

May 17, 2007

# PWR 7: Ultrasonic Flow Meter (UFM) Assessment

Categories: Generic Safety Issue and Plant-Specific Power Uprate Requests

**Discussion:**

SEs in ~2000 did not adequately address hydraulic considerations, changes were necessary to achieve the claimed W UFM uncertainty and uncertainty was sometimes greater than anticipated. Unresolved issues have been identified. W CROSSFLOW has resulted in overpower at six nuclear power plants. Projects has letter and SE that withdraws approval of W CROSSFLOW and SRXB will not approve any licensee requests using W CROSSFLOW or X-Beam UFM's until issues are satisfactorily resolved. The NRC staff has reviewed the Caldon LEFM Check and CheckPlus and found them acceptable subject to resolution of a minor issue to resolve transducer replacement uncertainty. This has not impacted use of Caldon LEFM since anticipated effect is small.

This is a licensed thermal power compliance issue of limited safety concern but with significant economic and political implications.

**Chronology:**

- 1999 - present Crossflow and LEFM UFM topical reports (TRs) received and approved via SE. Used for numerous measurement uncertainty recapture (MUR) power uprate amendment request approvals and for power recoveries to correct venturi fouling under 50.59.
- 01/13/03 SRXB concludes that Byron/Braidwood overpowered due to CROSSFLOW error.
- 07/18/03 Ft. Calhoun requests MUR based on X-Beam and later CROSSFLOW. Several changes follow over two years as they can't meet claimed uncertainty.
- 08/28/03 Beginning of power reductions at Byron/Braidwood due to overpower.
- 02/02/04 Wermiel Task Group formed to assess UFM's; W requests X-Beam UFM approval.
- 07/01/04 Task Group report identifies issues and provides recommended actions. DSS and SRXB told they have no further responsibility for CROSSFLOW review.
- 3/8/2005 Calvert Cliffs requests MUR uprate based on CROSSFLOW.
- 7/26/05 DSS / SRXB told to re-initiate review of UFM's. Status identical to 7/1/04.
- 09/13/05 Calvert Cliffs overpowered due to CROSSFLOW under 50.59. Power reduced.
- 09/22/05 Seabrook submits MUR request based on Caldon LEFM CheckPlus.
- 01/17-19/06 SRXB at Alden Labs: Observe CheckPlus testing. Meet with Caldon / Seabrook.
- 01/25/06 Observe tracer testing at Calvert Cliffs and discuss resolution progress.
- 5/22/06 Seabrook SE issued.
- Many meetings with W and many document submittals not listed.
- 06/05/06 Final document submittals received from W.
- 6/6/06 Caldon generic assessment report complete and into concurrence.
- 6/8/06 ET/LT meeting.
- 7/31/06 Draft detailed CROSSFLOW SE provided.
- 8/1/06 Martin - SE to be 3 pages and no further work to be done on CROSSFLOW detail.
- 8/7/06 Lyon instructed to provide Memo that covers CROSSFLOW review detail.
- 8/9/06 8/7/06 instruction complete.
- 8/15/06 Martin - Make 8/1/06 SE 8 pages.
- 8/30/06 Trip to Calvert Cliffs.

- Many iterations and rewrites of CROSSFLOW SE with communications to W throughout review process. Ditto with meetings with W.
- 9/20/06 Initiate concurrences on CROSSFLOW findings communication to W.
- 10/19/06 Marinos nonconcurrence on CROSSFLOW findings.
- 11/9/06 Response to non-concurrence issued.
- 11/17/06 Meeting with GE to discuss their UFM design and plans.
- Many CROSSFLOW findings rewrites in response to Management and OGC.
- 2/23/07 SRXB SE to Projects finding Calvert Cliffs MUR unacceptable.
- 2/26/07 SRXB SE to Projects finding Ft. Calhoun MUR unacceptable.
- 2/28/07 DSS / SRXB Learns of DPO regarding CROSSFLOW findings.
- 3/14/07 Dyer - Do not go public with CROSSFLOW findings document until DPO resolved.
- 3/16/07 Letter / SE for proprietary and error review to W
- 4/11/07 Meeting with Caldon to discuss resolution of open issue and updating TR.
- 4/13/07 W responds to 3/16/07 communication.
- 4/12/07 Davis Besse requests MUR using Checkplus.
- 5/1/07 Meeting with W to discuss 4/13/07 response.
- 5/11/07 Memo dated 5/8/07 to Projects containing letter and SE withdrawing approval of CROSSFLOW to W.

**Next Steps:**

- Provide Lyon Memo covering design detail to W for proprietary review.
- Issue letter and SE to W withdrawing approval of Crossflow TR.
- Issue RIS to inform industry of NRC suspension of Crossflow TR.
- Proprietary Lyon Memo to W and non-proprietary version publically available.
- Observe GE UFM tests at NIST.
- Write Temporary Instruction for inspections of licensees using CROSSFLOW.
- Review Caldon resolution of transducer replacement issue when received.
- Review Caldon TR update when received.
- Review Davis Besse MUR.
- Review Crystal River MUR (Checkplus UFM) when received.

**Support Needed:** Management action to issue communications and resolve issues.

**POCs:** Warren Lyon

The following U.S. plants have used or are currently using the W/AMAG Crossflow meter:

Appendix K MUR	Power Recovery	Demo/No Longer Used
Calvert Cliffs 1/2	Calvert Cliffs 1/2	ANO 1
Ft. Calhoun	Diablo Canyon 1/2	Braidwood 1/2
Hatch 1/2	Duane Arnold	Brunswick 1/2
Hope Creek	Fermi	Byron 1/2
Kewaunee	Hatch 1/2	Clinton
Monticello	Hope Creek	Davis Besse
Palisades	Palisades	Dresden 1/2
Pilgrim	Salem 1/2	LaSalle 1/2
Salem 1/2	Peach Bottom 2/3 - one time	North Anna 1/2
San Onofre 2/3	South Texas Project 1/2	Shearon Harris
South Texas Project 1/2	Susquehanna 1/2 - one time	Surry 1/2
	Vermont Yankee	