Caldon, Inc.
1070 Banksville Avenue
Pittsburgh, PA 15216
412-341-9920 Tel
412-341-9951 Fax
www.caldon.net

April 5, 2001
CAW 01-04

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

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: LEFM Interface and Reconciliation Document, "Response to Request for Additional Information in Support of LAR Nos. 289 and 161, Letter L-01-061"

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-01-04 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-01-04 and should be addressed to the undersigned.

Very truly yours,

Calvin R Hastings

Calvin R. Hastings
President and CEO

Enclosures

April 5, 2001
CAW-01-04

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 5th day of

April, 2001

Joann B. Thomas

Notarial Seal
Joann 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 the enclosure, LEFM Interface and Reconciliation Document, "Response to Request For Additional Information in Support of LAR Nos. 289 and 161, Letter L-01-061". This information is submitted for use by the NRC Staff and is expected to be applicable in other license submittals for justification of the use of Ultrasonic Flow Measurement Instrumentation to increase reactor plants' thermal power.

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.

Attachment B
LEFM Interface and Reconciliation Document
Calorimetric Uncertainties with the LEFM Check and Check Plus
April 5, 2001

I. Purpose

It is the purpose of this document to define precisely the uncertainties that Caldon will calculate and justify for a specific Appendix K uprate project. The uncertainties that are outside Caldon's scope are also defined, as well as the method for combining all uncertainties to obtain a power uncertainty. This document also breaks down the relationship between the uncertainties tabulated in Caldon reports covering the operation of the LEFM Check and LEFM CheckPlus instruments and the data that Caldon will provide for a specific uprate project.

II. Background

Reports covering the operation of the LEFM Check and LEFM CheckPlus instruments describe how the use of these instruments reduces the uncertainties in feedwater mass flow and feedwater enthalpy.[1] In combination with the uncertainties in the determination of other variables (steam enthalpy, for example), the uncertainties in feedwater mass flow and enthalpy establish the uncertainty in the core thermal power. The amount of a power increase allowable under an Appendix K uprate is directly dependent on achieving a thermal power uncertainty within bounds defined by the reports cited above.

The uncertainties in the variables measured by an LEFM, either mass flow or derived from its outputs (feedwater temperature and pressure, which are converted to enthalpy) are made up of several elements. These elements relate to the LEFM's measurements of time, to its dimensions, to the hydraulics of the installation and to correlations relating fluid temperature and density to sound velocity and pressure. With respect to the correlations and the measurements of time and dimensions, some of the uncertainties in mass flow are systematically related to the uncertainties in feedwater enthalpy while others are not. The structure and combination methods for power uncertainties are described further below.

III. Structure of the Thermal Power Uncertainties

The core thermal power as determined by a heat balance around the steam supply is given by:

(1) $Q_{RX} = W_{FW} (h_S - h_{FW}) + Q_{LOSS\ NET}$

Where Q_{RX} is the core thermal power
W_{FW} is the mass flow rate of the feed to the steam supply, the product of feedwater volumetric flow rate and feedwater density,
h_S is the enthalpy of the steam delivered by the steam supply, a function of its pressure and moisture content for saturated steam supplies and its pressure and temperature for superheated steam supplies,
h_{FW} is the enthalpy of the feedwater, a function of its temperature and pressure, and
$Q_{LOSS\ NET}$ is the net loss or gain in power from coolant pump heating, blowdown and/or reactor water purification, convective and radiant losses, etc.

[1] Caldon Engineering Reports ER-80P, ER-160P and ER-157P

The contributing uncertainties to the thermal power computation are defined by differentiating equation (1):

(2) $dQ_{RX} = dW_{FW} (h_S - h_{FW}) + W_{FW}\, dh_S - W_{FW}\, dh_{FW} + dQ_{LOSS\ NET}$

The contributors can be expressed per unit by dividing equation (2) by Q_{RX}.

(3) $dQ_{RX}/Q_{RX} = dW_{FW}/W_{FW}\, [1 - (Q_{LOSS\ NET}/Q_{RX})] + [dh_S/ (h_S - h_{FW})]\, [1 - (Q_{LOSS\ NET}/Q_{RX})] - [dh_{FW} / (h_S - h_{FW})]\, [1 - (Q_{LOSS\ NET}/Q_{RX})] + dQ_{LOSS\ NET}/ Q_{RX}$

Since the net gains and losses term is typically less than 1% of the reactor thermal power, the term $[1 - (Q_{LOSS\ NET}/Q_{RX})]$ may be taken as approximately 1.0. Hence,

(4) $dQ_{RX}/Q_{RX} = dW_{FW}/W_{FW} + [dh_S/ (h_S - h_{FW})] - [dh_{FW}/ (h_S - h_{FW})] + dQ_{LOSS\ NET}/ Q_{RX}$

It should be pointed out that equation (4) applies algebraically only if all error contributors are systematically related to each other. Most of these components are *not* systematically related. If all of the components were random errors or biases the power uncertainty of equation (4) would be the square root of the sum of the squares of the individual terms on the right hand side of the equation. In fact, a combination of the two procedures is appropriate as described below.

The feedwater enthalpy is a function of its temperature and pressure. Likewise, the density of the feedwater, which the LEFM combines with the volumetric flow to compute mass flow, is a function of temperature and pressure. Because of this and other factors, certain elements of the uncertainty in feedwater enthalpy are combined systematically with the mass flow uncertainty, while other elements, unrelated to the mass flow measurement, are combined randomly. For convenience in defining the combination of terms, the feedwater enthalpy will be related to its temperature and pressure by the following:

(5) $h_{FW} = \delta h/\delta p\,|_T\, (p_{FW} - p_0) + \delta h/\delta T\,|_p\, (T_{FW} - T_0) + h_0$

The computation of feedwater enthalpy from temperature and pressure by the plant computer—part of the thermal power computation—may be carried out by a more complex algorithm than that of equation (5), or the enthalpy may be determined from a look up table. Equation (5) is used here simply as a convenience for developing the elements of the error contributors to feedwater enthalpy. Using equation (5), the uncertainty in feedwater enthalpy is:

(6) $dh_{FW} = \delta h/\delta p\,|_T\, dp_{FW} + \delta h/\delta T\,|_p\, dT_{FW} + dh_0$

Here dh_0 represents the potential bias in the enthalpy algorithm of the plant computer.

Rewriting equation (4) to incorporate equation (6), and rearranging terms:

$$\text{(7)}\quad \frac{dQ_{RX}}{Q_{RX}} = \overbrace{\{dW_{FW}/W_{FW}\}}^{\mathbf{A}} - \overbrace{\{[1/(h_S - h_{FW})]\,[\delta h/\delta p\,|_T\, dp_{FW} + \delta h/\delta T\,|_p\, dT_{FW}]\}}^{\mathbf{B}}$$

$$+ \overbrace{\{[1/(h_S - h_{FW})]\, dh_O\}}^{C} + \overbrace{\{[1/(h_S - h_{FW})]\, dh_S\}}^{D} + \overbrace{\{dQ_{LOSS\ NET}/Q_{RX}\}}^{E}$$

In the determination of overall thermal power uncertainty, terms **A** and **B** will be provided by Caldon, based in part on a feedwater pressure uncertainty provided by the utility. This uncertainty is generally assumed to be within 11 psi.

Terms **C**, **D**, and **E** are outside of Caldon's scope, are based on other plant instruments, and are to be provided by others.

Caldon will provide a single uncertainty, **AB**, expressed as a percentage of the rated thermal power, that encompasses terms **A** and **B**. Under normal circumstances, there will not be a systematic relationship between term **AB**, on the one hand, and terms **C**, **D**, and **E**, on the other. Likewise, there will normally not be systematic relationships among terms **C**, **D**, and **E**. Therefore, the utility will normally compute the total thermal power uncertainty from the following.

$$\text{(8)}\quad dQ_{RX}/Q_{RX} = [(\mathbf{AB})^2 + (\mathbf{C})^2 + (\mathbf{D})^2 + (\mathbf{E})^2]^{1/2}$$

IV. Reconciliation of Uncertainties for Beaver Valley 1 and 2 With the Uncertainties Quoted in Caldon Engineering Reports

Table 1 below compares the expected site-specific bounding uncertainties for Beaver Valley Units 1 and 2 to the following Caldon Engineering Reports:

- ER-80P, Rev. 0, the original Caldon topical report from 1997 that requests a 1% power uprate based on an accuracy of the LEFM Check system bounded by 0.6% thermal power accuracy.
- ER-160P, Rev. 0, which presents instrument uncertainties exactly the same as those in ER-80P. ER-160P recognizes that, in accordance with NRC Rulemaking in June 2000, a power uprate up to and including 1.4% power can be requested for the LEFM Check System (since ER-80P demonstrates that its accuracy supports a thermal power uncertainty of ± 0.6%).
- ER-157P, Rev. 3, which describes Caldon's next generation LEFM CheckPlus. ER-157P revises the uncertainty analyses of ER-80P to reflect actual LEFM Check data as applied to a typical single flow measurement application (similar to Beaver Valley). It also shows that the LEFM Check system can achieve power uncertainties as low as ± 0.5% thermal power accuracy. Additionally, ER-157P demonstrates that the LEFM CheckPlus can support power uncertainties as small as ± 0.3%.