Calvert Cliffs Nuclear Power Plant

1650 Calvert Cliffs Parkway
Lusby, Maryland 20657

Constellation Energy
Nuclear Generation Group

May 7, 2009

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Response to Request for Additional Information – License Amendment for Measurement Uncertainty Recapture Power Uprate - Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2

REFERENCE: (a) Letter from Mr. D. V. Pickett (NRC), to Mr. J. A. Spina (Calvert Cliffs) dated March 24, 2009, Request for Additional Information Re: License Amendment for Measurement Uncertainty Recapture Power Uprate – Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2 (ML090770532)

In Reference (a), the Nuclear Regulatory Commission (NRC) requested additional information to be submitted to support their review of Calvert Cliffs Nuclear Power Plant, Inc. submittal for a measurement uncertainty recapture power uprate. Our response to this request is provided in Attachment (1).

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NRR

Should you have questions regarding this matter, please contact Mr. Jay S. Gaines at (410) 495-5219.

Very truly yours,

Thomas E. Trepanier
Plant General Manager

STATE OF MARYLAND :
: **TO WIT:**
COUNTY OF CALVERT :

I, Thomas E. Trepanier, being duly sworn, state that I am Plant General Manager - Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP), and that I am duly authorized to execute and file this License Amendment Request on behalf of CCNPP. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other CCNPP employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of Calvert, this 7 day of May, 2009.

WITNESS my Hand and Notarial Seal:

Wendy L Hunter
Notary Public

My Commission Expires:

Wendy L. Hunter
NOTARY PUBLIC
Calvert County, Maryland
My Commission Expires 01/01/10
Date

TET/KLG/bjd

Attachments: (1) Response to Request for Additional Information (ML090770532) - Measurement Uncertainty Recapture Power Uprate

cc: D. V. Pickett, NRC
S. J. Collins, NRC
Resident Inspector, NRC
S. Gray, DNR

ATTACHMENT (1)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

(ML090770532) - MEASUREMENT UNCERTAINTY RECAPTURE

POWER UPRATE

Calvert Cliffs Nuclear Power Plant, Inc.
May 7, 2009

Supplemental Request No. 3:

Based on information obtained in Figures 1 and 2 of Attachment (2) Response to Request for Additional Information dated November 17, 2008, Measurement Uncertainty Recapture Power Uprate - it appears that the downstream pressure transmitters may be in close proximity to either the spool piece or an elbow. Please explain the effects a spool piece and elbow will have on the pressure indication and what measures are taken to correct for any effects.

CCNPP Response:

The pressure transmitter supplies a signal for the mass flow determination. Its purpose is to support the computation of feedwater temperature and density. The temperature is a function of the sound velocity and static pressure of the fluid.[1] The density is a function of the temperature and static pressure of the fluid. The pressure tap is nominally perpendicular to the direction of fluid velocity; consequently, the pressure in the impulse line between the flow element and the transmitter represents the static pressure at the tap location—that is, no component of the fluid velocity impinges, either positively or negatively, on the tap connection. If there are transverse velocity components such as swirl produced by upstream features, then these components could artificially reduce the static pressure in the way of the transmitter and therefore introduce an error. Cameron does not believe that this effect is valid; it is their position that the transmitter measures a static pressure that accurately characterizes the properties of the fluid. However if the argument were valid, the largest transverse velocity component at Calvert Cliffs is about 5 feet/second. The static pressure reduction produced by a 5 feet/second transverse component is about 0.1 psi—negligible relative to the pressure uncertainty allowance of 15 psi.

The 15 psi pressure uncertainty is accounted for by the (systematic) errors affecting both the temperature and density determinations. Consequently, if a transverse velocity component were to produce a static pressure error, its effect on the density determination would be likewise negligible.

Supplemental Request No. 4:

The information provided by the licensee shows inconsistencies between the laboratory calibration setup and the piping run in that there are nearby elbows downstream of the in-situ ultrasonic flow meter installation. The supplement does not appear to discuss or explain these differences between the as-tested and as-installed configuration, as requested by the staff.

This is particularly of concern for the Unit 1, Loop A header, where the spool piece is to be installed 1 foot, 3 inches upstream of a piping elbow. This is narrowly less than a single piping diameter, and far less than the 20 or greater pipe diameters commonly accepted to be the required length to establish fully developed, turbulent flow.

Please explain how the laboratory calibration accounts for the close-by downstream configuration changes that are not displayed in the laboratory testing report.

CCNPP Response:

A downstream disturbance such as a bend can produce changes in the direction of local fluid velocity components upstream, but not at distances greater than 1 internal diameter from the entrance to the

[1] The derivation of the relationship between sound velocity, pressure and temperature is described in ER-80P and Appendix C of that document. Uncertainties in the temperature determination are also covered in these references.

disturbance. The chordal paths of the Leading Edge Flow Measurement (LEFM) CheckPlus in Loop A of Unit 1 at Calvert Cliffs are 2.7 diameters upstream of the entrance to the bend.

The following references support this position:

- In Figure 12 of his technical note No. 1471, Weske[2] shows that at station 1, one diameter upstream of the entrance to the bend, the profile is fully developed and symmetrical, with no transverse velocity components. A copy of the figure is attached for convenience.
- In model tests to establish calibrations for two 4 path chordal flowmeters used to measure reactor coolant flow at Prairie Island Unit 2[3], the center of the chords was approximately 1.5 diameters upstream of a downstream bend. The bend was modeled to ensure that any effect would be accounted. To establish an optimum meter orientation, calibrations were run for selected chordal angular orientations "around the clock," relative to upstream and downstream bends, so as to establish an orientation that minimized the effect of cross flow. The data showed that the transverse flow was produced by the upstream bends, since transverse velocity was minimized when the four chords were perpendicular to the plane of that bend. Furthermore, the meter factor for the chordal system averaged over 360° equaled that for the same meter in straight pipe, without transverse flow. It was concluded that, with the chords centered 1 ½ diameters upstream of the downstream bend, that bend had no effect on the calibration of the meter.
- A downstream bend was included in a recent calibration test for an LEFM CheckPlus system to be installed at another nuclear facility. In this case the entrance to the bend was 1.5 diameters downstream of the acoustic paths, 1.2 diameters closer than the bend in Loop A at Calvert Cliffs Unit 1. To confirm that the bend was having no significant effect on the meter factor, an eccentric orifice was installed immediately downstream of the bend for one of the parametric calibration tests. The measured change in meter factor from the reference configuration was 0.05%—within the observational uncertainty of the parametric tests. Both the reference and the eccentric orifice meter factors were close to that which would be expected for the same meter in straight pipe (that is, within the observational uncertainty).

It should also be noted that, in its specifications for the configuration of nozzles for mass flow measurements, the American Society of Mechanical Engineers (ASME) locates the static tap one diameter upstream of the entrance to the nozzle. This location was based on testing by the ASME to establish that the static pressure of the flow stream at this location is unaffected by the presence of the nozzle downstream. It is believed that the ASME specification of a straight length 5 diameters downstream of a flow nozzles is for the purpose of recovering, insofar as possible, the losses produced by that nozzle. This consideration does not apply to the LEFM.

2 National Advisory Committee for Aeronautics (NACA) Technical Note 1471, "Experimental Investigation of Velocity Distributions downstream of Single Duct Bends," John R. Weske

3 MPR-440, "Tests of the Westinghouse LE Flowmeter with a 2/3 Scale Nuclear Steam Generator Model at Alden Laboratories, April, 1974"

March 22, 2009
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34 NACA TN No. 1471

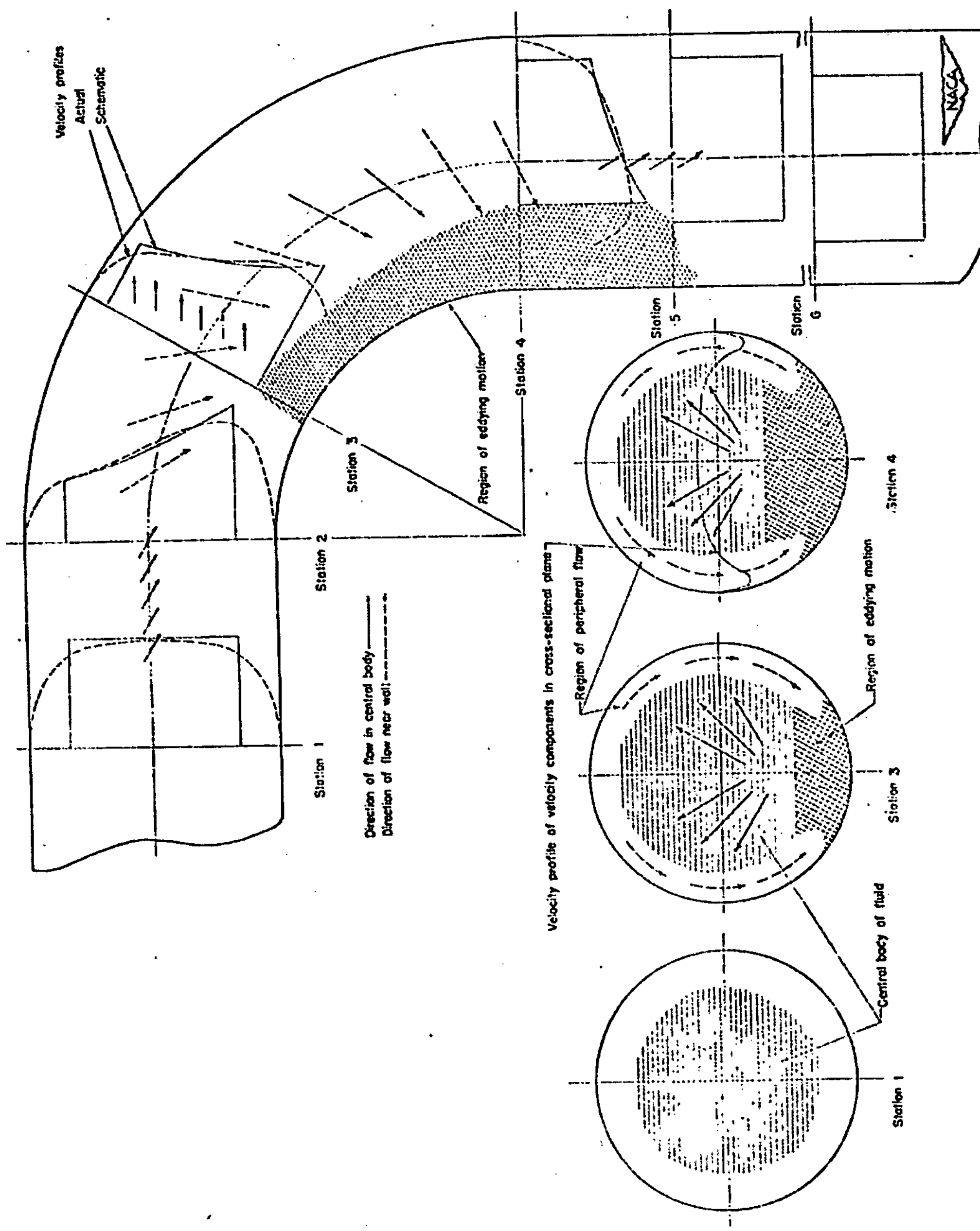

Figure 12- Schematic drawing showing flow phenomena in a curved duct.