
Watts Bar Nuclear Plant Unit 2 Completion Project

Seventh Quarterly Update to the Estimate to Complete November 2013 - January 2014

Published April 2014



**Nuclear
Construction**

Table of Contents

Section 1 - Executive Summary 3

Section 2 - Background..... 4

Section 3 - Quarterly Performance 4

 Safety 5

 Quality 6

 Cost..... 7

 Schedule 7

Section 4 - Reserve Management 9

Section 5 - Known Risks 9

 Regulatory Risk for Obtaining the Operating License 9

Section 6 - Improvements, Specific Issues, and Challenges10

Section 7 - Project Oversight.....12

Section 8 - Project Organizational Health13

Section 9 - Going Forward14

Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, November 2013 - January 2014

Section 1 - Executive Summary

The seventh quarterly update of TVA's Estimate to Complete (ETC) for Watts Bar Nuclear Plant Unit 2 (WBN2) focuses primarily on the activities between November 2013 and January 2014.

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

A significant milestone was achieved during the quarter as the last major systems were completed and released to pre-operational startup in support of open vessel testing (OVT) which is scheduled to begin in May. The systems released included the Chemical and Volume Control System (CVCS) and the Safety Injection (SI) System.

System-specific construction work continued to support testing for future milestones, including the cold hydrostatic test, hot functional testing, an integrated leak rate test, and fuel load. The schedule is organized to test systems in a logical sequence that supports each milestone.

The WBN2 team recognizes there will be challenges as the project moves forward. These include:

- Completing the release of more than 35 systems for pre-operational testing during a compressed time period while maintaining safety and quality standards;
- Testing systems that share components between units without jeopardizing the safe and reliable operations of Watts Bar Nuclear Plant Unit 1 (WBN1);
- Coordinating installation and testing activities during the spring WBN1 refueling outage;
- Executing staffing plans in support of project completion that maintain the right numbers and skill mix of personnel;
- Addressing regulatory and licensing issues.

The WBN2 organization will adjust as necessary to facilitate the resolution of challenges. The organization also will achieve the alignment needed to support the reliable operation of WBN1 while supporting the safe and high quality completion of WBN2 within budget and on time and to successfully transition the site to dual-unit operations.

Quarterly Summary Points

Exceeded more than 25 million work hours without a lost-time incident

Performed activities in a manner that resulted in a Quality Control acceptance rate of 97 percent

Met cost and schedule expectations

Continued to track to a most likely December 2015 target for commercial operation

Released two more plant systems for pre-operational testing

Identified no new risks that currently affect project completion

Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, November 2013 - January 2014

Section 2 - Background

In August 2007, the TVA Board of Directors approved resuming construction to complete WBN2. However, the project did not fully meet expectations for schedule or budget.

In August 2011, a new management team performed a root cause analysis of the issues responsible for the 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 WBN2.

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 new ETC, can be found in the Executive Final Report on the Estimate to Complete posted on this link: 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 November 2013 to January 2014.

During the course of the quarter, two additional major systems were completed and released for pre-operational testing: System 62 - CVCS and System 63 - SI. This brings the total to eight major systems released for pre-operational testing.

Pre-operational system testing includes cleaning, flushing, and component tests, such as running motors, as well as acceptance tests on overall systems. The successful completion of these tests is crucial for loading fuel in 2015.

As these and other systems are installed and released for pre-operational testing, the next steps are to clean, flush, inspect, and prepare these systems for various tests. The purpose is to discover and resolve any remaining issues that might impede the smooth completion of testing. Major system components, such as motors and power operated valves, will be individually tested prior to testing the overall system. Temporary test fixtures will be installed to conduct pressure boundary integrity testing (hydrostatic testing) on systems that will contain pressurized fluids. Temporary test instrumentation will be installed, and fluid flow balance measurements will be made. Upon successfully completing the remaining system acceptance tests, the system will be released for subsequent control and management by the WBN2 Operations staff.

Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, November 2013 - January 2014

Some of the significant test-related activities included testing of components within Emergency Core Cooling systems and other tests listed below:

- Pre-operational fluid flow balance testing was performed on the Essential Raw Cooling Water (ERCW) System;
- Logic testing was started on the Containment Spray (CS) System controls;
- Flushing of the CS System and the Component Cooling Water (CCS) System was completed;
- Test run of the CS motors, SI System motors, and Centrifugal Charging motors (part of CVCS) while uncoupled from the pumps;
- Began flushing the SI System, CVCS, and Residual Heat Removal (RHR) System piping;
- Test run of the RHR pumps and motors;
- Placed in service the refueling water storage tank with the CS pumps, RHR pumps, and SI pumps in recirculation;
- Test run of the condenser circulating water (CCW) motors and pumping of water through the cooling tower.

A portion of System 68 “Reactor Vessel Ready for Flush” is the remaining major component to be released for pre-operational testing prior to OVT this spring. OVT will involve pumping water through the open reactor vessel and specific systems needed for shutting down the reactor and supporting nuclear operations.

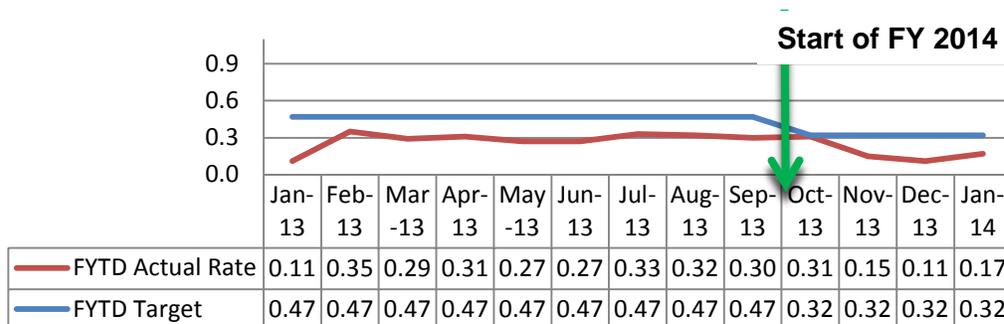
As the project moved forward, it also continued to strengthen its organizational response to emergent issues. Through the judicious use of daily structured review meetings in close coordination with a dedicated response team, new issues are promptly being assessed with corrections being planned and executed.

More information illustrating project performance is provided in the remaining sections below.

Safety

During the quarter, WBN2 personnel exceeded 25 million work hours without a lost-time incident, a significant accomplishment. And as the chart below shows, the Recordable Injury Rate¹ performance continued to be better than the target.

Watts Bar 2 Recordable Injury Rate



¹ Recordable Injury Rate is a rate-based measure of employee safety. It tracks the number and types of work-related injuries reported by TVA employees and contractors through TVA's record keeping system for safety statistics.

Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, November 2013 - January 2014

There were several contributing factors to workers' good safety performance:

- A commitment by employees to stay safe;
- Approximately 800 constructive interventions performed by craft safety teams;
- Work demonstrations by the Tri-Lateral Safety Alliance to show at-risk behaviors to avoid;
- Nearly 4,000 human performance observations.

These interventions were positively received, underscoring the beneficial and shared concern for everyone's safety.

The WBN2 team closely monitors low-level safety incidents and communicates those among project personnel, along with safety experiences across TVA and the industry. This helps workers identify potential risks so they can take actions to keep themselves safer.

Quality

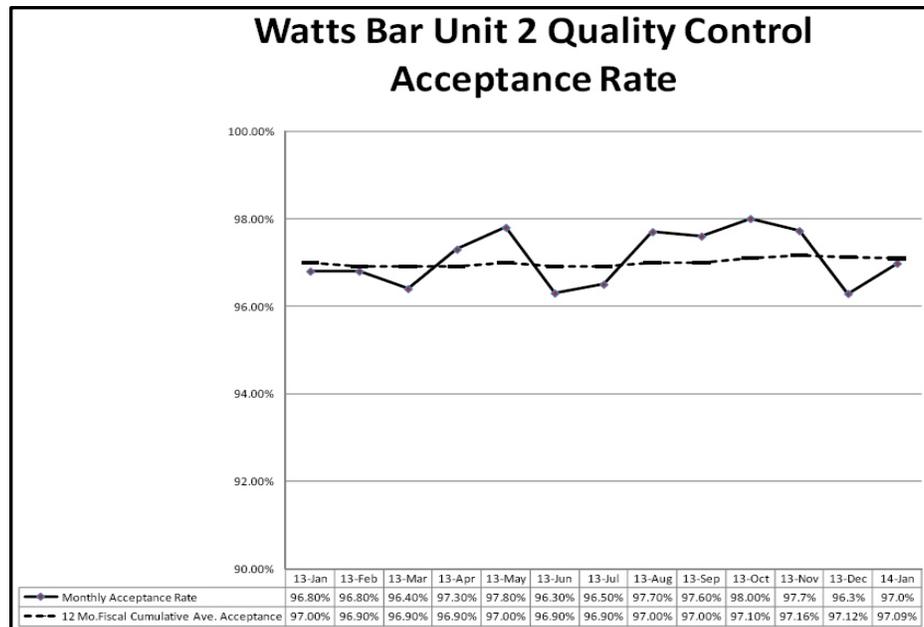
The quality of WBN2 work remains high as measured by the Quality Control acceptance rate (see the chart below). This rate measures the percentage of work that has passed the quality control inspection process for each month. Overall for the quarter, the acceptance rate remains at 97 percent.

Quality Assurance (QA) continues to provide increased oversight of the process for releasing systems for pre-operational testing as the project transitions from the completion of construction toward more testing activities. This includes close monitoring of actual component testing and pre-operational testing.

QA observed the following activities and provided feedback to the startup group:

- Implementation of system flushing of CCS and RHR systems;
- Performance of Pre-operational Test Instruction for the ERCW and the CCW systems;
- Component troubleshooting of the CS System and CCS System.

During the quarter, QA completed the audit of American Society of Mechanical Engineers (ASME)² Section III QA manual activities that are conducted by TVA and construction partners.



² American Society of Mechanical Engineers Boiler and Pressure Vessel Code Section III for nuclear power plant construction establishes rules of safety — relating only to pressure integrity — governing the design, fabrication, and inspection of boilers and pressure vessels, and nuclear power plant components during construction.

Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, November 2013 - January 2014

The audit team concluded that project personnel satisfactorily implemented program requirements and WBN2 ASME III activities met QA and regulatory requirements. The team also identified actions to further improve implementation of program requirements.

Cost

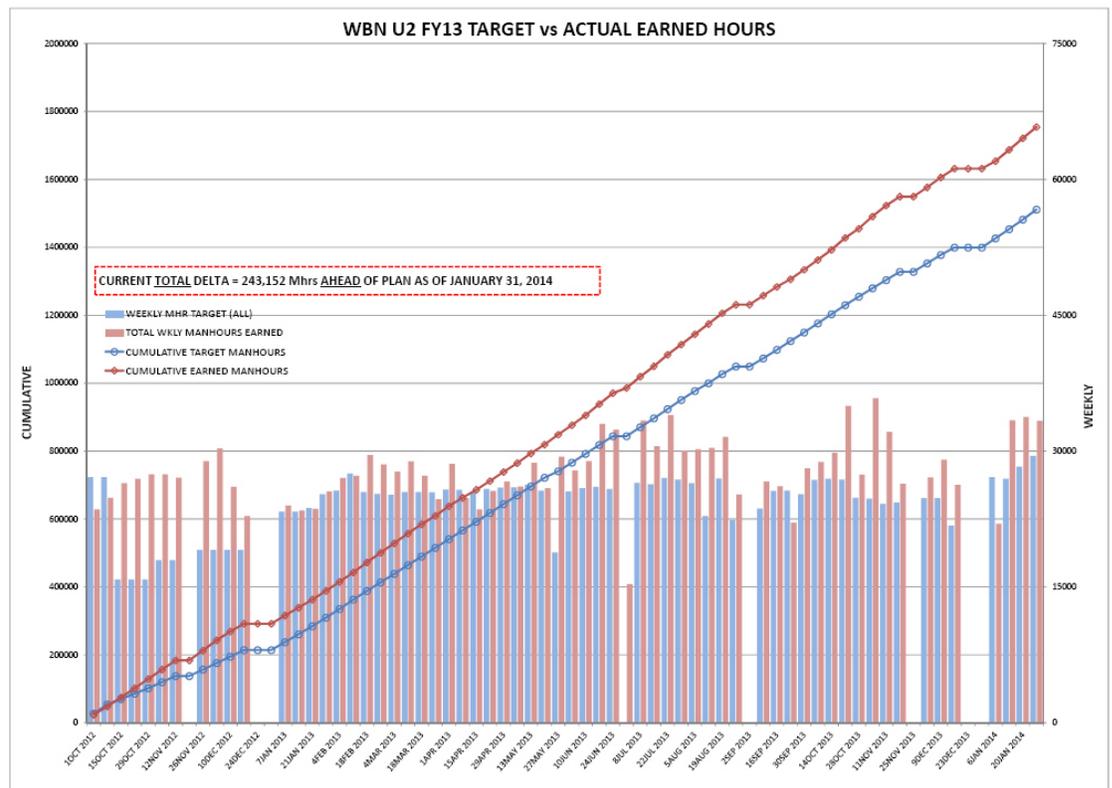
During the quarter, the project continued to trend to a completion cost between \$3.96 to \$4.23 billion, which is on target and within the range included in the ETC. This is consistent with meeting the most likely commercial operation date of December 2015.

With the organization preparing to transition from construction to operations, a staffing plan is being developed to methodically reduce the project workforce. This is part of the project plan and is needed to ensure budget and schedule adherence.

Schedule

During the quarter, the WBN2 team was focused primarily on system completion and the release to testing of systems needed to support the early target for OVT.

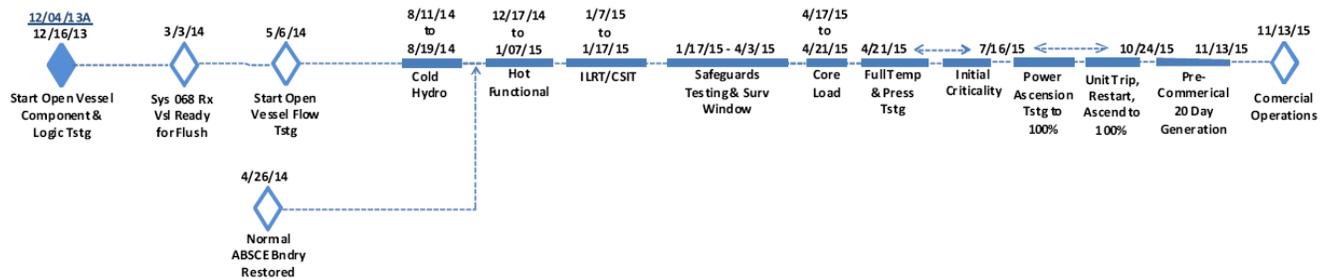
Overall, the project continued to earn more hours than targeted. This is shown on the chart to the right which compares actual earned hours per week to the number of hours targeted to be earned.



Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, November 2013 - January 2014

The major milestones for project completion are shown below. Based on current and targeted schedule performance, the project continues to track earlier than the most likely fuel load date of June 2015 and commercial operation in December 2015.

Major Project Milestones



Commodity Quantity Analysis

The project team reviews the quantity of material commodities installed each quarter as a way to monitor progress of project completion.

The project made significant progress installing material commodities this quarter, particularly in the area of large bore hanger modifications and electrical cable.

There were additional quantities added this quarter primarily generated from two sources: (1) a thorough review of scope requirements and material installation status for OVT-related systems, and (2) the finalization of Fukushima-related scope.

Overall, the progress of commodities installed met expectations this quarter. As construction progress nears completion and the remaining systems are released for pre-operational testing in the next few quarters, commodity quantity tracking will no longer be necessary.

Commodity Quantity Analysis

DATA as of 1/26/2014

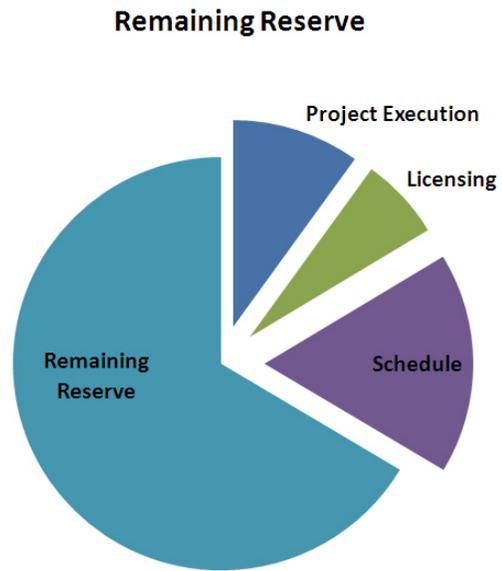
Commodity Description	UOM	Board Approved To-Go (as of 10/2/11)	To-Go (as of 1/26/2014)	% Complete
Misc Steel	LB	109,855	22,194	80%
LB Pipe Weld	EA	322	207	36%
LB Hanger	EA	152	38	75%
LB Hanger Remove	EA	229	27	88%
LB Hanger Modify	EA	506	163	68%
SB Pipe	LF	2,044	547	73%
SB Weld	EA	2,959	487	84%
SB Hanger	EA	232	66	72%
SB Hanger Remove	EA	104	7	93%
SB Hanger Modify	EA	375	72	81%
LB Valve	EA	75	34	55%
SB Valve	EA	470	98	79%
Conduit	LF	43,991	12,503	72%
Conduit Support	EA	7,386	2,415	67%
Cable	LF	311,255	141,760	54%
Cable Terms	EA	33,386	19,244	42%
Instruments Mechanical	EA	1,941	817	58%
Tubing	LF	22,933	15,476	33%
Tubing Inspect / Dimension / Rework	LF	20,556	3,134	85%
Instr SB Pipe	LF	10,965	3,539	68%
Instr SB Pipe Weld	EA	4,442	1,409	68%
Tubing Support	EA	3,965	1,857	53%
Instr SB Pipe Support	EA	2,589	696	73%
Duct Mods	EA	206	9	96%

LB = Large Bore, SB = Small Bore, EA = each, LF = linear foot

Section 4 - Reserve Management

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

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



Section 5 - Known Risks

In order to ensure a realistic perspective of risk, the project has emphasized risk identification and analysis during the critical transition to system testing. As a result, no new significant risks were identified during the quarter that might compromise project completion.

Based on progress with dual-unit operational readiness, that area, while still a challenge to the site, is no longer considered a significant risk.

A summary of notable risks is shown in the table to the right. Additional information on the risks follows.

<u>Risk</u>	<u>Risk Trend</u>
Regulatory Risks for Obtaining Operating License	Stable
Fukushima	Decreasing
Cyber-security	Stable
Waste Confidence	Stable

Regulatory Risk for Obtaining the Operating License

Since delays in regulatory reviews, inspections, and resolutions might delay the receipt of the operating license for WBN2, attention is being given to the early resolution of the portions of these issues within the control of the project. Below are the major regulatory risk areas receiving this level of attention.

Construction Completion to Support NRC Inspection Schedule

A critical area requiring focused attention is resolving Inspection, Planning, and Scheduling (IPS) items with the Nuclear Regulatory Commission (NRC). The IPS items must be resolved before fuel may be loaded in WBN2. The project is developing a concentrated approach to prioritize and streamline IPS item closure activities in support of the fuel load milestone.

Cyber-security Requirement Implementation

The NRC has developed new requirements for cyber-security. These requirements help protect the important information technology assets from damage from malevolent entities. The

Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, November 2013 - January 2014

requirements for cyber-security at WBN2 are in the final stages of planning and are being implemented.

Fukushima

The NRC continues its work to fully develop a final regulatory framework for the nuclear industry's response to the March 2011 events at the Fukushima nuclear station in Japan. The project has established a path forward that meets NRC requirements to date, resulting in a lower risk. (Refer to Section 6 for specific information on the progress of completion.)

Waste Confidence

The NRC is in the process of revising its "Waste Confidence Rule," which is a generic determination that spent nuclear fuel can be safely managed on site after a plant is shut down and until a permanent repository is established. The revised Waste Confidence Rule is scheduled to be issued and approved by October 2014. A significant challenge related to the Waste Confidence Rule is a set of contentions raised by external stakeholders. These contentions will not be addressed until the final rule is published. If the contentions are not quickly resolved by the NRC at the time the Waste Confidence Rule is "effective," then delays will be experienced in the issuance of the operating license for WBN2. The WBN2 team has addressed their concerns with NRC senior management and the NRC commissioners. The WBN2 team, supplemented by outside resources, is developing contingency options to address the potential delay. Since the regulatory entities are not under the control of the project team, a project delay remains a strong risk.

Section 6 - Improvements, Specific Issues, and Challenges

Construction Completion

As the construction phase of the project draws to a close, instrumentation work scope becomes a significant portion of the remaining installation work. As such, productivity improvement in this part of the organization is an important management focus area. Action plans to improve schedule performance are having positive results.

In addition, metrics are in place to monitor effectiveness and productivity each day and to drive schedule performance improvement at the crew level. Monthly reviews are being conducted to ensure improvements remain effective.

Emergent Work and Verification of Released Systems

Levels of emergent work are still higher than desired. Beginning early this quarter, considerable additional resource allocations were required to address work from the sequence of systems that would prepare the Reactor Coolant System for OVT. Upon analysis only a small percentage represented new scope. Of the 1,800 new work orders written during this quarter, the majority are being initiated to implement known scope that required additional planning for smooth completion.

Incomplete work and incomplete documentation were discovered on 40 previously released systems – more than 40,000 additional work-hours were needed for closure. This delayed both the testing and release of the systems to the Operations staff.

Watts Bar Unit 2 Completion Project

Quarterly Update to the Estimate to Complete, November 2013 - January 2014

In response, the project developed a new system release process to avoid emergent work in the future. Dedicated teams have been formed to complete the additional detailed planning. The project is closely monitoring the release process for the next key systems required for the cold hydrostatic and the hot functional test milestones and is ready to promptly apply further improvements as needed.

Documenting Completion of Work

The quantity and complexity of the required documentation represents a productivity challenge. The accuracy and completeness of these QA records are essential to documenting the as-built details of plant systems, components, and structures that will meet the stringent regulatory requirements in order to obtain the operating license. A thorough review to ensure accuracy and completeness of these records is a time-consuming effort.

The project has made many positive changes aimed at ensuring both quality and ease of completion of the required documentation. The new system release process serves a key function by unbundling complex or multi-system design packages into smaller, system-specific scopes that simplify the verification of the documentation. Other key changes include performing earlier quality checks of documentation during the work; inspecting for specific, critical attributes of the documentation after the work is completed; and closer monitoring of the quality of the documentation to determine if additional improvements may be necessary. Recent assessments show that improvements are being made.

Testing Systems Shared between WBN1 and WBN2

The upcoming refueling outage this spring for WBN1 represents the last practical opportunity to conduct crucial testing of shared systems that must be performed while the operating unit is shut down. Watts Bar 2 personnel performed reviews of required scope to ensure work requiring a dual-unit shutdown was identified.

Dual-unit Operational Readiness

The ability to transition the Watts Bar site to dual-unit operations is a vital goal for TVA. The upcoming transition has received a significant amount of management attention and previously resulted in the early formation of a Dual-unit Operational Readiness Team. This team has the structure, staff, processes, and procedures to facilitate integration of activities that promote safe and reliable dual-unit operations.

Efforts continue to develop power ascension testing procedures. The efforts are on track, with completion targeted for next year, ahead of unit licensing. Processes for system, area, and program transfers have been approved, and pilot turnovers of systems and areas have been completed. Progress on deliverables – processes, procedures, and programs – to support dual-unit operations is expected to meet the project milestones, with performance metrics continuing to receive attention by the leadership team.

During the quarter, additional reviews and analyses from both internal TVA and industry experts were conducted. Site departments also undertook a second round of self-assessments, which reviewed progress towards operational readiness. Improvement opportunities from those assessments are being entered into the Corrective Action Program for timely resolution.

Watts Bar Unit 2 Completion Project Quarterly Update to the Estimate to Complete, November 2013 - January 2014

An independent team comprised of TVA corporate individuals, industry, and fleet peers completed an assessment of overall operational readiness. The assessment team noted a comprehensive plan exists for the transition to dual-unit operations, but highlighted the need for more engagement across the site in certain transitional areas. These improvements are being implemented.

Fukushima Upgrades

As a result of the events at the Fukushima Daiichi Nuclear Plant in Japan during March 2011, the NRC now requires U.S. nuclear plants to upgrade their facilities to provide diverse and portable means of supplying cooling water and AC power during an extended period of loss of offsite power and loss of normal access to the ultimate heat sink. These additions also include diesel generators, diesel and electric pumps, readily accessible temporary connections, and a new fortified storage building for the equipment. As a result, WBN2 will be much more resilient to a broader range of unexpected environmental events.

The Watts Bar site has been designated as the pilot for the industry for these upgrades and has made significant progress in completing the required additions for both units. Specific accomplishments during the quarter include:

- Completed micro-piles, a base slab, and several exterior walls for the new Flexible Equipment Storage Building;
- Began excavation for the new auxiliary feedwater storage tank foundation;
- Began construction of new nitrogen stations.

Section 7 - Project Oversight

The Project Assurance group is independent of the WBN2 organization and is responsible for assessing various facets of project performance and reporting its findings to the Senior Vice President of Watts Bar Operations & Construction.

Observations made and provided to WBN2 management during the quarter included:

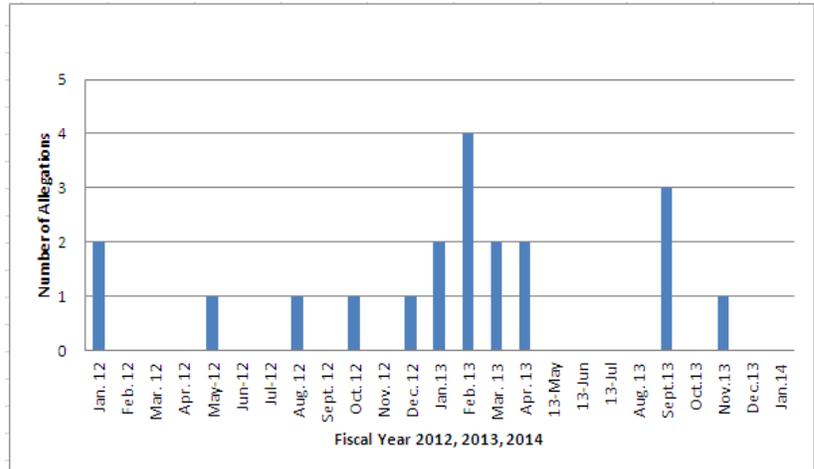
- The project continues to track toward the ETC most likely dates for fuel load of June 2015 and for commercial operation of December 2015;
- Improvement opportunities exist in tracking and trending of safety behaviors in startup testing/construction completion;
- Lessons learned from releasing systems required for OVT will be incorporated for future system turnovers;
- There are challenges with completing component tests in time to support the start of OVT;
- Early communication and prioritization of support will improve WBN1 resource allocation for WBN2 work. As the project progresses, WBN1 support of WBN2 testing will be crucial to the success of the project.

Section 8 - Project Organizational Health

Nuclear Safety Culture

The amount of concerns expressed by workers during this quarter was less than the previous reporting period. An associated decline in NRC allegations was also observed during this reporting period, with only one onsite allegation being received in November 2013 (see chart).

TVA's Employee Concerns Program continued to evaluate this decline to ensure personnel remain willing to utilize local processes for reporting concerns. No evidence or trends suggest personnel would not utilize local processes for



reporting concerns. The decline in the number of concerns is in part due to holiday periods and the project continuing to improve two-way communication opportunities.

Concerns related to management and personnel issues continue to be two-thirds of the types of concerns received. This is lower than the previous reporting period, but shows a continuing need for attention to worker-manager relationships and communications. Technical issues accounted for one-third of the concerns.

To reinforce behaviors to support nuclear safety culture and to emphasize the need for open and constructive communications, additional actions have been implemented that include the following:

- Conducting face-to-face and small group project briefings with all employees;
- Conducting craft focus group meetings;
- Conducted Nuclear Safety Culture Traits versus Attributes Gap Assessment.

Project Completion Incentive Program

Approximately 3,000 workers have met the 1,000 work-hours requirement to be eligible for the WBN2 Project Completion Incentive Program. These individuals have been assigned and dedicated to the project, and provided they remain with the project until their work is completed, could receive an incentive payout proportional to the hours they have worked. For any incentive payout to be made to eligible program participants, commercial operation must be certified by TVA by December 31, 2015, and the project must be completed at or below \$4.4 billion.

The incentive program was implemented in October 2012 to help ensure safety and achieve the construction timeline and budget of the ETC. The program is designed to help retain skilled workers and encourage them to complete their work as planned. The incentive program will be funded by savings realized by the project if it is completed in a safe, quality, cost-effective, and timely manner.

Section 9 - Going Forward

Work to complete plant systems and release them for testing will continue during the next quarter. Testing will continue on the subsystems, structures, and components that make up the operational and safety systems required for OVT. These component and logic tests are to validate that the equipment works properly and can be controlled and monitored from the plant control room as designed. These are important steps in the pre-operational startup tests that will verify the full systems meet regulatory requirements before their control is turned over to the site's operations staff.

Conditions in the field will be constantly changing as systems are released for pre-operational testing and as tests are set up and conducted. Equipment will be energized, pressurized, and manipulated to meet test conditions, requiring a continued focus on working safely. Multiple methods will be used to emphasize to workers the need to look out for each other, stay aware of changing plant conditions and work plans, and stop when something unexpected is encountered.

In addition to moving toward OVT, the project is focused on preparation for cold hydrostatic testing and hot functional testing, two major milestones to commercial operation, as well as the development of a project demobilization plan. The plan will help make sure that as the project is completed, construction support structures and materials are removed and permanent structures and site grounds are restored. As part of the demobilization efforts, a staffing plan will be implemented to ensure effective project completion and that outplacement services are made available to help those leaving the project navigate the transition process.