

# **CROSSFLOW Ultrasonic Flow Measurement System**

**CROSSFLOW Status Update  
September 12, 2005**

# CROSSFLOW Status Update - Agenda

<u>Topic</u>	<u>Responsible Party</u>	<u>Minutes</u>
<b>Introduction</b>	NRC, <u>W</u>	5
<ul style="list-style-type: none"> <li>- NRC organization, personnel, and review responsibilities</li> <li>- <u>W</u> organization, personnel, and responsibilities</li> </ul>		
<b>Meeting Objectives</b>	NRC	10
<ul style="list-style-type: none"> <li>- Describe review status</li> <li>- Identify issues and questions</li> <li>- Ensure consistent MUR technical basis</li> </ul>		
<b>Status of System Issues (Regulatory Update)</b>	<u>W</u>	45
<ul style="list-style-type: none"> <li>- Responsibility for draft questions pertaining to flow profile</li> <li>- Explanation of adequacy of existing technical basis for CROSSFLOW</li> <li>- Division of technology responsibilities</li> </ul>		
<b>Evaluation and Implementation of WOG CROSSFLOW User Guidelines</b>	<u>W</u>	30
<ul style="list-style-type: none"> <li>- Discussion of guidelines</li> <li>- Effect of guidelines on Topical Report CENPD-397-P</li> <li>- Applicability of guidelines to already approved MUR power uprates</li> <li>- Applicability of guidelines to current and future MUR power uprates</li> <li>- Division of vendor/licensee implementation responsibilities</li> </ul>		
<b>Break</b>		10
<b>CROSSFLOW X-Beam Topical Report Review</b>	NRC	45
<ul style="list-style-type: none"> <li>- Status</li> <li>- Technical issues</li> <li>- Schedule</li> </ul>		
<b>CROSSFLOW Generic Action Plan (GAP) Initiatives</b>	<u>W</u>	10
<ul style="list-style-type: none"> <li>- Status</li> <li>- Results</li> </ul>		
<b>Westinghouse/AMAG Technology Advancements</b>	<u>W</u>	10
<b>Summarize Commitments and Schedule</b>	NRC, <u>W</u>	15

## **Westinghouse/AMAG Organization & Responsibilities**

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- Advanced Measurement & Analysis Group, Inc. (AMAG)
  - Armando Lopez, President
    - Vahid Askari, Vice President
- Westinghouse Electric Company, LLC (Westinghouse)
  - John McInerney, Director, Safety & Monitoring Systems
  - Chris Savage, Director, Systems & Safety Analysis
    - Bill Turkowski, Manager, Plant Systems
      - Chip French, Fellow Engineer
    - Jim Gresham, Manager, Regulatory Compliance & Plant Licensing
      - Chuck Molnar, Senior Engineer

## Meeting Objectives

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- Address Reactor Systems Branch questions to facilitate review and approval of pending plant-specific license amendment requests (LARs)
- Develop a plan and schedule to complete plant-specific LAR review
- Discuss guidance to achieve acceptable plant-specific implementation
- Concur on CROSSFLOW X-Beam topical report review activities
- Update the NRC on the status of CROSSFLOW Generic Action Plan (GAP) initiatives

# CROSSFLOW Implementation and Operation

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- Regulatory basis
  - CENPD-397-P-A, Rev. 1 is the licensing basis for CROSSFLOW application including installation and operation
- Establish plant baseline
  - Installation procedures provide rigorous approach for establishing installation baseline
- System operation – alarms and diagnostics
  - Continuous monitoring of system performance
  - System is designed to recognize unacceptable performance and alert users through system alarms
- Periodic surveillance and maintenance
  - Provided in vendor documentation and summarized in Westinghouse Owners Group (WOG) CROSSFLOW Task Force (CTF) User Guidelines
- Operating experience
  - CROSSFLOW performance is consistent with the design and licensing basis

## CROSSFLOW System Overview

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- CROSSFLOW ultrasonic flow measurement is based on cross-correlation technology; which differs in principle and application from transit-time technology
- Provides an independent feedwater flow measurement
  - Does not replace existing plant instrumentation
  - Used in conjunction with other plant instrumentation
- 40 CROSSFLOW systems for feedwater flow measurement are in operation globally by 20 utilities
  - MUR Appendix K power uprate installations (11 licensed in the USA)
  - Venturi power recovery installations (6 in the USA)
  - Over 100 plant-years of service experience

# Regulatory Update

# Regulatory Update

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- NRC Agenda Topics
  - Explanation of adequacy of existing technical basis for CROSSFLOW
  - Division of technology responsibilities
  - Responsibility for draft questions pertaining to flow profile



## Regulatory Update

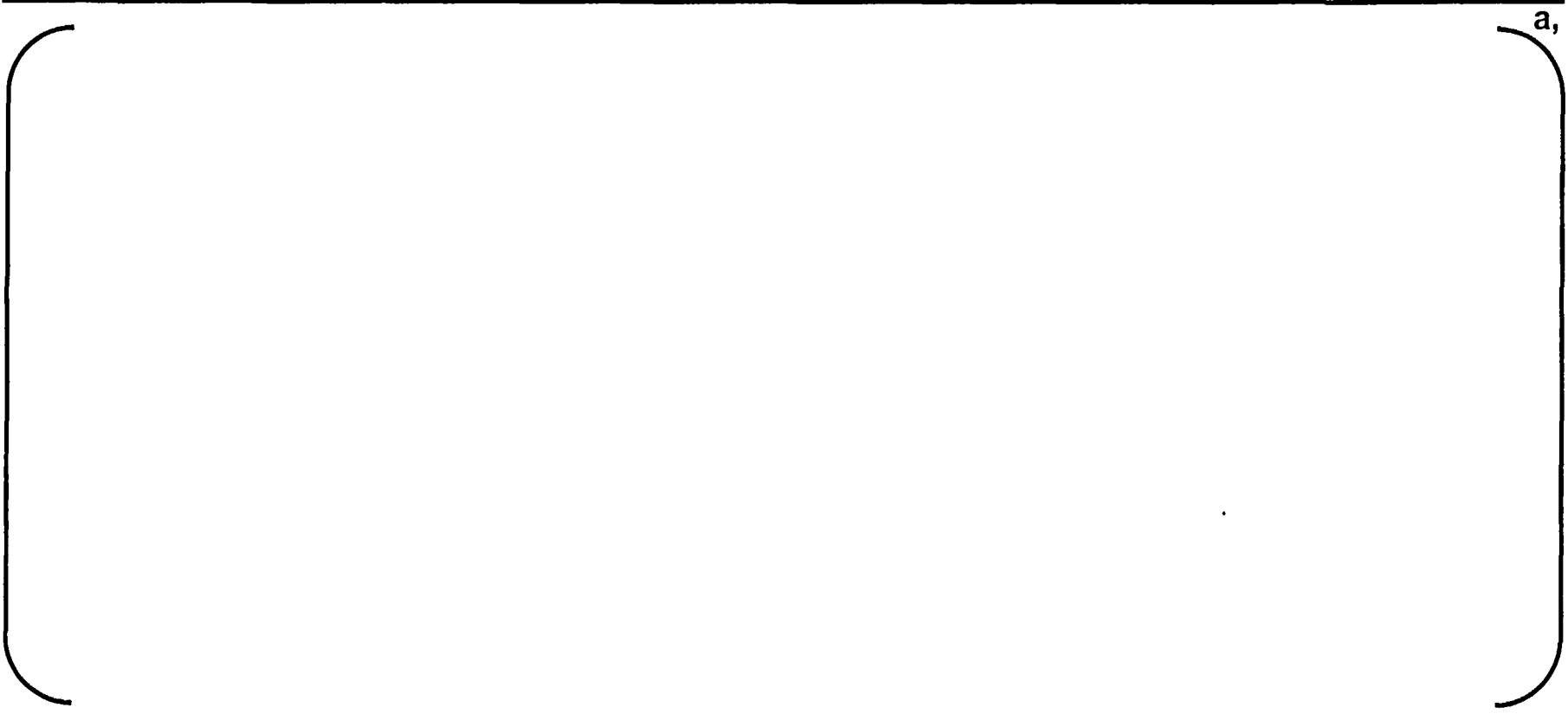
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- Explanation of adequacy of existing technical basis for CROSSFLOW
  - NRC-approved topical report; CENPD-397-P-A, Rev. 1
    - The topical report and NRC Safety Evaluation (SE) form the basis by which licensees implement requests for Appendix K MUR power uprate license amendments.
  - Numerous technical discussions and meetings with the NRC staff
  - Letters and reports from the WOG and Westinghouse to address questions

# Regulatory Update

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# Regulatory Update

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- The CROSSFLOW flow measurement uncertainty is:



# Regulatory Update

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- Division of responsibilities

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- Division of responsibility for CROSSFLOW is consistent with standard industry practice for other plant equipment

# **Evaluation and Implementation of WOG CROSSFLOW User Guidelines**

# WOG CROSSFLOW User Guidelines

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- NRC Agenda Topics
  - Discussion of guidelines
  - Effect of guidelines on topical report CENPD-397-P-A, Rev. 1
  - Applicability of guidelines to already approved MUR power uprates
  - Applicability of guidelines to current and future MUR power uprates
  - Division of vendor/licensee implementation responsibilities

# WOG CROSSFLOW User Guidelines

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- Discussion of guidelines
  - Purpose:
    - Develop WOG CTF User Guidelines to help ensure CROSSFLOW system is consistently operated as designed and licensed.
    - A reference for CROSSFLOW users to help implement plant-specific programs by compiling CROSSFLOW documentation and experience
    - Does not replace vendor documentation
  - Status: Complete
    - Information copy provided to NRC
    - The Guidelines provide information that covers the following areas:
      - Theory and Overview of the CROSSFLOW Technology
      - Use and Application
      - Operation Management
        - » Periodic maintenance, surveillance and training
      - Operating Experience



## WOG CROSSFLOW User Guidelines

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- Effect of guidelines on Topical Report CENPD-397-P
  - User guidelines do not affect the Topical Report



## WOG CROSSFLOW User Guidelines

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- Applicability of guidelines to already approved MUR power uprates



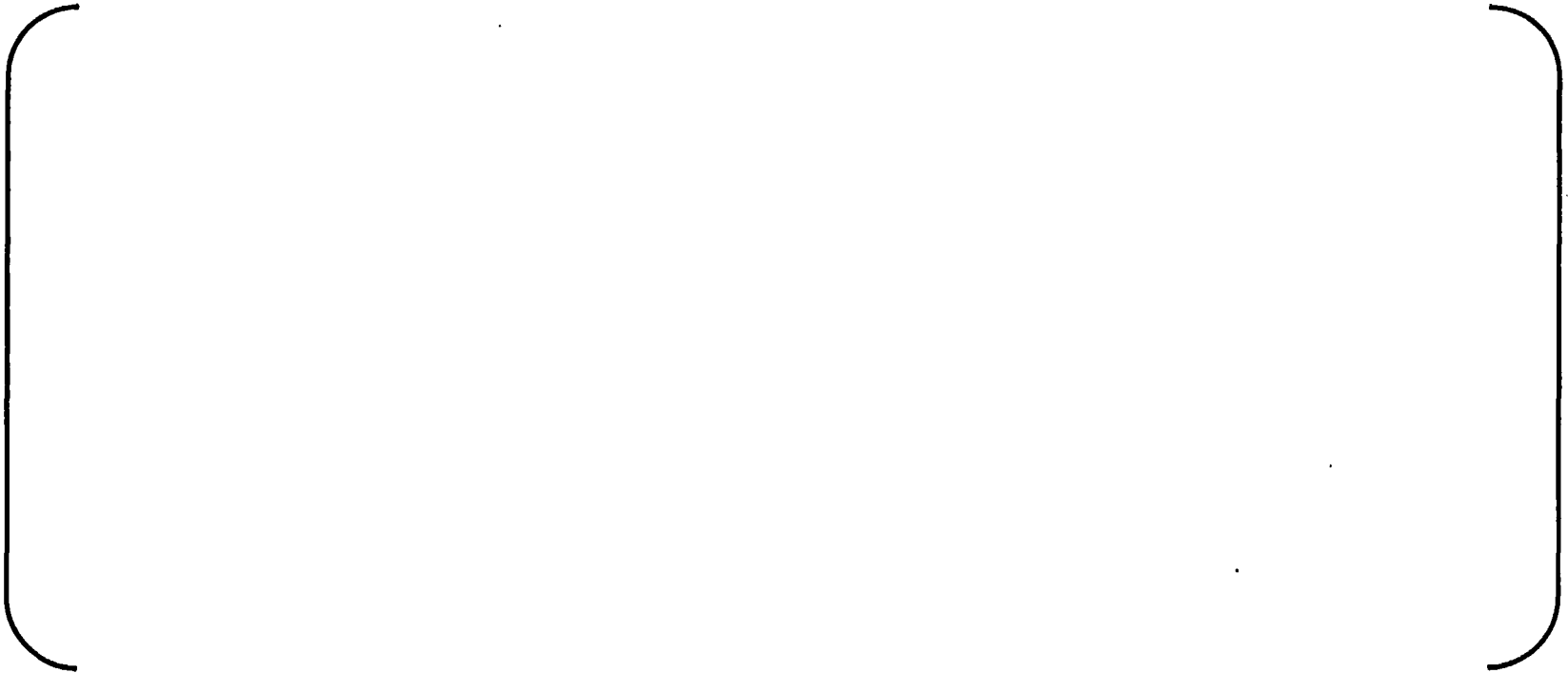
- Applicability of guidelines to current and future MUR power uprates
  - Same as above

# WOG CROSSFLOW User Guidelines

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- Division of vendor/licensee implementation responsibilities

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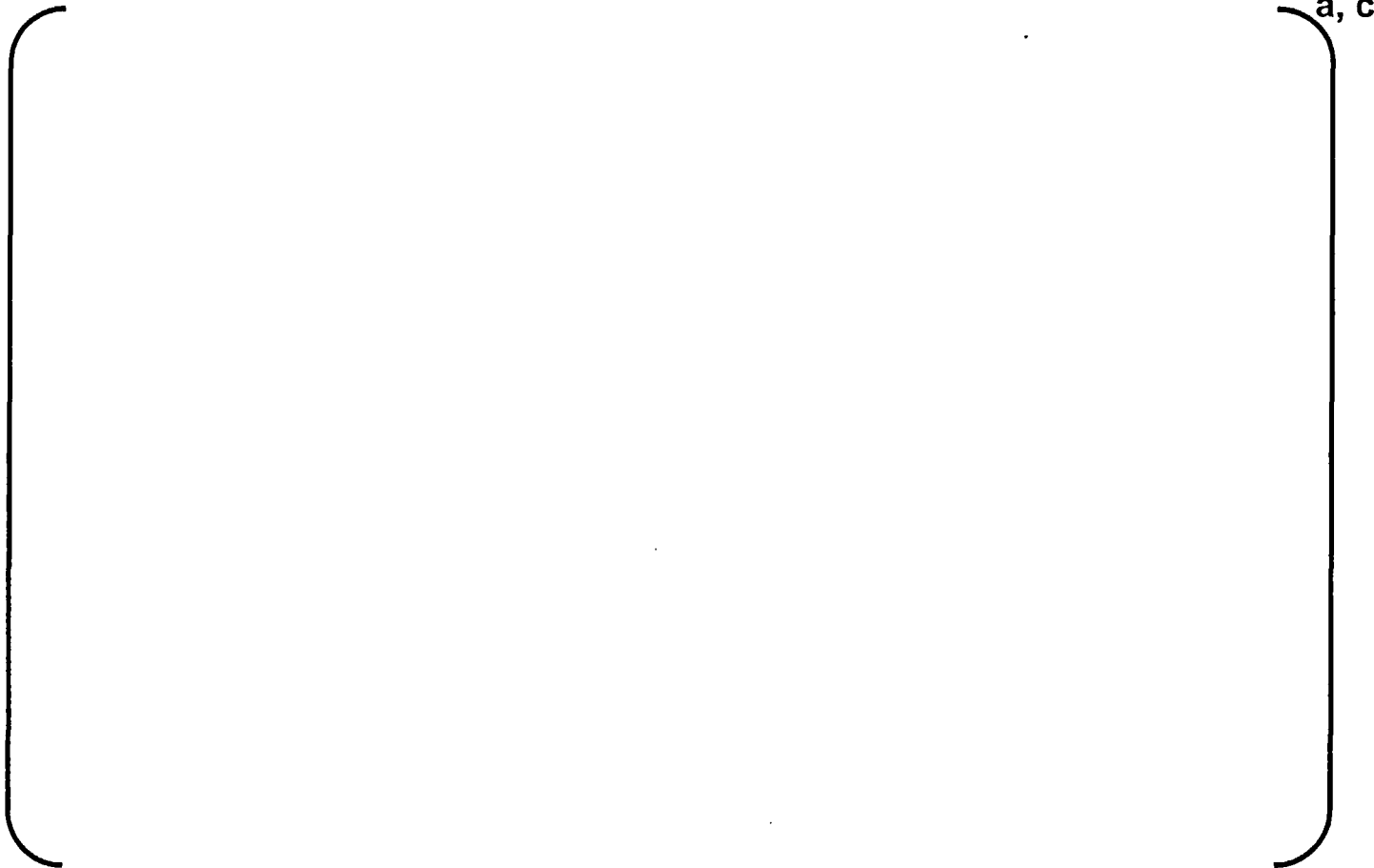
# **CROSSFLOW Generic Action Plan (GAP) Initiatives**

## **Status of CROSSFLOW Phase 2 GAP Initiatives**

## CROSSFLOW Generic Action Plan (GAP) Initiatives

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- The following Generic Action Plan (GAP) Phase 2 initiatives were established:



# CROSSFLOW Generic Action Plan (GAP) Initiatives

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# CROSSFLOW Generic Action Plan (GAP) Initiatives

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# CROSSFLOW Generic Action Plan (GAP) Initiatives

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# **Westinghouse/AMAG Technology Advancements**

## **Phase 3 GAP Initiatives**

# Westinghouse/AMAG Technology Advancements

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- Phase 3 GAP Initiatives

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# **X-Beam Topical Report Review**

## **Discussion**

# Summarize Commitments and Schedule

# Summary

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- Regulatory basis
  - CENPD-397-P-A, Rev. 1 is the licensing basis for CROSSFLOW application including installation and operation
- Establish plant baseline
  - Installation procedures provide rigorous approach for establishing installation baseline
- System operation – alarms and diagnostics
  - Continuous monitoring of system performance
  - System is designed to recognize unacceptable performance and alert users through system alarms
- Periodic surveillance and maintenance
  - Provided in vendor documentation and summarized in WOG CTF User Guidelines
- Operating experience
  - CROSSFLOW performance is consistent with the design and licensing basis

## Schedule / Next Actions

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- Plant-specific LARs for Fort Calhoun and Calvert Cliffs are consistent with the approved CROSSFLOW base topical/SER.
- Next actions
  - Identify any LAR-specific issues delaying approval
    - Reactor Systems Branch reviewer(s) meeting for in-depth CROSSFLOW technology discussions with Westinghouse/AMAG
    - Define the vendor/utility responsibilities to resolve the Reactor System Branch questions.
  - Establish a schedule for issuance of Fort Calhoun and Calvert Cliffs LARs

# Appendix

# CROSSFLOW Status Update

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- CROSSFLOW Topical Reports
  - CENPD-397-P-A, Rev. 1, “Improved Flow Measurement Accuracy Using CROSSFLOW Ultrasonic Flow Measurement Technology”, May 2000
    - This is the licensing basis document for CROSSFLOW technology.
  - WCAP-15689-P, Rev. 1, “Evaluation of Transit-Time and Cross-Correlation Ultrasonic Flow Measurement Experience with Nuclear Plant Feedwater Flow Measurement”, September 2002
    - Submitted to provide information relative to Caldon Report ER-262, “Effects of Velocity Profile Changes Measured In-Plant on Feedwater Flow Measurement Systems ”.
  - WCAP-16163-P, Rev. 0, “CROSSFLOW Ultrasonic Flow Measurement System, X-Beam Modification”, February 2005
    - Currently under NRC review.



# CROSSFLOW Status Update

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- Recent CROSSFLOW Vendor Communications
  - Signal Interference
    - TB-03-6, “CROSSFLOW Ultrasonic Flow Measurement System Signal Issues”, September 5, 2003.
    - NSAL-03-12, “CROSSFLOW Ultrasonic Flow Measurement System Flow Signal Interference Issues”, December 5, 2003.
  - Configuration/Alignment Sensitivity Observations
    - TB-04-4, “Information Regarding Recent CROSSFLOW Ultrasonic Flow Measurement System Performance Observations”, February 12, 2004

## CROSSFLOW Performance Documentation

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- Correspondence regarding adequacy of CROSSFLOW performance
  - June 8, 2004, WOG Letter
    - “Westinghouse Owners Group, CROSSFLOW Task Force: Feedback Regarding Westinghouse Technical Bulletin, TB-04-4”, WOG-04-310
  - June 18, 2004, Westinghouse Letter
    - “Westinghouse Conclusions Regarding Recent CROSSFLOW Ultrasonic Flow Measurement System Performance Events”, LTR-NRC-04-37
  - Oct. 19, 2004, Westinghouse Letter
    - “UFM Technology Update “, LTR-NRC-04-61
  - Oct. 20, 2004, WOG Letter
    - “Westinghouse Owners Group, Comparison of CROSSFLOW and ASME Flow Section Feedwater Flow Measurement at Kewaunee Nuclear Power Plant (Proprietary) (PA-SEE-0162)”, WOG-04-541
  - Dec. 10, 2004, WOG Letter
    - “Westinghouse Owners Group, Assurance that CROSSFLOW Technology, Installation, and Operation Maintain Design and Licensing Basis (Proprietary)”, WOG-04-622