



Sequoyah and Watts Bar Nuclear Plants

***NTTF Recommendation 2.1, Flooding
Hazard Reevaluation Report Extension Request***

April 29, 2013



TVA *Agenda*

Introduction	Joe Shea, VP Nuclear Licensing
Tennessee River Operations Overview	Kevin Casey, Sr. Program Manager Fukushima Response Project, Licensing
SQN and WBN Hazard Reevaluation Report Task Schedule Update	Kevin Casey
TVA Dam Stability Analysis <ul style="list-style-type: none">- TVA Dam Screen Process- PMF and Seismic Stability Analysis- Seismic and Combined Events Evaluation Methodology- Multiple Dam Failure Event Evaluation Methodology- Critical Path for SQN & WBN HRR Submittal	Kevin Casey
TVA Review of Draft Dam Failure Interim Staff Guidance (ISG)	Kevin Casey
Current Flood Protection	Joe Shea
Impact to Browns Ferry Nuclear Plant	Joe Shea
Impact to Watts Bar Nuclear Plant, Unit 2	Joe Shea
Closing Remarks	Joe Shea

◆ **Schedule Update**

- Improve to March 2015

◆ **Review of Draft Interim Staff Guidance**

- Stability of Guidance



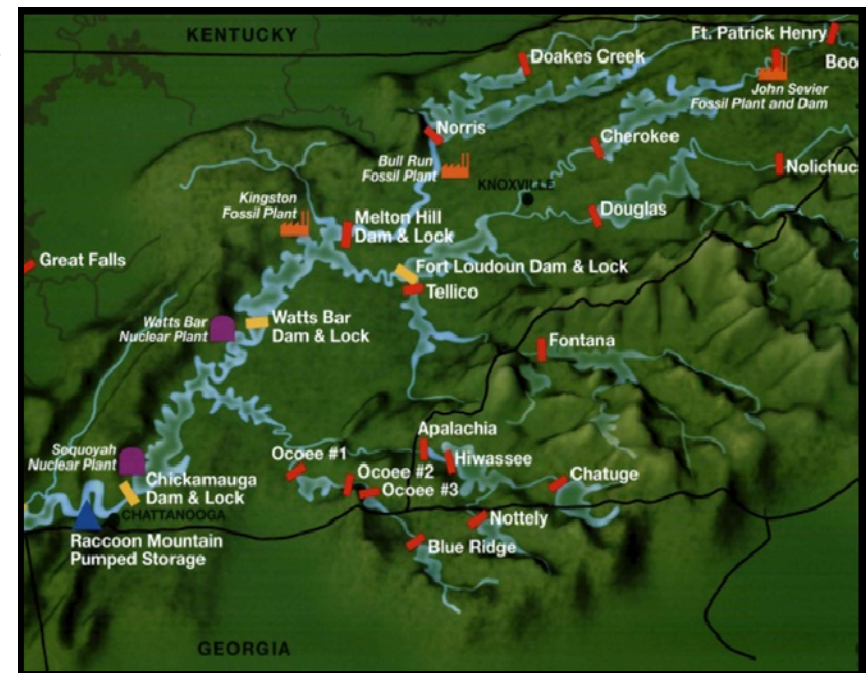
TVA River Operations and Dams

Kevin Casey, Sr. Program Manager Fukushima Response Project, Licensing

TVA River Operations **TVA Managing the Rivers of the Tennessee Valley**

TVA is unique in its responsibility and ability to manage the Tennessee River and its major tributaries through a system of 49 major dam projects

- ◆ The Tennessee watershed is complex, draining over 40,000 square miles
- ◆ River Operations provides operational control of the reservoirs in the Tennessee River System in an integrated fashion, including:
 - Flood Control
 - Navigation
 - Hydropower
 - Water Quality
 - Water Supply
 - Recreation
- ◆ TVA has been a leader in river forecasting for several decades
 - The Tennessee River is a well-researched and understood river system
 - Many river modeling systems in place today had origins based in part on consultation with TVA experts



TVA River Operations
Potentially Critical TVA Dams



APPALACHIA



BLUE RIDGE



BOONE



CHATUGE



CHEROKEE



CHICKAMAUGA



DOUGLAS



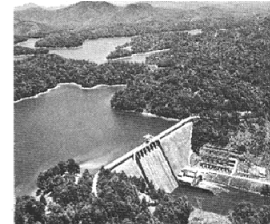
FONTANA



FORT LOUDOUN



FORT PATRICK
HENRY



HIWASSEE



MELTON HILL



NORRIS



NOTTELY



SOUTH HOLSTON



TELLICO



WATAUGA



WATTS BAR



SQN and WBN HRR Status

Kevin Casey, Sr. Program Manager Fukushima Response Project, Licensing

SQN and WBN HRR Status
TVA Main Task Status Update – March 2015

	Task	Start	Finish	Status
	Main River Modeling Code Migration			
1a	(SOCH to HEC-RAS)	May 2012	Nov 2012	Complete
1b	Tributary River Modeling Code Migration (SOCH to HEC-RAS)	March 2013	Nov 2013	In-progress
2	Confirm critical storm PMP selection	Dec 2012	Jan 2013	Complete
3	Perform local intense precipitation analysis for SQN/WBN	Sept 2012	May 2013	In-progress
4a	Sunny Day Dam Failure – WBH – east embankment failure	Jan 2013	Feb 2013	Complete
4b	Sunny Day Dam Failure - Tributary Dams	March 2013	Nov 2014	In progress
5	Perform PMF simulations - 2 storms - all dams stable	Feb 2013	March 2013	In progress
6	Evaluate Stability of 18 dams under PMF conditions	Sept 2012	March 2014	In-progress
7	Perform PMF simulations using results of stability analysis	April 2014	Dec 2014	Not Started
8	Develop dam specific seismic hazards	Feb 2013	April 2013	In-progress
9	Evaluate seismic stability of 18 dams	Sept 2012	March 2014	In-progress
10	Perform simulations using results of seismic stability analysis	April 2014	Dec 2014	Not Started
11	Perform simulations to quantify uncertainties	June 2014	Dec 2014	Not Started
12	Prepare HRRs with results and interim actions, as required	Jan 2015	March 2015	Not Started



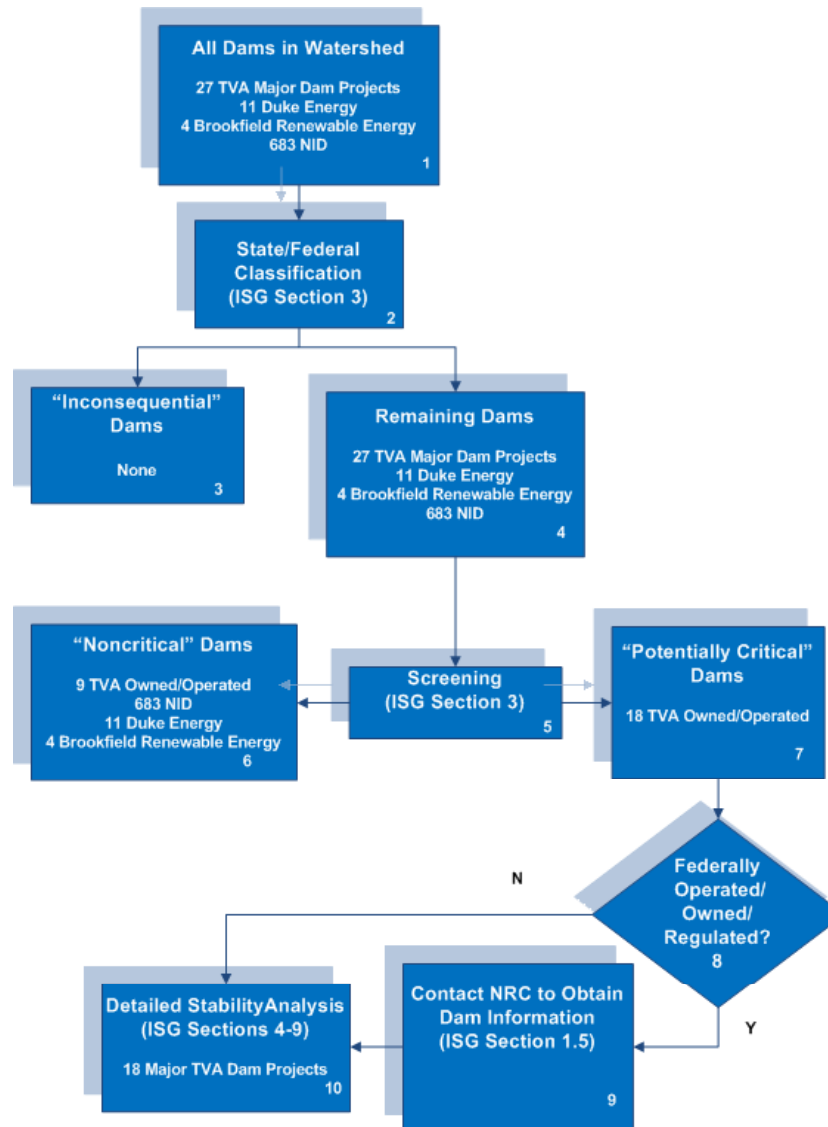
TVA Dam Stability Analysis

Kevin Casey, Sr. Program Manager Fukushima Response Project, Licensing



TVA Dam Stability Analysis

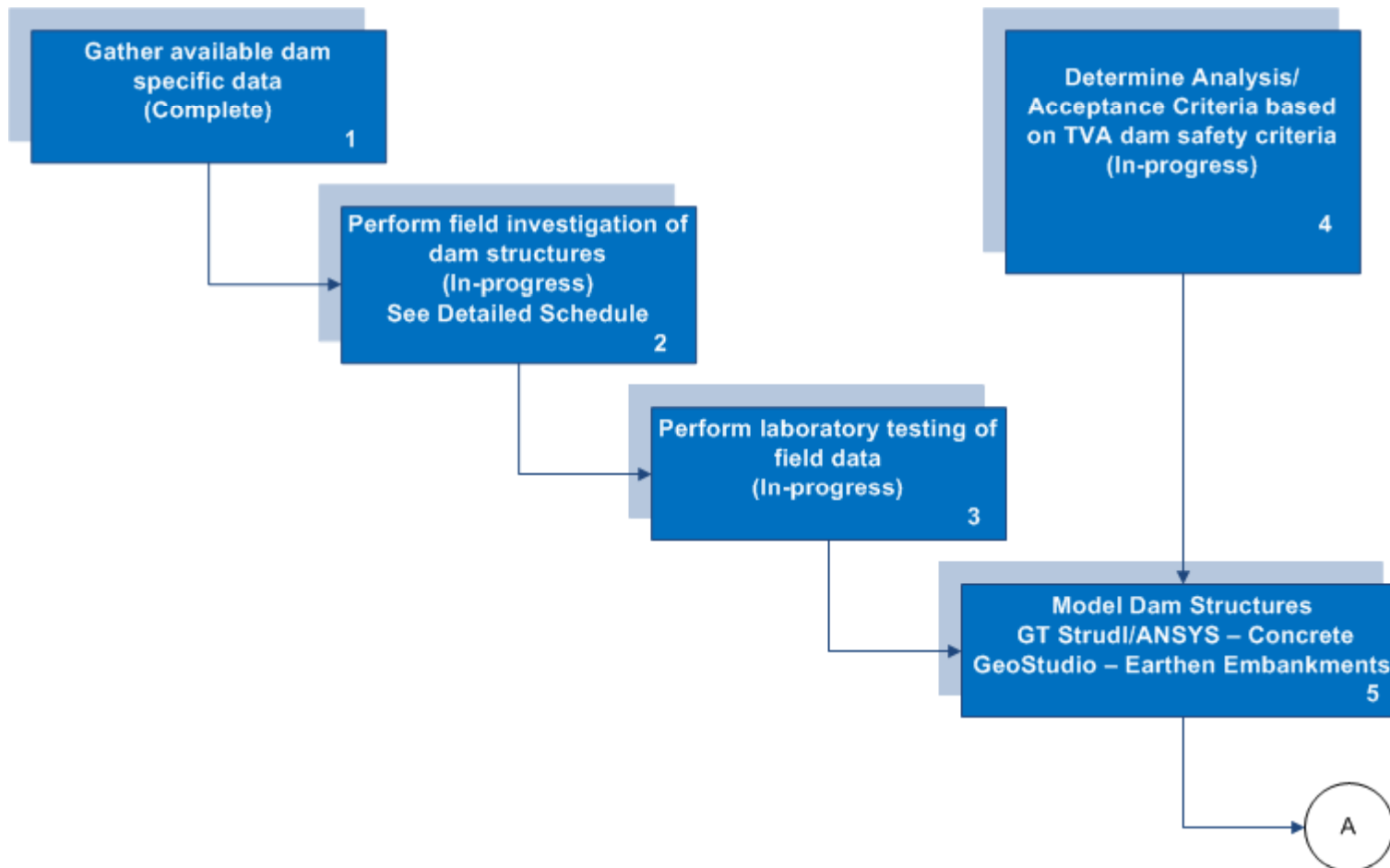
TVA Dam Screening Process Flowchart



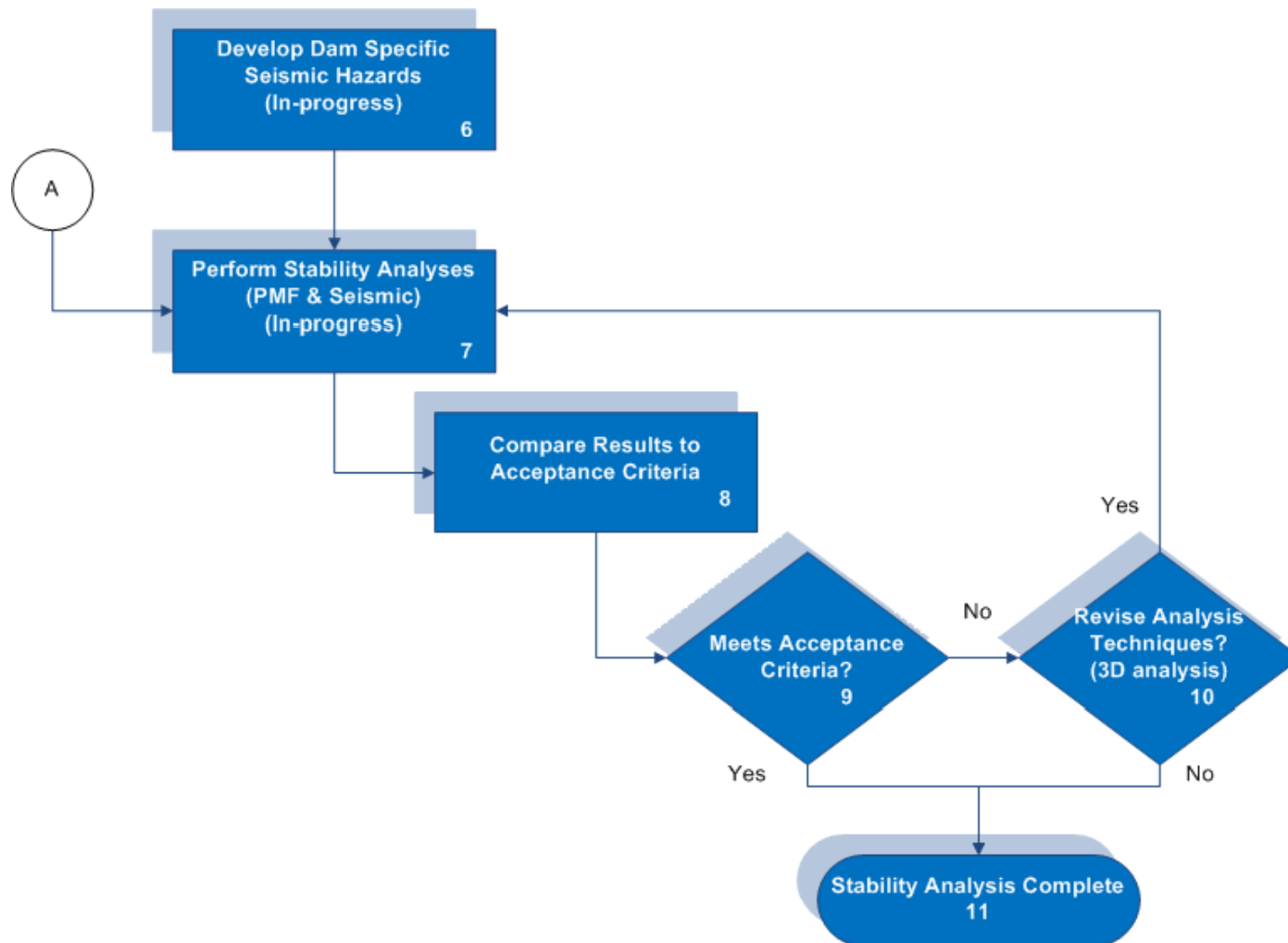
TVA River Operations
TVA Potentially Critical TVA Dams with Structures ID'd

	Dam Projects	Types of Dam Features					# of Hydro Units
		Embankments	Concrete	Spillways	Intake Gates	Other Features	
1	Apalachia	0	1	10	1	Penstock, Lined & Unlined Tunnel, Surge Channel	2
2	Blue Ridge	1	0	8	2	Un-gated spillway	1
3	Boone	1	1	5	6	Sluiceway	3
4	Chatuge	4	0	50	2	Penstock	1
5	Cherokee	4	1	9	4	8 - Sluices	4
6	Chickamauga	2	1	18	6	1 - Lock	4
7	Douglas	11	1	11	4	8 - Sluices	4
8	Fontana	0	1	4	3	6 – Sluices, Emergency Spillway	3
9	Fort Loudoun	2	1	14	6	1 - Lock	4
10	Fort Patrick Henry	0	1	5	4	None	2
11	Hiwassee	0	1	7	2	2 – Penstock, 4 – Lined Sluices	2
12	Melton Hill	0	1	3	3	1 - Lock	2
13	Norris	1	1	3	2	2 – Penstock, 8 - Sluices	2
14	Nottely	2	0	50	2	Steel Lined Tunnel	1
15	South Holston	2	0	1	1	Power Tunnel, Sluiceway, Lined Tunnel, Emergency Spillway	1
16	Tellico	4	1	3	0	Emergency Spillway	0
17	Watauga	1	0	1	1	Power Tunnel, Sluiceway, Lined Tunnel	2
18	Watts Bar	3	1	20	6	1 - Lock	5
	TOTAL	38	13	222	52	58	43

TVA TVA Dam Stability Analysis **PMF and Seismic Stability Analysis Flowchart**



TVA *TVA Dam Stability Analysis*
PMF and Seismic Stability Analysis Flowchart (cont'd)



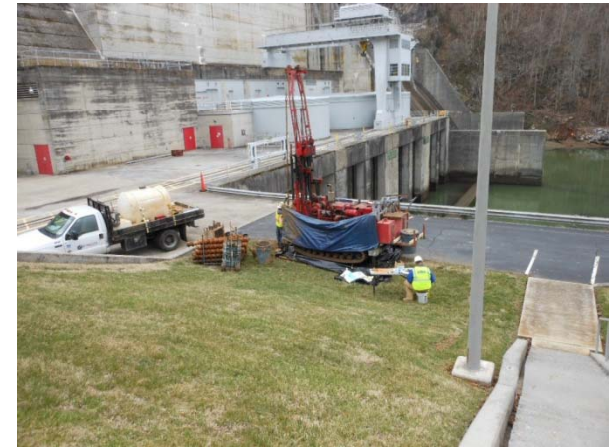
TVA *TVA Dam Stability Analysis* **Detailed Field Investigation Status Flow Diagram**

	Dam Projects	Dam Structure Borings (Complete/Total)		Status
		Embankments	Concrete	
1	Apalachia	2/10	0/0	In-progress
2	Blue Ridge	0/0	0/0	Complete
3	Boone	15/15	0/0	Complete
4	Chatuge	51/51	0/0	Complete
5	Cherokee	42/42	0/0	Complete
6	Chickamauga	33/58	0/0	In-progress
7	Douglas	68/79	4/4	In-progress
8	Fontana	5/6	0/0	In-progress
9	Fort Loudon	48/58	13/13	In-progress



TVA *TVA Dam Stability Analysis* **Detailed Field Investigation Status Flow Diagram**

	Dam Projects	Dam Structure Borings (Complete/Total)		Status
		Embankments	Concrete	
	Fort Patrick Henry	3/6	0/0	In-progress
	11 Hiwassee	0/4	4/26	In-progress
	12 Melton Hill	0/9	0/0	Not Started
	13 Norris	7/17	0/0	In-progress
	14 Nottely	26/49	0/0	In-progress
	15 South Holston	40/40	0/0	Complete
	16 Tellico	32/37	4/4	In-progress
	17 Watauga	3/24	0/0	In-progress
	18 Watts Bar	35/45	2/10	In-progress



TVA Dam Stability Analysis ***Seismic and Combined Events Evaluation Methodology***

TVA assumed the following in development of the SQN and WBN HRR proposed schedule:

- ◆ Develop probabilistic seismic hazard analysis (PSHA) 1×10^{-3} , 10^{-4} , 10^{-5} uniform hazard response spectra for each potentially critical dam including deaggregation plots for use in multiple dam failure evaluations due to a single seismic event
 - 2012 EPRI CEUS source model
 - 2004/2006 EPRI attenuation model
 - Site amplification using dam specific geologic profiles
- ◆ Perform combined events (seismic + flood) stability evaluations of dams
 - 1×10^{-4} uniform hazard response spectra and 25 year flood inflows
 - $\frac{1}{2}$ of 1×10^{-4} uniform hazard response spectra and 500 year flood inflows
 - Based on draft NEI white paper and several previous public meeting discussions

TVA Dam Stability Analysis

TVA Multiple Dam Failure Event Evaluation Methodology

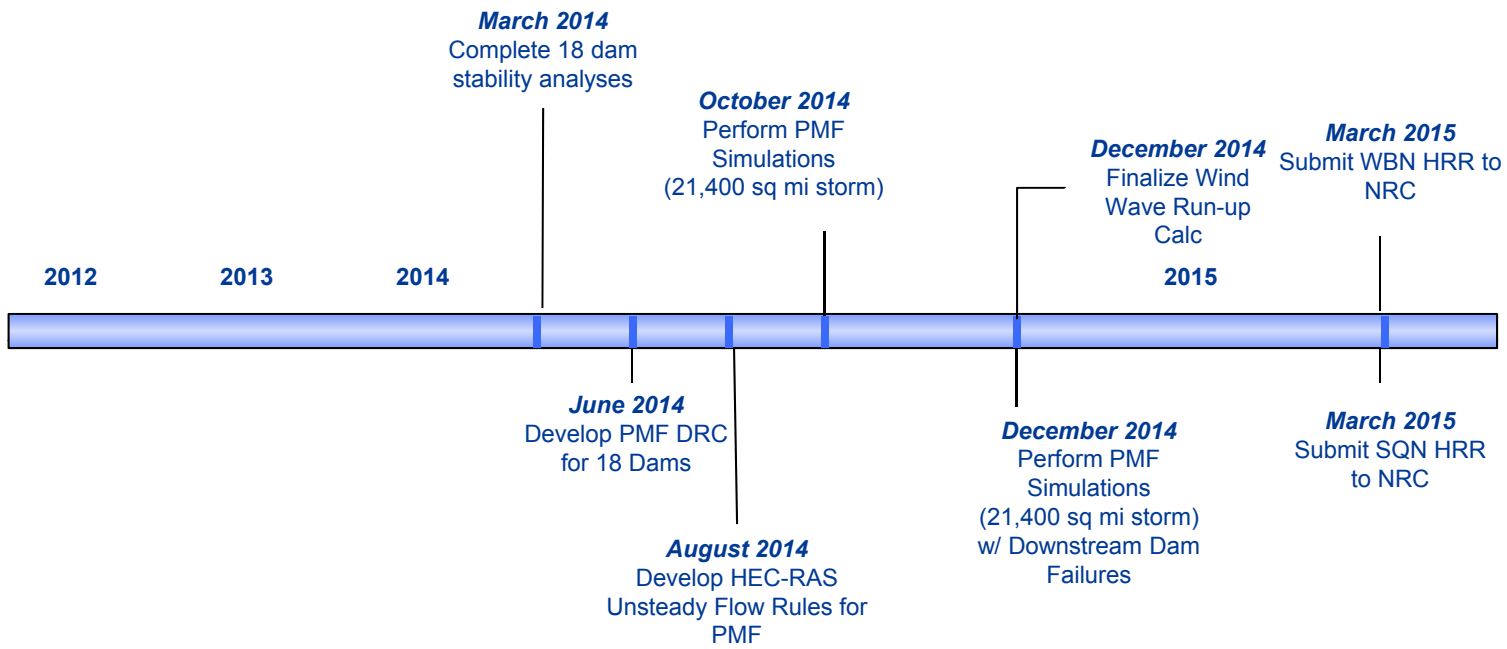
TVA is developing evaluation methodologies to address multiple dam failure evaluations due to a single seismic event and will consider the draft ISG

- ◆ Utilizing outside resources through Jack R. Benjamin & Associates, Inc
- ◆ TVA will present details of its multiple dam failure methodology to the NRC on or before June 30, 2013 as stated in the SQN and WBN HRR extension request letter



TVA Dam Stability Analysis

Critical Path Tasks for SQN & WBN HRR Submittal





TVA Review of Draft ISG

Kevin Casey, Sr. Program Manager Fukushima Response Project, Licensing



TVA Review of Draft ISG

TVA has begun a thorough review of the draft ISG and has identified the following areas as impacting current analysis assumptions:

- ◆ Use of USBR risk based analysis methods vs TVA dam stability deterministic methods
- ◆ Requirement for 10^{-6} annual exceedance probability of combined events (seismic + flood)
- ◆ Detailed seismic analysis of spillways, gates, outlet works, and other appurtenances
- ◆ Consideration for potential impact from barges on navigable waterways
- ◆ At least one turbine should always be assumed to be down (e.g. for maintenance or other reasons) in performing flood routings.

TVA will continue to review the guidance and TVA will submit formal comments on the draft ISG as requested in the Federal Register Notice.



TVA- Current Flood Protection

Joe Shea, VP Nuclear Licensing

TVA –Current Flood Protection

TVA Hydrology Actions Taken by TVA

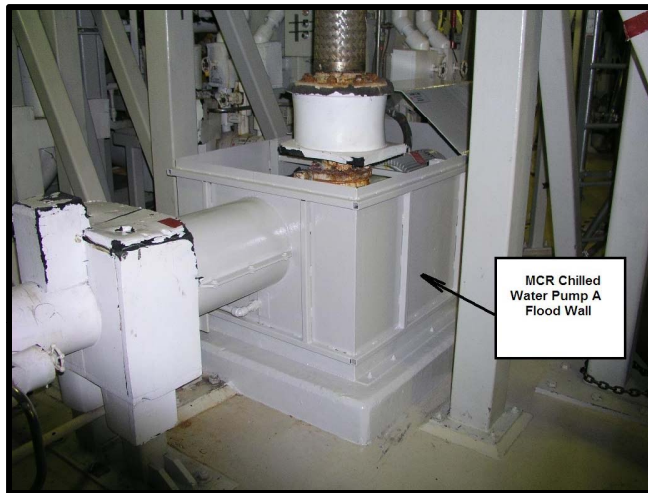
TVA has taken several actions to mitigate flood risk:

- ◆ Comprehensive review and updating of TVA Hydrology modeling and calculations (Complete)
- ◆ Fukushima Response
 - Conducted walkdowns to review impacted systems, structures and components and identify physical margins
- ◆ Ran simulation to show feasibility of closing HESCO barrier openings (Complete)
- ◆ Perform monthly inspections of HESCO flood barriers until permanent modification complete (Continuous)
- ◆ Flood Mode preparation procedure improvements including reasonable simulation by December 31, 2013 (Scheduled)
- ◆ Modifications to address flood mode operations
 - Diesel Generator barriers (SQN) (Complete)
 - Essential Raw Cooling Water (ERCW) barrier (SQN) (Complete)
 - Flood Mode Spool Piece Reduction (SQN and WBN) (In Design)
 - Intake Pumping Station (IPS) barrier (WBN) (In Design)
 - Thermal Barrier Booster Pump (TBBP) barrier (WBN) (Complete)
 - Main Control Room / Shutdown Board Room chiller barriers (WBN) (Complete)
 - Spent Fuel Pool Pumps and Skimmer pumps barrier (WBN) (Complete)



TVA has committed to complete permanent modifications to replace HESCO barriers at four dams upstream of SQN and WBN by October 2015

TVA *TVA –Current Flood Protection* **Hydrology Actions Taken by TVA (Cont'd)**

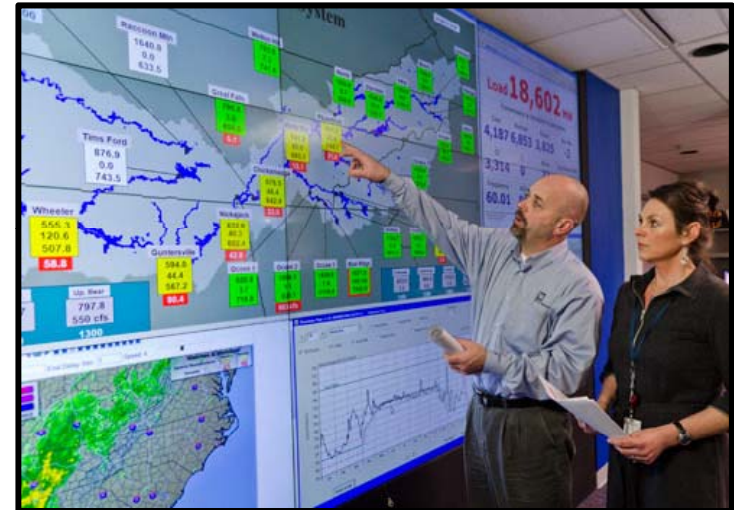


TVA –Current Flood Protection

TVA Coordination between NPG and River Operations

River Operations' ability to control river flows, reservoir storage levels, river temperatures and levels presents TVA with unique advantages to enhance and protect nuclear plant operations, including:

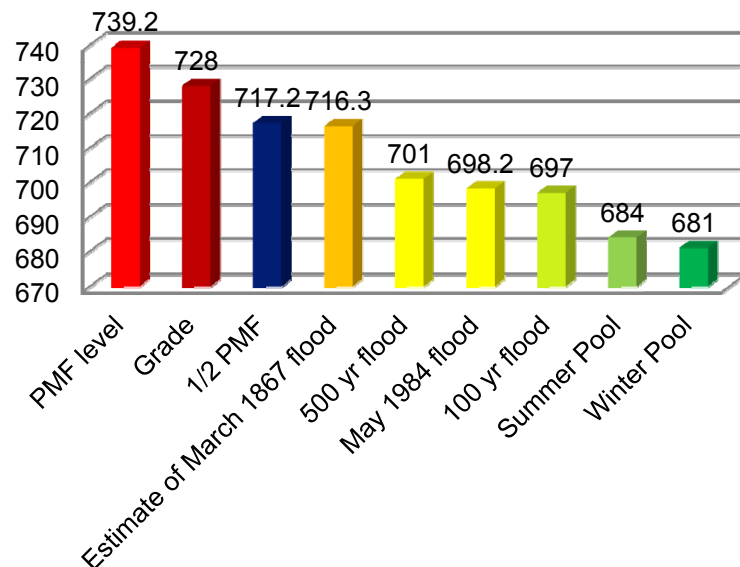
- One vision and mission
 - Owns river system operations and nuclear plants
 - Dam release coordination
 - Shared Responsibility for Nuclear and Dam Safety
-
- ◆ The River Forecast Center (RFC) staff utilizes forecasts of significant precipitation events, allowing for implementation of actions that can be taken to mitigate hydrothermal and flood challenges
 - ◆ The RFC operates 24 hours a day, 365 days a year
 - Monitors 200+ rain gauges , 60+ stream flow gauges, reservoir headwater, tailwater and discharge at 49 dams
 - Reviews and revises river discharge schedule 2-4 times a day, and provides flood warning notification based on pre-determined conditions
 - Utilizes procedures that require NPG review of any changes and assumptions used to model river conditions to determine impact to site licensing basis (e.g., Intergroup Agreement: Nuclear Operations and River Operations; Coordination of Hydrology Issues)
 - NPG and RO&R procedures require early communication with sites to identify any potential flooding conditions based on predicted precipitation volumes not measured volumes



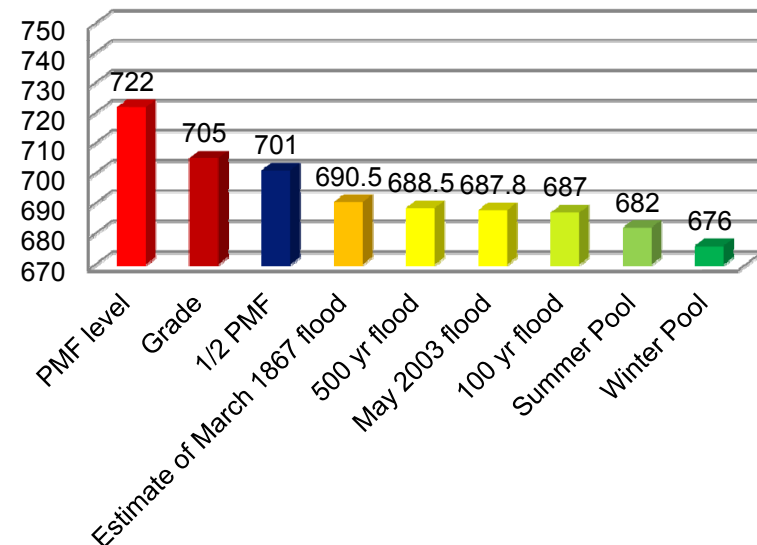
TVA –Current Flood Protection
TVA History of Recorded Floods

The TN valley has not experienced a flood in recorded history which has exceeded plant grade at either SQN and WBN.

WBN Flooding Elevations vs Site Grade



SQN Flooding Elevations vs Site Grade



It is TVA's position that the likelihood of such an event occurring within the extension request timeframe is very low.



TVA- Impact to Browns Ferry Nuclear Plant

Joe Shea, VP Nuclear Licensing

TVA *Impact to Browns Ferry Nuclear Plant*

- ◆ BFN identified as “Priority 2” site, hazard reevaluation report due March 2014
- ◆ In addition to the 18 dams impacting SQN and WBN, 4 additional dams required to be analyzed for BFN



NICKAJACK



GUNTERSVILLE



TIMS FORD



WHEELER

- ◆ BFN HRR cannot be completed prior to completion of SQN/WBN HRR analysis work
- ◆ BFN Recommendation 2.1 Project has started



TVA- Impacts to Watts Bar Nuclear Plant, Unit 2

Joe Shea, VP Nuclear Licensing

TVA *Impact to Watts Bar Nuclear Plant, Unit 2*

Watts Bar Unit 2 Licensing Basis

- ◆ SECY-07-0096 established the considerations for WBN Units 1 and 2 having the same licensing basis
- ◆ The WBN Unit 1 licensing basis, as modified by the License Amendment Request currently under review by the Staff is appropriate for Unit 2
- ◆ Fukushima Orders for FLEX and Spent Fuel Pool Instrumentation will be implemented
- ◆ WBN 2 will follow the WBN Unit 1 lead in the Flood Hazard Reevaluation and Actions
- ◆ WBN 2 will propose a license condition to track the Flood Hazard Reevaluation commitments
- ◆ WBN2 will implement the Improved Flood Mitigation Capabilities discussed in TVA's April 16, 2013, letter to NRC

TVA considers the current licensing approach to external flood hazards as described in the WBN Unit 2 FSAR as supplemented by the improvements described in TVA's letter dated June 13, 2012, as providing sufficient basis for supporting a finding that the licensing basis will provide adequate protection against design basis external floods.



Closing Remarks

Joe Shea, Vice President, Nuclear Licensing
