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Sent: Friday, April 25, 2008 7:20 AM
To: Joseph Sebrosky; Sterdis, Andrea Lynn
Subject: Fw:
Attachments: 20080425 TVA BLN Hydrology Update-Final.pdf

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From: Ray, Phillip M
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Sent: Fri Apr 25 06:39:13 2008
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Mail Envelope Properties (28921B76CDD05940A918AEEC9EBCA7C0078D7FB4)

Subject: Fw:
Sent Date: 4/25/2008 7:20:17 AM
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From: Ray, Phillip M

Created By: pmray@tva.gov

Recipients:
"Joseph Sebrosky" <Joseph.Sebrosky@nrc.gov>
Tracking Status: None
"Sterdis, Andrea Lynn" <alsterdis@tva.gov>
Tracking Status: None

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NuStart Energy sm

TVA Bellefonte Nuclear Plant

Bellefonte Design Basis Flood Whitepaper Overview / Project Status

April 25, 2008

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Agenda

0800	Introductions, Opening Statements	NRC
0820	Presentation on Hydrology Whitepaper	TVA
1015	Break	
1030	Informal Discussion - Data Packages	TVA
1140	Public Comment Period	All
1200	Adjourn	

Introduction / Purpose of Presentation

- Highlight some key points of Whitepaper
- Communicate Progress to date
- Discuss TVA's confidence / basis for confidence
- Communicate actions going forward
- Communicate June Workshop deliverables

Purpose / Objective of the Whitepaper

- Communicate the modeling approach used by TVA to determine design basis flood levels
- Communicate methodologies, processes, computer codes used to develop the model
- Communicate methods TVA used to calibrate / verify current model

Purpose / Objective of the Whitepaper

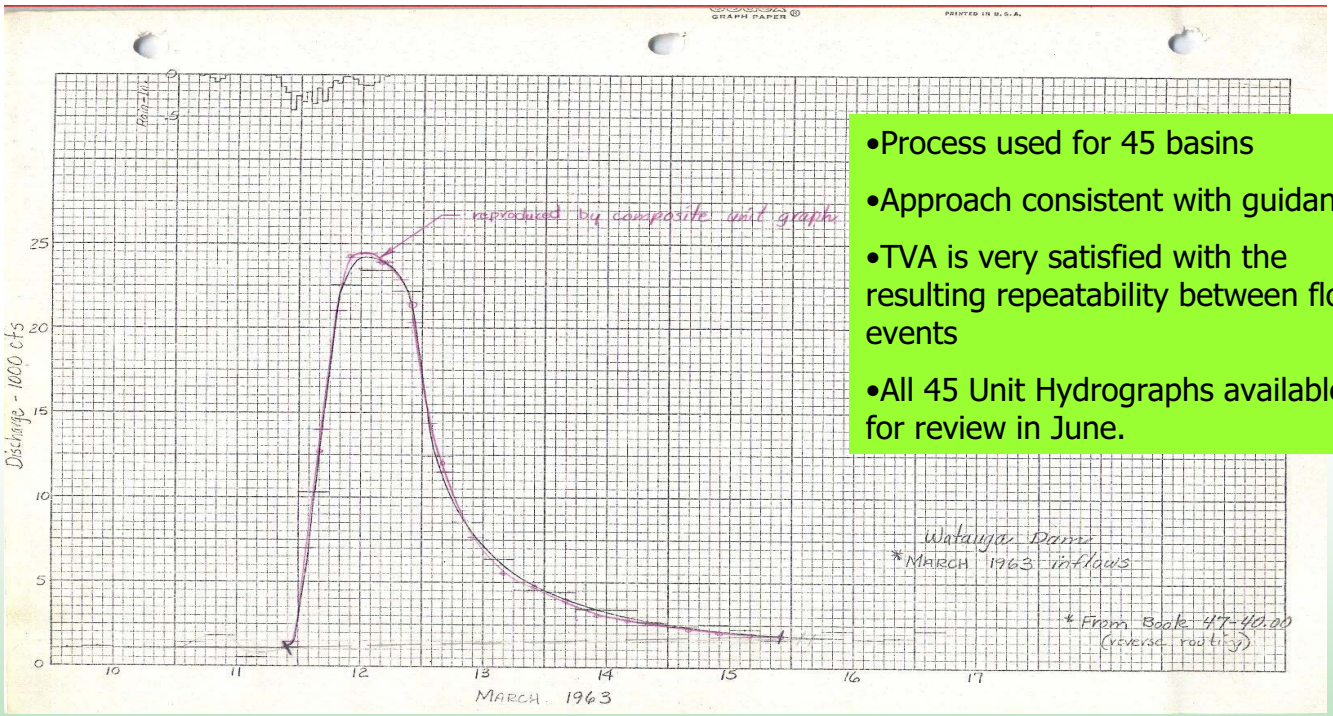
- Outline TVA's plan to update, validate, and document all the inputs and computer codes used to develop the model.
- Provide evidence of successful model calibration efforts to allow its use in predicting flood levels
- Solicit feedback from the NRC review staff regarding additional material or focus areas, to include in either a revision to the Whitepaper or within the June Workshop

Organization / Layout of the Whitepaper

- Background
  - Discuss Tennessee River Watershed and its complexity
  - Overview of flood storage capability
  - Overview of reservoir operating guidelines
- Development of Inputs
  - Unit hydrographs
  - Geometric data
  - Dam operating curves
  - Design storm rainfall distribution
- Development of individual computer codes
- TVA's plan and activities being undertaken to update, verify, and document all data and codes.

Whitepaper – Key Points

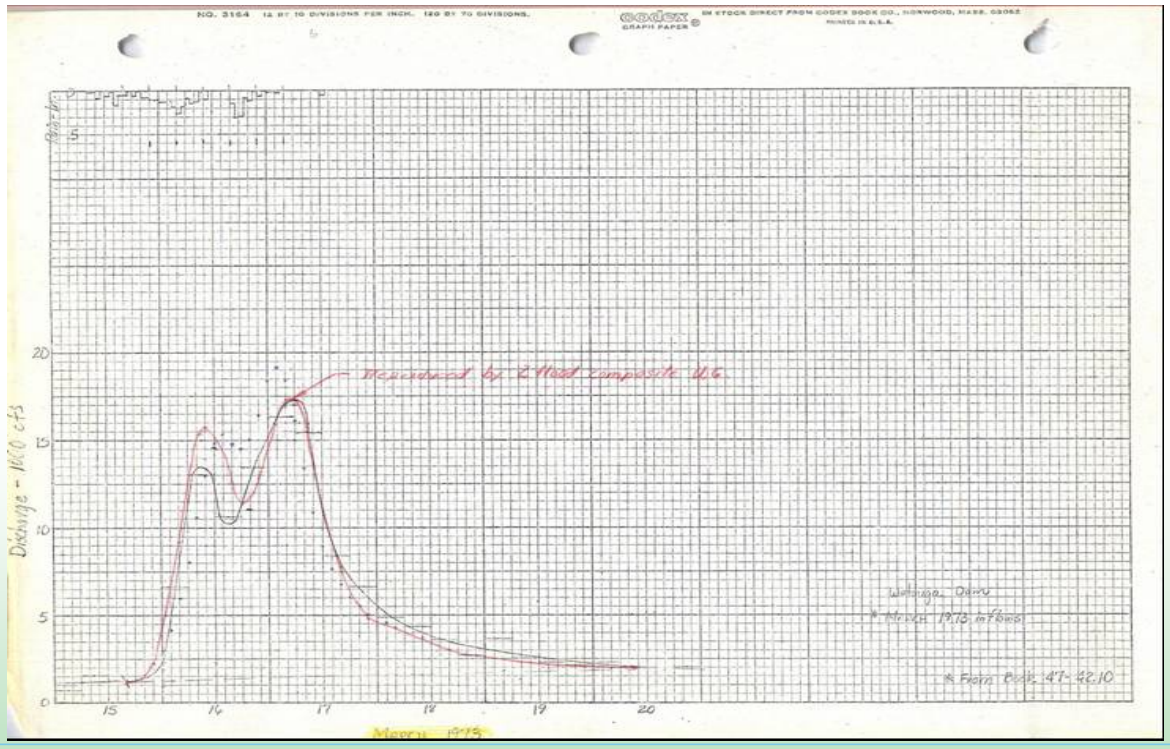
- **Figures 7 – 10 – Unit Hydrograph Development**



- Process used for 45 basins
- Approach consistent with guidance
- TVA is very satisfied with the resulting repeatability between flood events
- All 45 Unit Hydrographs available for review in June.

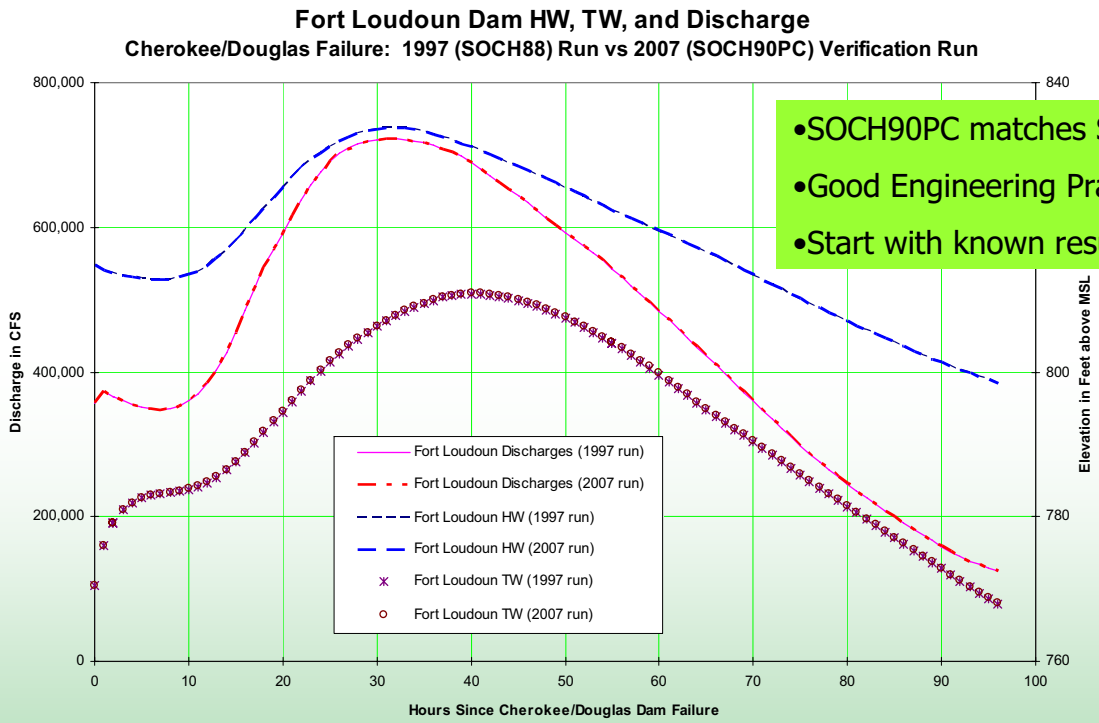
Whitepaper – Key Points

- **Figures 7 – 10 – Unit Hydrograph Development**



Whitepaper – Key Points

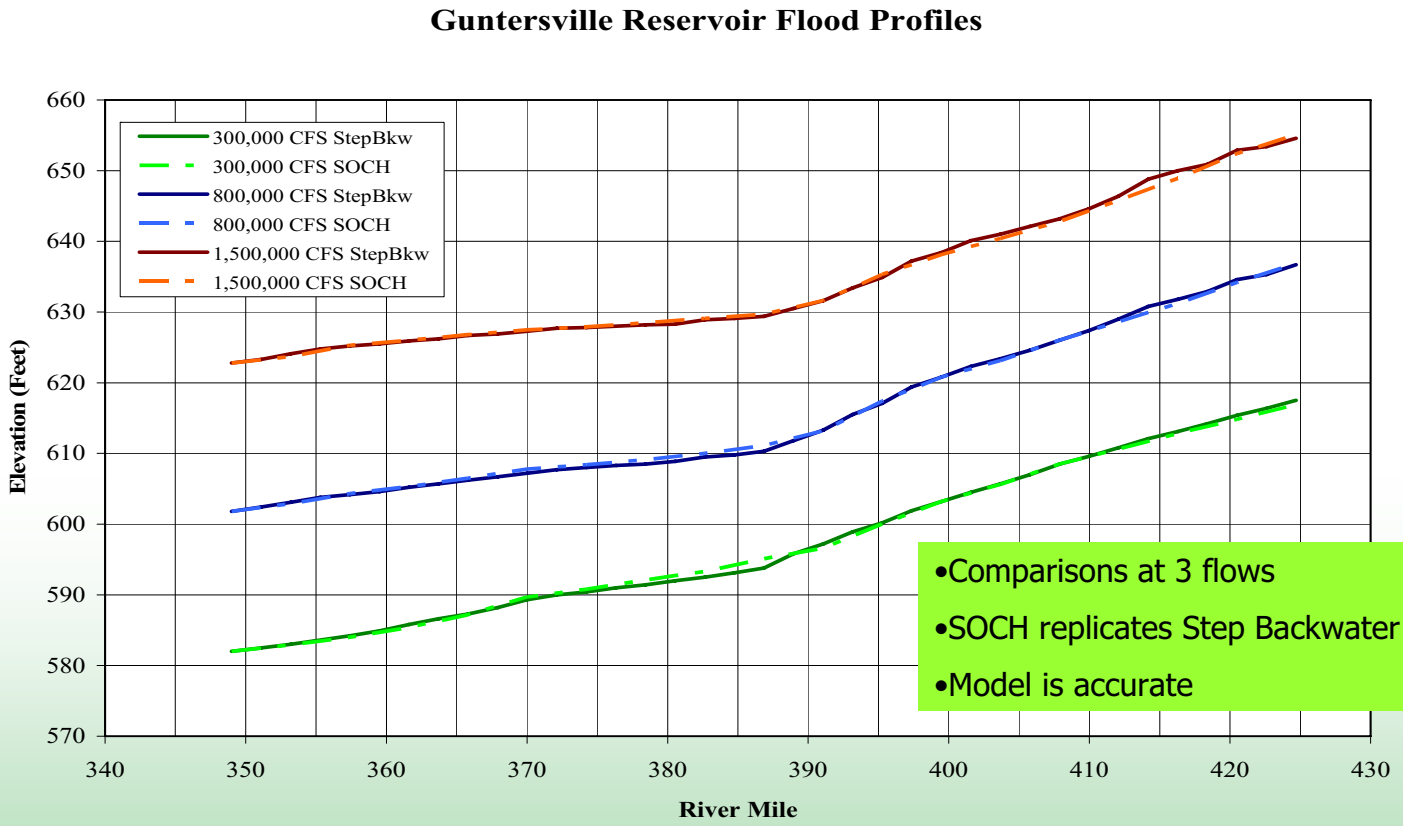
- **Figure 24 – SOCH88 vs SOCH90PC Comparison**



- SOCH90PC matches SOCH88
- Good Engineering Practice
- Start with known results

Whitepaper – Key Points

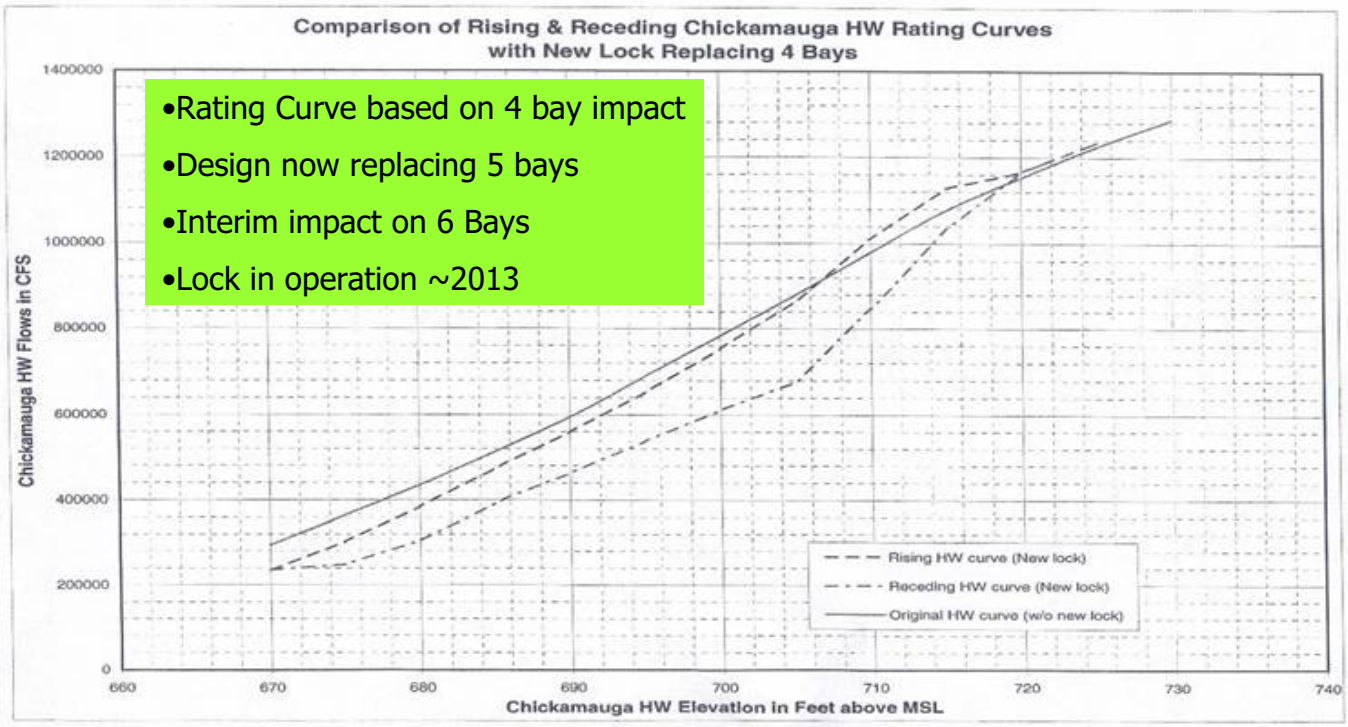
- **Figure 25 – Comparison Profile Plot – SOCH vs Step Backwater**



- Comparisons at 3 flows
- SOCH replicates Step Backwater
- Model is accurate

Whitepaper – Key Points

- **Figure 42 – Chickamauga Dam Headwater Rating Curve**



Whitepaper – Key Points

- **Figures 26-29 – Model Calibration and Verification Comparisons – A few examples of many. Included to communicate:**
  - Model results can replicate historical events
  - Model results can replicate operating events
  - Model is calibrated over a large range of flows
- **Section 7 – Summary of steps being taken to Update and Verify Runoff and Stream Course Models**
  - Use of recent USACE underwater contour data
  - Plan to verify unit hydrographs
  - Plan to calibrate against 2003 flood
  - Plan to review/verify, update as necessary the dam rating curves.

Software Verification and Validation Plan

- **All software will have an SPP-2.6 Verification and Validation package at the end of the effort.**
- **The 10 codes will be grouped into 5 families of codes**
  - SOCH90PC
  - DBREACH
  - CONVEYANCE, WEIGHTED WIDTH
  - UNITGRAPH, FLDHYDRO, CHANROUT, TRBOUTE, THIESSEN,
  - HMR56 (Not required for BLN design basis floods)
- **Documentation Required by SPP-2.6**
  - Users Manuals
  - SRS – Software Requirements Specification
  - SDD – Software Design Description
  - SVVR – Software Verification and Validation Report

Progress to Date

- **Implemented an efficient method and plan to verify and document the large amount of input data**
- **Verification Methods Established for Inputs**
  - Four Major Groupings of Inputs
    - Unit Hydrographs
    - Geometric Data Inputs
    - Dam Headwater Rating Curves
    - Basin Average PMP – HMR-41
  - Verification of Unit Hydrographs will be performed using a V&V version of HEC-1
  - Verification of Geometric Data Inputs will be performed by using alternate data source for reservoir volume checks, model calibration/verification on multiple floods (IAW RG 1.59 guidance)
  - Verification of the 45 watershed basin areas by comparison to alternate digital data from GIS, performing area checks.

Progress to Date

- **Verification Methods Established for SOCH Sub-Codes**
  - Use of Excel as an alternate analysis to reproduce similar, reviewable results
  - Will have an issued document by June for use as input to SPP 2.6 SRS, SDD, SVVR development.
- **Verification Methods Established for SOCH**
  - Use of 2003 flood event for calibration and verification
  - Regulatory Guidance suggests two flood events for model calibration and verification (ANS 2.8-1992 Sections 5.4.1.6 & 5.4.2.3).
  - Use of historical events such as the 1963, 1973, & 2003 flood will be consistent with regulatory guidance.

Progress to Date

- **Original Design Inputs Collected**
  - Existing unit hydrographs and drainage areas
  - Stream stage (elevation) and discharge data
  - Sub-basin rainfall data
  - Dam Spillway Rating Curves for normal and failed conditions
  - Original pre-reservoir contour data
  - Cross-Section location maps, cross sections, Manning roughness coefficients
- **The design inputs are a sub-set of hydrologic data contained in a population consisting of over 160 file books and over 140 reels of microfilm**

Progress to Date

- **Developed Plan for Missing or Illegible Original Design Inputs**
  - Surface area by elevation for reservoir volume
    - Plan to use latest digital GIS data
    - Reconstruct surface areas for each reach
    - Perform volume checks against known data
  - Some rainfall data located on microfilm is difficult to retrieve or read
    - Plan to use more recent (2003) digital rainfall data
    - Seek alternative sources of rainfall data such as NWS
    - Independent check of unit hydrographs using HEC-1
    - Eliminates the need to re-establish legibility of some rainfall data

Progress to Date

- **Contract established with A/E to assist with workload**
- **Processes Developed**
  - Anomaly Reporting and Reconciliation
  - Verification Package Signature Sheets
  - Dam Rating Curve Verification
  - Confirmation of Bathymetry data – Using USACE underwater contour data (2007 and 2008)

Forms / Process Development

TVA HYDROLOGY ANALYSES
ANOMALY DOCUMENTATION FORM

Anomaly Tracking Number:	ADF-01
Anomaly Short Title:	
Initiator / Date:	
Description of Anomaly:	
What Caused the Anomaly:	
How was Anomaly Reconciled:	
Comments / Notes:	

	River Operations Org*	Nuclear Engineering Org*
Prepared By / Date:		
Reviewed By / Date:		
*** N/A as appropriate**		

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Forms / Process Development

INPUT CHECKING / VERIFICATION PACKAGE

Package Number:	
Code Input utilized by: (FORTRAN Code Name)	
Input Data:	

Source Files, Notebooks, Microfilm, etc.:

Notebooks	Reel/Frames	Other			

Preparer / Checker's Discussion:

Method of Verification:
- ☐ Design Review
- ☐ Alternate Calculation
- ☐ Qualification Test

Verification Discussion:

	River Operations Org	Nuclear Engineering Org
Prepared By:		
Checked By:		
Reviewed / Verified By:	N/A	
Approved By:	N/A	

Page 1 of ___

INPUT CHECKING / VERIFICATION PACKAGE
Continuation Sheet

Package Number:	

Input Data Continuation:

Preparer / Checker's Discussion:

Verification Discussion:

Page 2 of ___

TVA Position

- BLN was previously shown to be a dry site
- TVA is confident that BLN will remain a dry site
- TVA is confident that through the Whitepaper, the Workshop, and formal RAI process, the NRC staff reviewers will have sufficient, objective evidence to substantiate this position
- At the end of this effort, TVA will have established sound, QA documented evidence of inputs used, prior and current analyses, and computer code V&V packages.
- The following slides provide the basis for such confidence

Basis for TVA's Confidence

- **SOCH Model will be confirmed to produce acceptable flood levels from the PMF**
  - Individual alternate analysis for each sub-code verifying their accuracy
  - Verification runs SOCH88 vs. SOCH90PC comparisons
  - Use of known inputs (1963, 1973 flood events) generates acceptable results when compared to observed flood stage data - calibration and verification of model IAW Regulatory Guidance – See Whitepaper Figures 25 - 29

Basis for TVA's Confidence

- **Supporting Efforts**
  - Relative importance of specific data to impact final result
    - Bathymetry data indication of silt accumulation – potential to increase elevations
      - Results to date – Significant changes have not been seen from reviews of Bathymetry data – Using USACE underwater contour data (2007 and 2008)
    - Urbanization affects shape of unit hydrographs and increases in runoff due to land use changes
      - Results to date – Data obtained from USGS National Land Cover Data (NLCD) indicates urbanization of area increased by only about 4% between 1992 and 2001, to a total urbanization of less than 10%
    - Rating curves – can release more/less water for a given elevation
      - Results to date – An ongoing review of some of the 21 rating curves indicates a reduction in discharge based on model test data and gate operating procedures.

Basis for TVA's Confidence

- Conservatisms noted in existing analysis
  - Credit has not been taken for some Dam Safety modifications at upstream tributary reservoirs
  - Available flood retention volume was not previously reflected in the model, but can now be accounted for due to enhanced digital (GIS) data.
- Any decrease in BLN PMF level will be treated as Design Margin, and captured as such in the calculation revision – BLN PMF level will remain at 622.5 Feet.

Path Forward

- **Complete Verification of Unit Hydrograph Data Packages**
- **Complete Verification of Geometric Data Packages**
- **Address older data issue by using 2003 flood data to calibrate, verify then re-baseline the model, consistent with Regulatory Guidance.**
- **Provide Status / Update at the May 15 Site Visit**
- **Develop User Manuals for Codes by June Workshop**
- **All Sub-codes to be verified by Excel by June, and documented in a summary report**
- **Documentation of any anomalies found and their reconciliation.**

Path Forward

- **Supporting Efforts to strengthen confidence**
  - Verification of over 25% of design input data is planned to establish confidence in the SOCH software inputs –
    - To be complete by June:
      - 66% of Dam Rating Curves for the upstream dams will have been verified.
      - 44% of unit hydrographs will have been verified
      - 21% of river reach cross sections (geometric data for 2 of 11 Reservoirs) will have been verified

Path Forward

- **SOCH90PC Model Runs – Re-perform - All Runs will be routed past BLN**
  - Show continuity between SOCH88 and SOCH90PC
  - Design Basis Case for PMF, seismic dam failures
  - Before / after Chickamauga Dam Lock modifications – 4, 5, & 6 spillway replacement
  - Show comparison between before / after Dam Safety Program modifications at Chickamauga Dam

June 23, 2008 Workshop Deliverables

- All input data packages available for review
- 14 of 21 Dam headwater rating curves will be verified
- 20 of 45 Unit Hydrograph Data Packages will be verified
- 2 of 11 Geometric Data Packages will be verified
- The sub-codes will be verified by alternate analysis
- The code User Manuals will be available
- Anomalies identified with reconciliation

June 23, 2008 Workshop Deliverables

- Observations and plan to address Sedimentation
- Observations and plan to address Urbanization
- Observations and plan to address Hydrograph Peaking
- Provide Schedule for final documentation wrap-up
  - Remaining Verification Packages - Issued
  - Software V&V Documents (SRS, SDD, SVVR)
  - Revision 1 to 1998 Reassessment Calculation

Summary / Wrap-up

- The Whitepaper is complete, and represents a good starting point for the review of the methods used by TVA to determine PMF levels
- TVA welcomes your feedback – Will address either through revision or at the workshop.
- TVA wants the June Workshop to serve as an opportunity for open communication and information transfer, and will provide the necessary resources to assure the NRC understands the development and use of the SOCH model
- TVA will provide firm dates for documentation finalization at the June Workshop
- Any further questions at this time?
- Informal Breakout discussion on the three data packages.