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Robert J. Barrett  
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November 20, 2002  
IPN-02-091

U.S. Nuclear Regulatory Commission  
ATTN: Document Control Desk  
Mail Stop O-P1-17  
Washington, DC 20555-0001

SUBJECT: Indian Point Nuclear Generating Unit No.3  
Docket No. 50-286  
**Reply to Request for Additional Information  
Regarding Proposed License Amendment for  
1.4% Measurement Uncertainty Recapture Power Uprate**

REFERENCE: 1. Entergy letter to NRC, IPN-02-041, "Request for License Amendment for 1.4% Measurement Uncertainty Recapture Power Uprate," dated May 30, 2002.

2. NRC letter to Entergy Nuclear Operations, Inc; "Request for Additional Information, TAC NO. MB5297," dated August 26, 2002.

3. Entergy letter to NRC, IPN-02-073, "Reply to Request for Additional Information," dated September 12, 2002.

Dear Sir or Madam:

This letter provides additional information requested by the NRC regarding the license amendment request submitted by Entergy Nuclear Operations, Inc (ENO) in Reference 1. Additional information was initially requested by the NRC in Reference 2 and ENO provided responses in Reference 3. Subsequently, the NRC staff requested more detailed information regarding the testing and calibration of the flow measurement spool pieces discussed in question and answer 5 of References 2 and 3, respectively. ENO is providing the additional detail in the enclosed documents. Since portions of the supporting information are proprietary to Caldon, Inc, the owner of the information, two copies each of the proprietary and non-proprietary versions of the document are enclosed.

Also enclosed is Caldon, Inc authorization letter dated November 14, 2002 (CAW-02-04), with the accompanying affidavit. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the NRC and addresses the considerations listed in paragraph (b)(4) of Section 2.790 of the Commission's regulations. Accordingly, it is respectfully requested that the information that is proprietary to Caldon be withheld from public disclosure in accordance with 10 CFR 2.790.


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Correspondence with respect to the application for withholding of proprietary information should reference CAW-02-04 and should be addressed to Calvin R. Hastings - President and CEO, Caldon, Inc., 1070 Banksville Avenue, Pittsburgh, Pennsylvania 15216.

The information provided herein does not alter the conclusions of the no significant hazards evaluation previously provided in Reference 1. There are no new commitments identified in this letter. If you have any questions or require additional information, please contact Mr. Kevin Kingsley at 914-734-5581.

I declare under penalty of perjury that the foregoing is true and correct. Executed on 11-20-02.

Very truly yours,



Robert J. Barrett  
Vice President, Operations – IP3  
Indian Point 3 Nuclear Power Plant

cc: Mr. Patrick D. Milano, Senior Project Manager  
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U.S. Nuclear Regulatory Commission  
Mail Stop O 8 C2  
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Mr. Hubert J. Miller (w/o proprietary encl)  
Regional Administrator  
Region I  
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475 Allendale Road  
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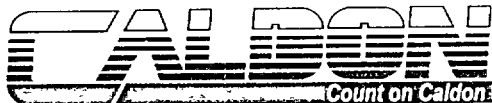
Resident Inspector's Office (w/o proprietary encl)  
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Buchanan, NY 10511

Mr. William M. Flynn (w/o proprietary encl)  
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Mr. Paul Eddy (w/o proprietary encl)  
New York State Dept. of Public Service  
3 Empire Plaza  
Albany, NY 12223

## ENCLOSURES TO IPN-02-091

- **Caldon, Inc Authorization letter CAW-02-04 dated November 14, 2002, requesting withholding from public disclosure ( with accompanying affidavit)**
- **Two copies of proprietary version of Caldon, Inc document, "Clarification; Response to Question 5, Indian Point 3 RAI dated 8/26/02."**
- **Two copies of non-proprietary version of Caldon, Inc document, "Clarification; Response to Question 5, Indian Point 3 RAI dated 8/26/02."**



Caldon, Inc.

November 14, 2002  
CAW 02-04

Document Control Desk  
U. S. Nuclear Regulatory Commission  
Washington, DC 20555

APPLICATION FOR WITHHOLDING PROPRIETARY  
INFORMATION FROM PUBLIC DISCLOSURE

Subject: "Clarification: Response to Question 5, Indian Point 3 RAI dated 8/26/02"

Gentlemen:

This application for withholding is submitted by Caldon, Inc. ("Caldon") pursuant to the provisions of paragraph (b)(1) of Section 2.790 of the Commission's regulations. It contains commercial strategic information proprietary to Caldon and customarily held in confidence.

The proprietary information for which withholding is being requested is identified in the subject submittal. In conformance with 10 CFR Section 2.790, Affidavit CAW-02-04 accompanies this application for withholding setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject information, which is proprietary to Caldon, be withheld from public disclosure in accordance with 10 CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should reference CAW-02-04 and should be addressed to the undersigned.

Very truly yours,

Calvin R. Hastings  
President and CEO

Enclosures

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

SS

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared Calvin R. Hastings, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Caldon, Inc. ("Caldon") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

*Calvin R. Hastings*

Calvin R. Hastings,  
President and CEO  
Caldon, Inc.

Sworn to and subscribed before me

this 14<sup>th</sup> day of

November, 2002

*Jean B. Thomas*

Notarial Seal  
Jean B. Thomas, Notary Public  
Pittsburgh, Allegheny County  
My Commission Expires July 28, 2003

Member, Pennsylvania Association of Notaries

1. I am the President and CEO of Caldon, Inc. and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rulemaking proceedings, and am authorized to apply for its withholding on behalf of Caldon.
2. I am making this Affidavit in conformance with the provisions of 10CFR Section 2.790 of the Commission's regulations and in conjunction with the Caldon application for withholding accompanying this Affidavit.
3. I have personal knowledge of the criteria and procedures utilized by Caldon in designating information as a trade secret, privileged or as confidential commercial or financial information.
4. Pursuant to the provisions of paragraph (b) (4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.
  - (i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Caldon.
  - (ii) The information is of a type customarily held in confidence by Caldon and not customarily disclosed to the public. Caldon has a rational basis for determining the types of information customarily held in confidence by it and, in that connection utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Caldon policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential advantage, as follows:

- (a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Caldon's

competitors without license from Caldon constitutes a competitive economic advantage over other companies.

- (b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.
- (c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, and assurance of quality, or licensing a similar product.
- (d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Caldon, its customer or suppliers.
- (e) It reveals aspects of past, present or future Caldon or customer funded development plans and programs of potential customer value to Caldon.
- (f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Caldon system, which include the following:

- (a) The use of such information by Caldon gives Caldon a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Caldon competitive position.
- (b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Caldon ability to sell products or services involving the use of the information.
- (c) Use by our competitor would put Caldon at a competitive disadvantage by reducing his expenditure of resources at our expense.

- (d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Caldon of a competitive advantage.
- (e) Unrestricted disclosure would jeopardize the position of prominence of Caldon in the world market, and thereby give a market advantage to the competition of those countries.
- (f) The Caldon capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.
- (iii) The information is being transmitted to the Commission in confidence, and, under the provisions of 10CFR Section 2.790, it is to be received in confidence by the Commission.
- (iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same manner or method to the best of our knowledge and belief.
- (v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in "Clarification: Response to Question 5, Indian Point 3 RAI dated 8/26/02". This information is submitted for use by the NRC Staff in their review of the MUR uprate license amendment request of Entergy Indian Point 3 Nuclear Power Station.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Caldon because it would enhance the ability of competitors to provide similar flow and temperature measurement systems and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without the right to use the information.



The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Caldon effort and the expenditure of a considerable sum of money.

In order for competitors of Caldon to duplicate this information, similar products would have to be developed, similar technical programs would have to be performed, and a significant manpower effort, having the requisite talent and experience, would have to be expended for developing analytical methods and receiving NRC approval for those methods.

Further the deponent sayeth not.

**Clarification; Response to Question 5, Indian Point 3 RAI dated 8/26/02**

*This information supplements and clarifies the response to the subject RAI, which asked: "Were the flow elements [to be used in the IP 3 uprate] tested in a plant specific geometry?"*

As stated in the initial submittal, the LEFM flow elements installed at IP 3 were provided by Westinghouse in the early 80's and were not calibrated in a certified hydraulics laboratory. They were, however, subjected to Westinghouse quality assurance and their dimensions determined with precision, prior to their installation. The Profile Factors assigned to the IP 3 LEFMs are based on calibration data for similar flow elements for other plants (including IP 2), with uncertainty allowances adjusted to reflect this fact as well as the hydraulics of the installations. The analysis on which the Profile Factor selection and its uncertainty are based is contained in a Caldon engineering report, ER 100. This analysis was performed when IP 3 replaced Westinghouse electronics with Caldon electronics in 1998. It should be noted that, following the recent installation of LEFM Check hardware, some of the uncertainties in the ER 100 analysis have been revised to reflect improved electronic performance and the more exacting installation procedures associated with a power uprate. The time measurement uncertainties are examples. However, the analysis in ER 100 with regard to Profile Factor and dimensional uncertainties remains valid. Specifics of this analysis are discussed below.

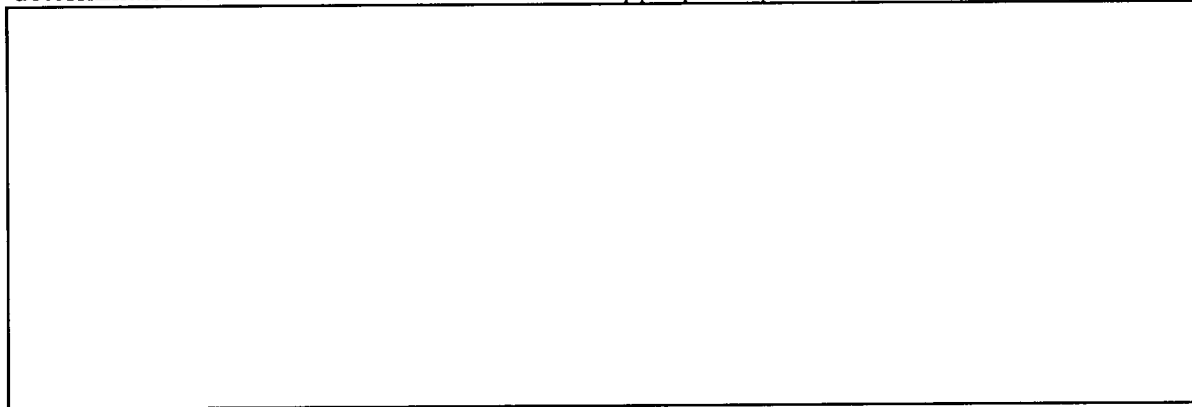
In regard to the treatment of Profile Factor and its uncertainties, the basis for the uprate at IP3 is similar to that for Comanche Peak Units 1 and 2. However, because the calibration uncertainty associated with system hydraulics is considered to be somewhat greater for the IP 3 installation, a more conservative approach was taken both in the selection of a calibration coefficient (Profile Factor) and in the estimation of the uncertainty associated with the Profile Factor. As background, the Comanche Peak submittal:

- Used data from a flow element sample larger than that used for IP3, which covered a range of flow element sizes, to establish a mean profile factor, which was applied to Comanche Peak,
- Used these same data to establish the calibration uncertainty in this profile factor. Because the flow element sample covered a range of sizes, tested in a certified laboratory at different times over several years, no additional uncertainty for the laboratory was carried in the analysis.
- Assigned a small additional uncertainty to account for the potential effects of upstream hydraulics (the calibration data used to establish a mean profile factor were all measured in straight pipe),
- Assigned an uncertainty to account for the departure of the actual flow element dimensions, as measured, from the ideal, and for the uncertainties in the dimensional measurements themselves.

The analysis for IP 3:

- Uses calibration data for flow elements of the same internal diameter as the flow elements installed in IP 3 to establish a mean profile factor. [These data are a subset of the data used for Comanche Peak.],
- Because the data sample is smaller, incorporates an additional uncertainty allowance of [ ] to account (conservatively) for potential calibration laboratory bias in the data sample,
- Incorporates a more conservative uncertainty to account for hydraulics [ ] [ ] because the flow elements are located closer to a significant hydraulic feature (a 90<sup>0</sup> bend) than are the elements at Comanche Peak,
- Assigns an additional uncertainty to account for the departure of the actual flow element dimensions, as measured, from the ideal, and for the uncertainties in the dimensional measurements themselves (as was done for Comanche Peak). The dimensional uncertainties are somewhat larger for IP 3 because the flow elements are smaller and a measurement error of a fixed length [ ] counts for more.

Pertinent data from the uncertainty analyses for Comanche Peak and for IP 3 are summarized in Table 1. It will be noted that the IP 3 analysis treats certain of the profile factor uncertainties as systematic (that is, of the same sign and similar magnitudes from one flow element to another). These uncertainties carry over undiminished in the determination of unit uncertainties. Other uncertainties are treated as random; these are diminished by a factor of 2 (inversely as the square root of the number of loops) in the determination of unit errors. This treatment is appropriate. [ ]



[ ] It will be noted that this result- [ ] is well within the budgeted allowance for LEFM Check systems ( $\pm 0.4\%$ ) in ER 80P and ER 157P.

The key to the conservatism in the approach taken for IP 3 is a demonstration that, in fact, an allowance of [ ] adequately covers the uncertainty assigned to the IP 3 LEFM hydraulic configuration. The configurations of each of the four IP 3 steam generator feeds in which the LEFMs are installed are identical. An isometric drawing in tab 4 of Appendix F of ER 262 shows the installations: Each LEFM is located about 6 diameters downstream of a 90<sup>0</sup> bend, which is in turn about 10 diameters downstream of a second, non planar 90<sup>0</sup> bend. Though the bends are separated, the non planar

configuration produces a swirl in some of the loops--up to 9% in loop 2, around 4% in loops 1 and 3, 1% in loop 4. For all loops, the profiles are flatter than those for fully developed flow in smooth pipes: the flatness ranges from 0.92 to 0.96.<sup>1</sup>

The initial response to this RAI referred to Appendix F of ER 80P. Table F-3 in this appendix provides calibration data on two Westinghouse flow elements (including one identical to those used at IP 3) downstream of one and two bends. [REDACTED]

Recent tests, performed on the prototype for an improved Caldon chordal flow element (the Mark II design), provide additional confirmation of the low sensitivity of 4 path chordal LEFMs to flow profile<sup>2</sup>. The tests were performed in straight pipe, with the LEFM at various distances downstream of flow straighteners and, additionally, in a variety of complex hydraulic geometries. For all of the latter tests, the LEFM was about 9 downstream of a 180° bend—a location qualitatively similar to that at IP 3—the greater distance from the bend is offset by the more pronounced distortion and vortices produced by the 180° bend (versus the 90°) bend. The configuration upstream of the 180° bend was varied. A header upstream of the bend was fed by two non planar feeds—one immediately upstream of the 180, the other more distant. The proportion of the total flow seen by the LEFM could be varied between the two feeds. Varying the flow proportion between the feeds caused the swirl and the flatness to vary, providing an excellent parametric test of the sensitivity of the chordal system to hydraulic variables.

Results are shown in Figures 1 and 2. Figure 1 shows the sensitivity to flatness. The cluster of data on the left—for flatness in the 0.83 to 0.85 range—are the straight pipe data. The cluster of data on the right—flatness 0.90 and up—are with complex upstream geometries. The latter group embraces the flatness ratios measured at IP 3. The mean Profile Factors for the two data sets are essentially the same— [REDACTED] band about the straight pipe mean bounds all the data, including some for hydraulic conditions substantially more extreme than those at IP3.

Figure 2 shows the sensitivity of the profile factor to swirl<sup>3</sup>. There is no clear correlation of the Profile Factor with the magnitude of the swirl. The straight pipe data are clustered near zero swirl. All but one of the complex geometry cases are in the 1 to 6% swirl range --generally similar to the swirl that is present at IP 3. The extreme swirl data point (at 40% of the axial velocity) was produced by introducing all of the flow through the non planar feed immediately upstream of the 180° bend. [REDACTED]

<sup>1</sup> Flatness, as defined for Caldon 4 path chordal flowmeters, is the ratio of the sum of the outside (short) path velocities to the sum of the inside (long) path velocities. The significance of this ratio is discussed in Caldon engineering report ER 262. The data quoted are also taken from ER 262 (tab 4, Appendix F).

<sup>2</sup> The Mark II flow element differs only in mechanical details from the flow elements used at IP 3. The chordal spacing, path angles and transducer housings are essentially the same.

<sup>3</sup> Swirl is defined here as the absolute value of the tangential velocity, normalized to the mean axial velocity as measured at the outside paths (i.e., at 0.86 of the inside radius.)

Responses and Further Clarifications to NRC Questions from September 29, 1998 Meeting  
**Non-Proprietary version**

In summary, these data show that the selection of the Profile Factors for the IP 3 flow elements based on straight pipe data is a reasonable basis, given the IP 3 hydraulic geometry. They also show that the allowances for the uncertainties in the IP 3 Profile Factors are conservative.

October 25, 2002  
HEstrada

**Table 1**  
**Comanche Peak and IP 3 Profile Factor Uncertainty Comparisons**

|   |             |    |             |
|---|-------------|----|-------------|
|   |             |    |             |
| <b>Allowance, Profile Factor<br/>Uncertainty **</b> | $\pm 0.4\%$ | -- | $\pm 0.4\%$ |

\* Because the flow element sample covered a range of sizes, tested in a certified laboratory at different times over several years, no additional uncertainty for the laboratory was carried in the analysis.

\*\* Bounding Profile Factor uncertainty allowance assumed in analyses for LEFM Check in Caldon Engineering Reports ER 80P, ER 160P and ER 157P. These analyses assume that the flow element was calibrated in a flow laboratory; hence most dimensional uncertainties are embedded in the measured profile factor. [The analyses do include uncertainties associated with the installation of the flow element in the plant. These uncertainties are not included above. They are comparable for Comanche Peak, for IP 3 and in the Engineering Reports]

\*\*\* R is used to denote an uncertainty assumed, in the IP analysis, to vary randomly from one flow element to another. S is used to denote an uncertainty that is systematic from one flow element to another. Because IP 3 has 4 loops, random uncertainties in loop flow measurements are reduced by  $1/\sqrt{N} = 1/\sqrt{4} = 1/2$  in the unit uncertainty analysis. Systematic uncertainties however are not reduced.

Figure 1

Profile Factor vs Flatness, 16 inch MKII Prototype flow element

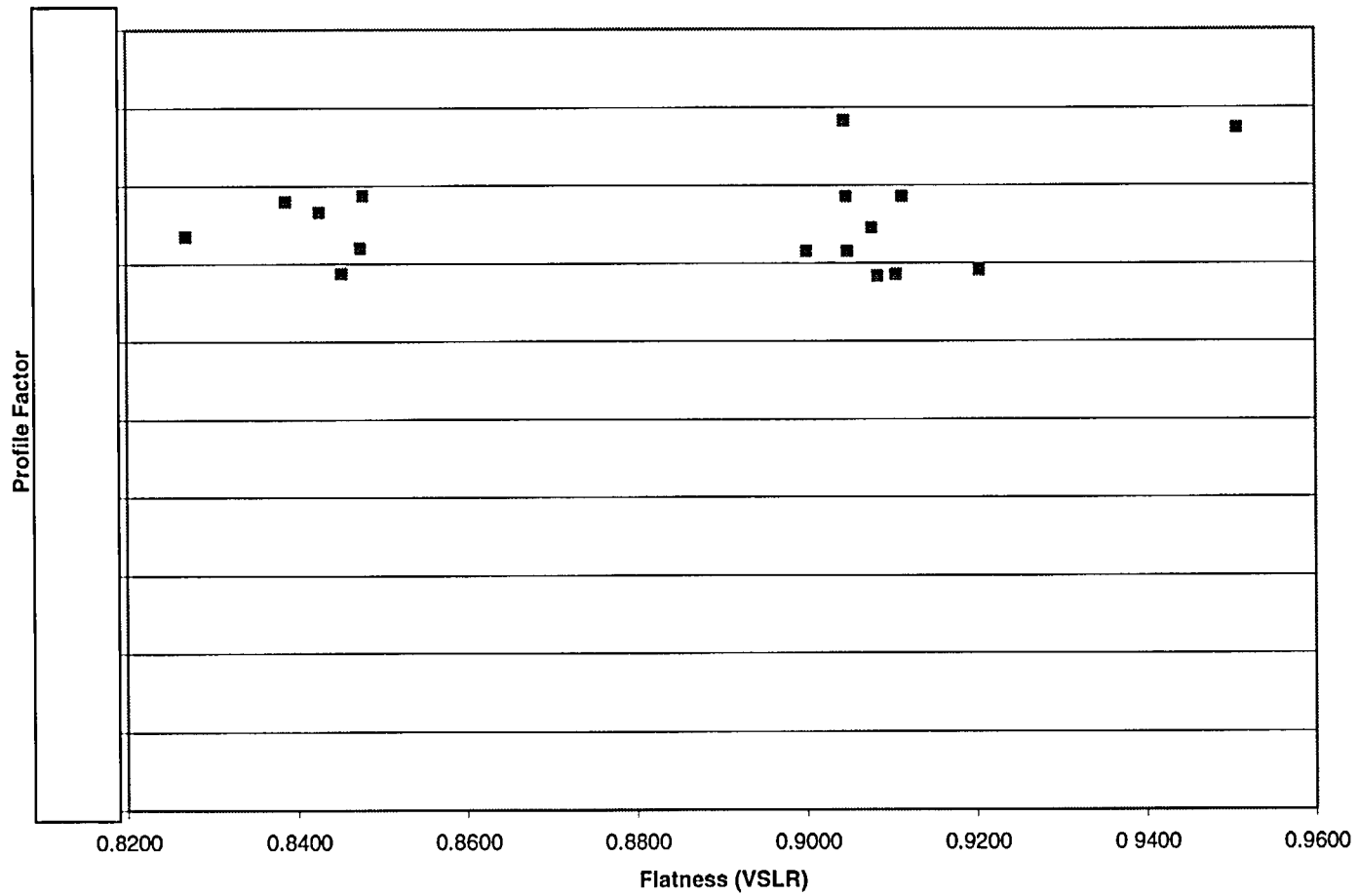


Figure 2

Profile Factor vs Swirl, 16 inch MKII prototype flow element

