance which is made up of TVA, represented crafts, and contract partners.
- Over 3000 management observations were documented, of which over 2000 focused on error prevention tools and their use by the employees.

**Watts Bar Unit 2 Completion Project**  
**Quarterly Update to the Estimate to Complete, May - July 2015**

**Quality**

The quality of WBN Unit 2 work remains above goal as measured by the Quality Control (QC) acceptance rate (shown on the chart at right). Each month, this rate measures the percentage of work that passes the QC inspection process on the first inspection.

For the past 12 months, the cumulative average acceptance rate is over 98 percent.

The Quality Assurance organization continues to provide oversight of the system turnover process, testing program, and engineering and construction document closure with a focus on the conduct of pre-operational testing.

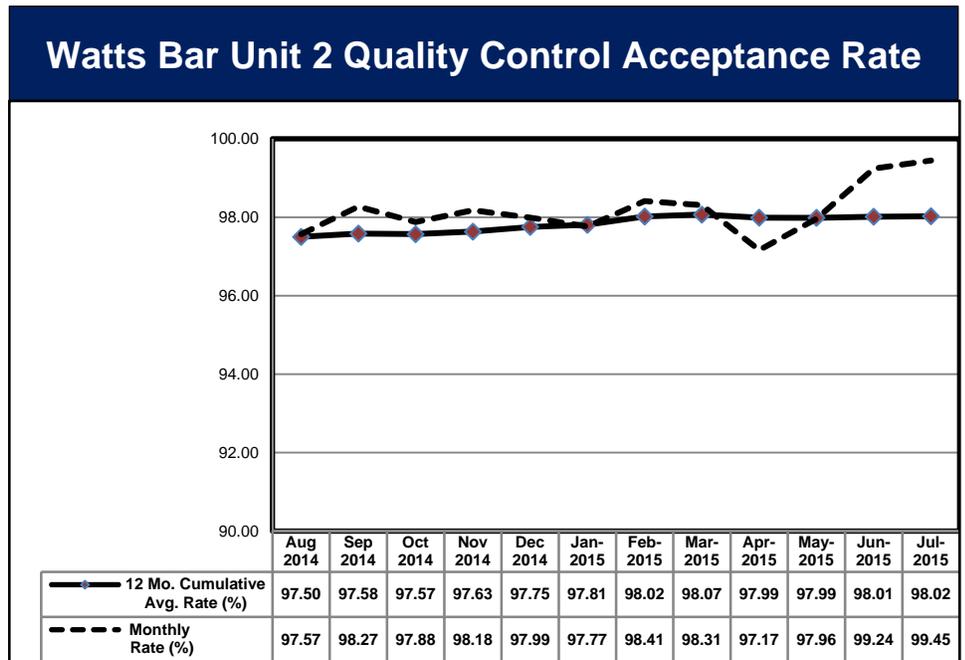
Also during this report period, American Society of Mechanical Engineers (ASME), Section III, Final N-5

Code Data Report approvals continued with only two systems now remaining to be certified: System 64 Ice Condenser Containment and System 90 Radiation Monitoring. Pre-service inspections of supports on ASME systems are underway. ASME certification confirms the unit has been constructed to meet the most stringent of industry standards

**Cost**

The project is trending to a total cost of \$4.448 billion, which is within the \$4.5 billion TVA Board approved ETC. This trend is based upon a September 2015 fuel load and January 2016 commercial operation.

Final completion of system startup testing phases are nearing completion. Demobilization plans are being implemented, including staffing reductions and removal of temporary facilities.



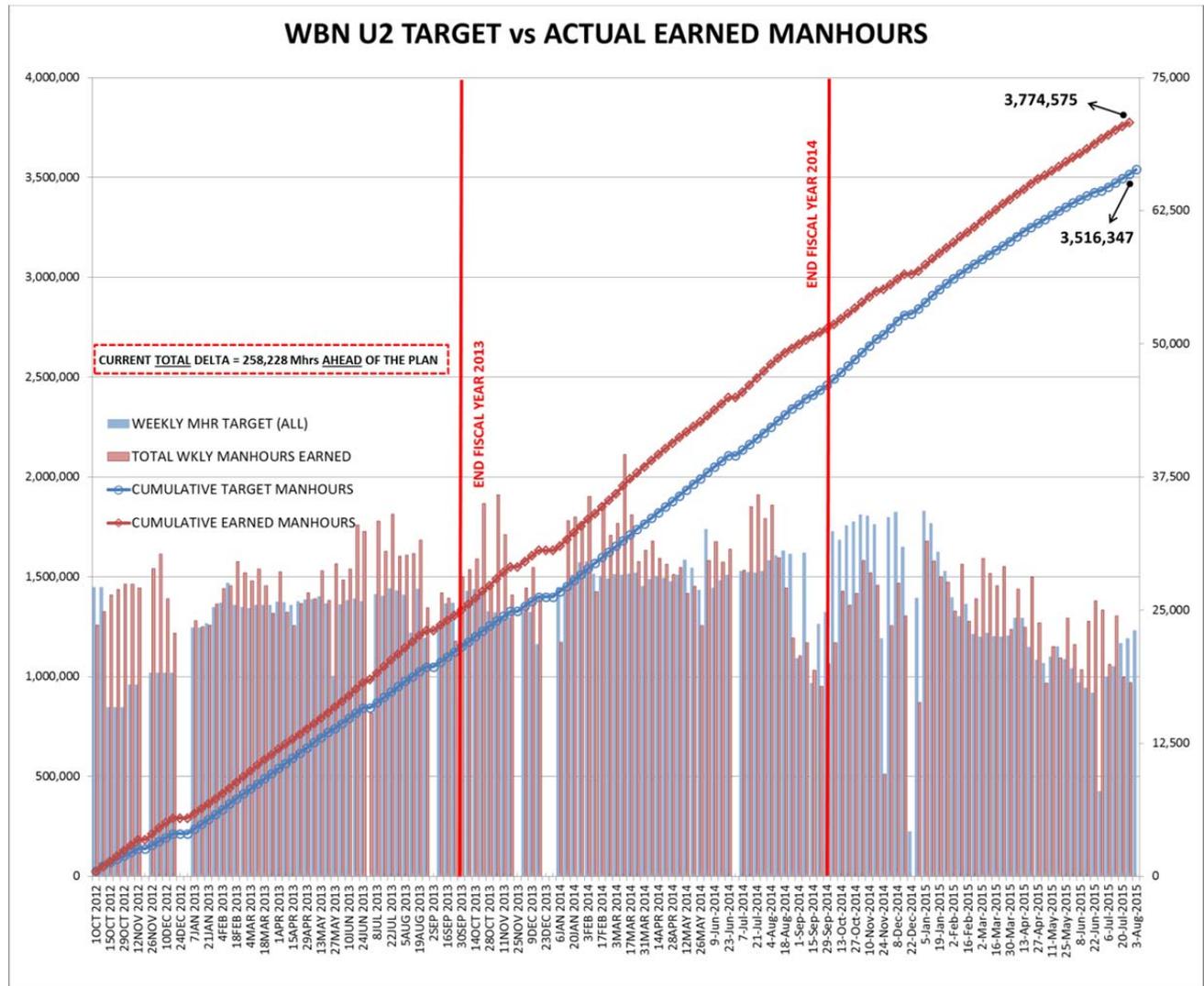
# Watts Bar Unit 2 Completion Project

## Quarterly Update to the Estimate to Complete, May - July 2015

### Schedule

Based on current and targeted schedule performance, the project is tracking to a commercial operation date in January 2016. Overall, the project earned man-hours exceeded the planned target as shown in the graph below; however, this was offset by delays in some system releases, component test failures, and productivity in the component testing area. This is discussed further in the Risks section of this report.

## Watts Bar Unit 2 Target Versus Actual Earned Work Hours

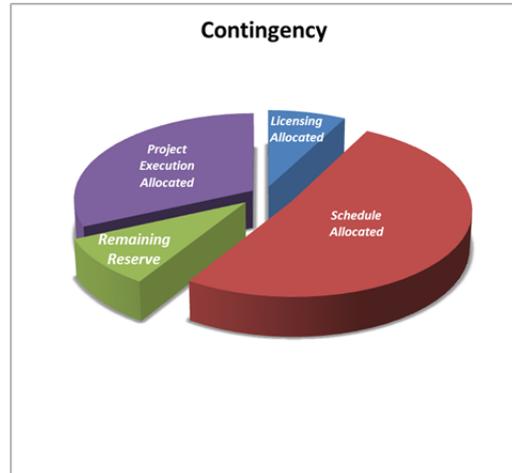


**Watts Bar Unit 2 Completion Project  
Quarterly Update to the Estimate to Complete, May - July 2015**

**Section 4 - Reserve Management**

Project reserve money is available to fund risk management and risk occurrence, as well as unforeseen expenditures.

The chart to the right shows that the project continues to expend a moderate portion of the established reserve. The relative sizes of the total allocations from the reserve through the end of this quarter are shown in the chart.



**Section 5 - Known Risks**

There were no new risks identified during this review period, and progress in completions and operational testing of equipment have reduced the probability of significant delays from several of the previously identified risks. A summary of all the risk items follows.

**Fire Protection Triennial Inspection Deficiencies**

In December 2014, the NRC concluded an inspection of the WBN dual-unit fire protection strategies and report, identifying several issues and concerns which warranted further review, correction, and a follow-up inspection. The project promptly formed a team to perform a detailed review of the Dual-Unit Fire Protection Report to ensure the design basis was sound and met regulations, the design implemented that basis, and the implementing procedures met the design and were achievable. Several issues were identified, some which had implications to the existing report and operating unit. Those have been input into the corrective action program for review and correction. Based on these findings, the team was given appropriate resources to do a complete review to identify and correct deficiencies in all elements of the program and prepare for the re-inspection. That inspection is progressing well with no significant issues to date and is expected to be complete by early September.

<u>Risk</u>	<u>Risk Trend</u>
Fire Protection Triennial Inspection Deficiencies	Stable
Waste Confidence/Continued Storage	Decreasing
Dual-Unit Operational Readiness	Decreasing
Closure of Licensing Issues	Stable
Documenting Completion of Work	Decreasing
Construction Completion	Decreasing
Cyber Security	Decreasing
Emergent Work and Verification	Decreasing
Startup Testing Delays	Stable
Fukushima	Closed

**Waste Confidence/Continued Storage**

On February 5, 2015, and April 21, 2015, members of the Southern Alliance for Clean Energy (SACE) filed contentions in the WBN Unit 2 licensing proceeding, which had previously been terminated.

The ASLB rejected SACE's February 5 contention, concerning a seismic report, in April, and on May 18, 2015, SACE appealed this decision to the Commission. TVA and the NRC Staff opposed the appeal, which is pending before the Commission.

## **Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, May - July 2015**

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The April 21, 2015, filing was a hearing request and petition to intervene, along with a motion to reopen the record to admit a “place-holder” contention challenging the NRC Staff’s reliance on the Continued Spent Fuel Storage Rule and Continued Spent Fuel Storage Generic Environmental Impact Statement (EIS) as part of the licensing proceeding for WBN Unit 2. The Commission rejected this on June 12, 2015; however, a remaining action related to the Continued Storage Rule is the NRC Staff’s comparison of the Generic EIS to the WBN Unit 2 FES to ensure that potential environmental impacts are appropriately addressed.

### **Dual-Unit Operational Readiness**

During this period, the NRC conducted their ORAT inspection, with no significant issues that would challenge dual-unit operations at WBN. Similarly, the World Association of Nuclear Operators conducted a brief visit to follow-up on some items that were not fully reviewed in their visit of August 2014, identifying no new issues, noting the corrections for the minor issues noted in the earlier visit were adequate, and identified one new strength for the significant progress towards dual unit operational readiness.

### **Closure of Licensing Issues**

An area that continues to require focused attention is resolving inspection, planning, and scheduling (IP&S) items with the NRC. Many of the IP&S items must be resolved before fuel may be loaded in Unit 2. The project has developed a concentrated approach to prioritize each item to a project completion milestone and streamline IP&S item closure activities, and has made progress toward closure of the items. Approximately 91 percent of the items have been completed, and of the remaining open items, a significant portion of the inspection work has been performed.

### **Documenting Completion of Work**

Process improvements noted in previous reports continue to produce quality documentation with improved productivity. As the project has moved further into the startup and testing phase, comparable focus has been applied to documentation and closure of startup and testing activities to ensure similar positive results.

Project back-end non-turnover systems and area work (insulation, painting, sealing, grouting, conduit supports, etc.) is ramping up around remaining critical path system completions and testing, and will produce another challenge for field and engineering documentation and closeout prior, during, and post HFT. Processes and indicators have been established to track and monitor progress to avoid adverse project impacts.

### **Construction Completion**

Construction completion productivity remained acceptable this quarter to move into the HFT milestone. Detailed plans have been created and are being implemented for the final construction significant scope of completing all penetrations. Focus for construction has now significantly changed to demobilization and project close out activities.

### **Fukushima**

This project at WBN established a path forward that meets the NRC requirements. This includes contingency equipment for the mitigation of a broad range of “outside the design basis” events, which is stored onsite, protected from earthquakes, floods, and other natural events, and separate from the installed equipment from the original design. The NRC has issued WBN a safety evaluation approving the approach for addressing a Fukushima type event. Additionally, the NRC has conducted an inspection that found implementation of the Fukushima response strategy was acceptable.

## **Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, May - July 2015**

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### **Startup Testing Delays**

The project experienced delays resulting from startup component testing activities leading into HFT. These delays are related to construction turnover, test failures, time needed to make repairs, and complications when testing systems common to Unit 1 and Unit 2. The organization responsible for pre-operational startup testing was modified to provide dedicated groups focused on readiness for HFT, a “ready-ready” group to make sure test preparations and support needs have been completed, a rapid response group to address testing issues, and a Project Control Center to provide centralized communication and project control. Production has improved as a result of the organization changes, demonstrated by a successful entry and completion of HFT. These proven strategies are being applied for the upcoming milestones of CILRT and IST.

### **Emergent Work and Verification of Released Systems**

Levels of emergent work added into the schedule continue to be higher than desired. However, the types of items being added are maintenance type items from hot functional or other testing activities, walkdown punchlist items from system and area walkdowns, or work orders requesting support for other activities. These items do not present a significant schedule risk for completion of the unit. A Joint Review Group has been established (Unit 1 and Unit 2 personnel) to begin reviewing all new work to make milestone and mode calls to ensure new work is properly assessed and tied in the schedule expeditiously.

## **Section 6 - Project Oversight**

### **Project Assurance**

With the completion and release to startup of the significant systems for HFT, the demobilization of the Project Assurance organization was completed in April. This organizational transition was enabled by the project’s focus shifting to testing completions – an area that is fully managed and executed by TVA leadership, with close oversight by the Senior Vice President of WBN Operations and Construction. Periodic meetings are being held with the TVA executives and senior managers to discuss progress of the testing and overall project. Independent reviews of project progress and cost will be performed at the discretion of the Senior Vice President of WBN.

## Section 7 - Project Organizational Health

### Nuclear Safety Culture

The number of concerns expressed during this reporting period decreased from the previous period. There were 35 concerns reported in the previous period and 30 received during the period with the highest number of concerns being received in the month of May. This was consistent with a decrease from 9 to 4 in anonymous Condition Reports (CRs) from the previous reporting period.

A total of six NRC allegations were received during this quarter (two each month during April, May, and June) for a year-to-date total of 8 allegations reported to the NRC for the 2015 calendar year (see chart).

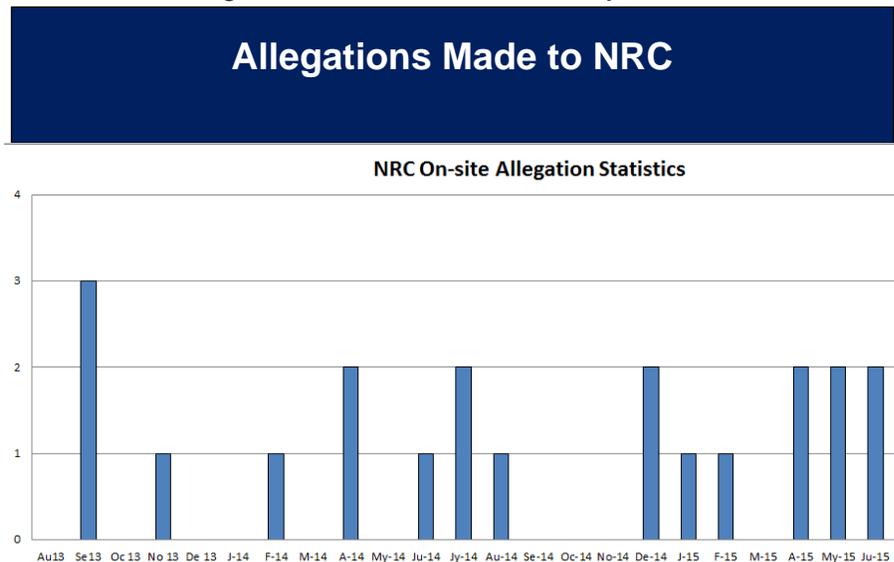
A slight increase in Nuclear Safety Quality (NSQ) issues has been observed; however, concerns related to management and personnel

type issues continue to be the highest contributor to the concerns received by both the Bechtel and TVA Employee Concerns Program (ECP). This indicates our need to emphasize improved leadership behaviors within supervision where improved communication and trustworthiness could be enhanced in an effort to encourage an environment for raising non-NSQ related issues.

ECP's goal is to offer all personnel exiting the construction site a voice to raise concerns by conducting exit interviews. During this quarter, ECP has seen a slight increase in concerns received during this exit process. ECP evaluates the site termination report at the end of each month and if an exit interview form has not completed, personnel are mailed the form offering them an additional opportunity to raise any issues they might have had while employed at WBN Unit 2.

Additionally, ECP continues the following activities to ensure issues or trends are identified early to ensure timely resolution:

- Concerns, CRs, and NRC allegations are reviewed to ensure that a Safety Conscious Work Environment (SCWE) is maintained.
- Site senior management is briefed weekly on concern status, survey results, and anonymous PER trending, and actions are identified if necessary to address any adverse trends.
- Pulsing surveys indicate a 97 percent positive response that the individual work departments support the raising of concerns.
- Weekly SCWE focus group sessions with Design Engineering was implemented in May due to concerns which had previously been addressed within the department.
- Senior managers rotate the responsibility of delivering a weekly SCWE message (which is provided by Employee Concerns) during the Monday project review briefing and it is then cascaded to site personnel.



## **Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, May - July 2015**

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- During demobilization, ECP gives every departing employee an opportunity to express concerns.

### **Project Completion Incentive Program**

The Project Completion Incentive Program offered an incentive payout to eligible participants for commercial operations certified by December 31, 2015, with a cost at or below \$4.4 billion. A payout from this program will not be made based on project costs and commercial operation date being above their thresholds.

### **Section 8 - Going Forward**

In the next quarter, HFT, the CILRT, and the IST will complete, as well as the release of the remaining systems to operations required for fuel loading. Surveillance testing of those systems to establish operability for fuel load is in progress as the systems are made available in schedule windows around those major tests.

The project will notify the NRC of the Substantial Completion of the unit in a letter detailing the remaining activities which will be finished prior to operations.

IST will demonstrate the safety-related systems and features can supply their functions for each of the design basis accident scenarios. It will also demonstrate that either of the two trains of safety systems can deliver that function independent of the other by simulating the complete loss of the train not under test.