Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

February 24, 1983

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Unit 2
Supplemental Information to Proposed Amendment to Appendix A Technical Specification to Support Operator with Fuel Supplied by Exxon Nuclear Company
NRC Docket No. 50-237

References (a): T. J. Rausch letter to H. R. Denton December 12, 1982.

(b): T. J. Rausch letter to H. R. Denton dated February 7, 1983.

Dear Mr. Denton:

Enclosed is a supplemental information for the subject amendment to Provisional Operating License DPR-19 for Dresden Station, Unit 2. This information was requested by your staff at a January 24, 1983 meeting held in Bethesda, Maryland. This supplemental information offers a draft of a proposed test and cycle monitoring program and additional analysis to support the use of four (4) Exxon 9x9 lead test assemblies (LTAs) during this fuel cycle.

Attachment 1 to this letter is our draft proposal for a local stability test and cycle monitoring program. An earlier version was reviewed by your staff at a meeting held on February 10, 1983 and their comments incorporated.

Attachments 2 and 3 to this letter contains specific analysis by Exxon Nuclear Company supporting the use of the four LTAs. Attachment 2 is a proprietary version of the report, Attachment 3 is the non-proprietary form.

Accordingly, we have enclosed an affidavit (Attachment 4) signed by ENC, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission, and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.790 of the Commission's regulations.

A001 Rec'd w/out 2.790 Info

It is respectfully requested that the information which is proprietary to Exxon Nuclear Company, Inc. be withheld from public disclosure in accordance with 10 CFR Section 2.790 of the Commission's regulations. Correspondence with respect to the proprietary aspects of this application for withholding of the supporting ENC affidavit should be addressed to G. J. Busselman, Manager Fuel Design, Exxon Nuclear Company, 2101 Horn Rapids Road, P.O. Box 130, Richland, Washington 99352.

Please address any questions you may have concerning this matter to this office.

One (1) signed original and thirty-nine (39) copies of this letter with Attachments 1, 3 and 4 are provided for your use. In addition, six (6) copies of this letter with proprietary Attachment 2 are also being provided.

Very truly yours,

B. Rybak

B. Rybak
Nuclear Licensing Administrator

lm

Attachments

cc: Region III Inspector - Dresden
R. Gilbert - NRR
G. Schwenk

Attachments (1): Dresden 2 Cycle 9 9x9 Lead Test Assemblies - Proposed Local Stability Test and Cycle 9 Monitoring Requirements.

(2): Additional Analysis in Support of 9x9 Lead Test Assemblies for Dresden 2 Cycle 9 (Proprietary).

(3): Additional Analysis in Support of 9x9 Lead Test Assemblies for Dresden 2 Cycle 9 (Non-Proprietary).

(4): Affidavit of Gary J. Busselman attesting to the proprietary nature of Attachment 2 above dated February 16, 1983.

6062N

ATTACHMENT 1

Dresden 2 Cycle 9 - 9x9 Lead Test Assemblies

Proposed Local Stability Test and

Cycle 9 Monitoring Requirements

Proposed Stability Test

A. Initial Conditions

1. The test will be performed after preconditioning the reactor core for full power operation.

2. The test will be performed at the intersection of minimum recirculation pump speed (two pump operation) and approximately the 100% power/flow line (~38% of rated flow and ~54% of rated power).

3. The control rod pattern will correspond to the nominal full power pattern.

B. Data Acquisition

1. Prior to test initiation, baseline data will be recorded to define the initial conditions for the test. This will include reactor power, core flow, core pressure, control rod pattern, LPRM readings, cycle exposure, and nuclear limits on power distribution (from the POWERPLEX Core Monitoring System). This data will be taken at the reactor conditions specified in Section A.2 above.

2. During the test, local and core-wide power response will be monitored with a multi-channel strip chart recorder. The following instrument response will be recorded:

   a. 1 or 2 APRM channels
   b. The B, C and D level LPRMs from LPRM string 16-17 (adjacent to 9x9 assembly-see attached core map.)
   c. The B, C and D level LPRMs from LPRM string 16-09 or 08-17 (adjacent to 8x8 assembly-see attached core map).

The exact LPRMs and APRM(s) to be recorded will be determined prior to the test considering LPRM and APRM operability/availability. The nominal chart speed will be 1 inch/second to provide resolution of the expected power oscillation.

C. Test Criteria for Initiating Corrective Action

1. If the LPRM signals being monitored exhibit divergent oscillations, the actions specified in section E below will be taken. An oscillation will be considered divergent if its amplitude increases by 5 or more watts/cm^2* relative to the initial flux peak as observed on the strip chart recorder or the Rod Block Monitor LPRM display.

*Although the LPRMs are calibrated in heat flux units for steady-state operation, they are responding proportional to the nuetron flux under these transient conditions.

2. Prior to performing the test, LPRM action levels will be determined for each LPRM being monitored as follows:

$$\text{LPRM Action Level} = \frac{0.95\ (\text{initial LPRM reading})\ (\text{initial CPR for 9x9 assembly})}{(\text{full power CPR operating limit for 9x9 assembly})}$$

where the initial values correspond to values obtained prior to test initiation as identified in section B.1 above (with control rod D-4 at the normal, full power position).

If sustained LPRM oscillations are observed (decay ratio=1) such that their amplitude exceeds the above defined criteria, the actions specified in section E below will be taken.

3. If sustained LPRM oscillations are observed with an amplitude that does not exceed the action levels from C.2 above, withdrawal of control rod D4 will be terminated although data acquisition may continue. Upon completion of data acquisition (as determined by the cognizant engineer), the actions specified in section E below will be taken.

4. If divergent or sustained APRM oscillations in excess of 15% peak-to-peak are observed on the strip chart recorder or the normal APRM chart recorders, the actions specified in section E will be taken.

D. Test Initiation

The local reactivity perturbation shall be accomplished by full insertion of Control Rod D4 followed shortly thereafter by continuous withdrawal of Control Rod D4 to its initial, pre-test position. This control rod is selected due to its close proximity to the monitored 9x9 fuel assembly. See attached core map.

E. Immediate Actions

1. Terminate withdrawal of control rod D4.

2. Insert control rod D4 to position 00.

3. Insert additional control rods as necessary to terminate power oscillations (specific control rods will be identified prior to test initiation.)

F. Subsequent Actions for Continued Operation

1. In the event that no sustained or divergent power oscillations are observed during the test, normal ascension to power may continue upon completion of test.

2. In the event that sustained or divergent power oscillations are observed such that the section E actions are invoked, normal operation may continue according to the following:

   a. Verify that power oscillations have been damped (returned to pre-test noise levels).

b. Insert control rods as necessary to reduce the flow control line by 5%.

c. Increase core flow by 5%.

d. Perform single notch withdrawal of Control Rod D4 to its position prior to stability test initiation (normal full power position).

e. Proceed with normal power ascension using flow control.

f. Additional control rod withdrawal is allowed to increase the flow control line providing that core flow is at least 60% of rated flow.

g. Refer to Section G.

G. Long Term Corrective Actions (duration of cycle 9)

In the event that either (a) sustained or divergent oscillations are observed such that the section E actions are invoked or (b) the oscillatory behavior of LPRM location 16-09 (adjacent to 9x9 assembly) is inconsistent with the behavior of the monitored LPRMs adjacent to an 8x8 assembly, the need for restrictions on future operation during Cycle 9 will be determined by the Dresden On-Site Review Committee. Recommendations will be formulated as necessary in consultation with CECo's Nuclear Fuel Services Department, Off-Site Review, Exxon Nuclear and the NRC, based on the oscillations observed during the test. The need for supplemental LPRM monitoring during cycle 9 will also be determined.

Proposed Monitoring Requirements for D2C9

Existing hard-wired LPRM alarms at Dresden Station provide continuous monitoring for abnormal LPRM indications. If excessive local power oscillations occur during cycle 9, the alarm setpoint will be exceeded resulting in an audible and visual alarm in the control room. Station procedures will require that the operator insert control rods to suppress local oscillations if sustained or oscillatory alarm indications are observed. A separate alarm is provided for each LPRM detector. LPRM alarm setpoints will be established to ensure that power oscillations would be detected prior to achieving levels that would correspond to the MCPR Safety Limit.

Since unusual local power oscillations are not expected during the local stability test or during normal operation, the above described LPRM monitoring will provide adequate protection for cycle 9 operation. Substantial BWR operating experience at Commonwealth Edison and throughout the industry has demonstrated the strong neutronic coupling of BWR cores. The occurrence of significant local power oscillations will result in core-wide power oscillations readily observable on the APRMs which provide automatic alarm, rod block and reactor scram functions.

If unusual power oscillations are observed during the stability test, the need for additional LPRM monitoring during cycle 9 will be re-evaluated by the Dresden On Site Review Committee (see Test section G).

ATTACHMENT 3

ADDITIONAL ANALYSIS IN SUPPORT OF 9x9 LEAD TEST ASSEMBLIES FOR DRESDEN 2 CYCLE 9

In support of the 9x9 lead test assembly program for Dresden 2 Cycle 9, ENC performed a fuel rod integrity analysis to demonstrate that substantial margin to the MCPR safety limit exists for Cycle 9 operation during a postulated core-wide unstable power oscillation. This analysis was performed for both limiting 8x8 and 9x9 fuel assemblies. The results of this analysis were presented during a joint meeting in Bethesda, Maryland, on January 24, 1983. The meeting was attended by representatives of the Nuclear Regulatory Commission, Exxon Nuclear Company, and Commonwealth Edison. The description and results of the analysis are attached.

In addition to the above, results of core stability calculations for ENC 8x8 and 9x9 reload fuels were discussed during the meeting. The core stability calculations were for an equilibrium cycle of Dresden 2/3 wherein the core is loaded entirely of ENC 8x8 or 9x9 reload fuels. A description and the results of the analysis are attached.

Fuel Rod Integrity Analysis

As part of the 9x9 lead assembly program for Dresden 2 Cycle 9, an evaluation of the impact upon limiting 8x8 and 9x9 fuel assemblies as a consequence of a postulated undamped power oscillation was performed. This analysis was performed to demonstrate that:

[ ]

o The performance of the 8x8 and 9x9 fuel during the power oscillation is similar.

[ ]

The analysis was performed using the Exxon Nuclear JP-BWR methodology as reported in XN-NF-80-19 and was performed in several steps in order to demonstrate compliance with the above criteria. A core-wide unstable (decay ratio = 1.0) power oscillation was generated with the COTRAN computer code in order to obtain core average values of power and flow during the oscillation. [ ]

[

]

The results of the XCOBRA code are provided in Table I [

]

Table I

Limiting Assembly XCOBRA Analysis

Limiting Fuel Type	Initial CPR	Transient CPR	MCPR Safety Limit
8x8	[	]	1.05
9x9			1.05

A detailed description for each step of the analysis is provided in the following sections.

Core Stability Model

The COTRAN analysis utilized the core average Dresden 2 Cycle 9 input as a base model. This base model is equivalent to that used in determining the Cycle 9 decay ratio values as reported in the Dresden 2 Cycle 9 Reload Analysis (XN-NF-82-77(P), Revision 1). [

] In addition, both the flow-bias scram and APRM high-level trip point were defeated and the core was allowed to oscillate in an unrestricted fashion. A comparison of conditions used in the stability analysis in support of the Cycle 9 reload and the fuel rod integrity analysis described herein are presented in Table II. As indicated by the

Table II

Stability Analysis Comparison

Parameter		
Initial Conditions	Cycle 9 Reload Analysis*	Fuel Rod Integrity Analysis
Core Flow	33% of rated	33% of rated
Core Power	58% of rated	58% of rated
[		]
[		]
[		]
[		]
[		]
Calculated Results		
Decay Ratio	0.69	1.0

* XN-NF-82-77(P), Revision 1.

initial conditions shown in Table II, the stability calculation performed for the fuel rod integrity analysis bounds the anticipated conditions utilized in the Cycle 9 Reload Analysis. Additional results of core stability calculations for the fuel rod integrity analysis are provided in Figure 1, which presents core power, core average heat flux, and core average flow as functions of time during the power oscillation.

Limiting Assembly Heat Flux Model

[

]

Table III

Initial Limiting Assembly Conditions

Parameter	8x8	9x9
Assembly Power, MW	[	]
Fuel Assy. Heat Flux, BTU/hr-ft^2		
Channel Flow, lb/hr		
Gap Coefficient, BTU/hr-ft^2-^{o}F		

CPR Analysis

The CPR analysis was performed using the XCOBRA model established for the Cycle 9 Reload Analysis modified to calculate the initial 8x8 and 9x9 CPR values consistent with the initial conditions for the core stability analyses. [

]

Table IV

Assembly Heat Flux and Flow Comparisons

	Time of Max. Heat Flux [ ]	Time of Min. Flow [ ]	Values Used In CPR Analysis
<u>8x8 Limiting Assy.</u>			
Fuel Assy. Heat Flux, BTU/hr-ft^2			
Fuel Assy. Flow, lb/hr			
<u>9x9 Limiting Assy.</u>			
Fuel Assy. Heat Flux, BTU/hr-ft^2			
Fuel Assy. Flow, lb/hr			

<u>Full Core Stability Analysis of 8x8 and 9x9 Fuels</u>

As part of the Exxon Nuclear Company effort to develop a 9x9 reload fuel design for boiling water reactors, stability analyses were performed for a Dresden 2/3 equilibrium cycle for fuel core loadings of 8x8 and 9x9 fuels. The principal design features of these fuel designs are provided in Table V. For comparison purposes, the design features of the 9x9 lead assemblies for Dresden 2 Cycle 9 are also presented in Table V.

The stability analyses for the 8x8 and 9x9 reload fuel designs were performed in accordance with the generic stability methodology presented in XN-NF-80-19. The results of the analyses are presented in Table VI. As indicated by the results in Table VI, the decay ratio for core-wide stability for both reload fuel designs provides margin to the potential of core-wide instability (decay ratio = 1.0) for Dresden 2/3 for reactor cores fully loaded with each reload fuel design.

Table V

Assembly Design Characteristics

Mechanical Design Parameters	8x8	9x9 Reload	9x9 Leads
Fuel Pellet O.D. (in.)	[ ]	.3565	
Cladding O.D. (in.)	.484	.424	
Cladding Thickness (in.)	.035	.030	
Active Length (in.)			
Enriched Fuel	133.24	133.24	
Natural Fuel	12.0	12.0	
Fuel Rod Pitch (in.)	.640	.572	

Thermal-Hydraulic Design Parameters	8x8	9x9 Reload	9x9 Leads
Number of Grid Spacers	7	7	
Fuel Assy. Heat Transfer Area (ft^2)	96.6	106.1	
Fuel Assy. Flow Area (ft^2)	.111	.113	
Upper Tie Plate Flow Area (ft^2)	.106	.094	
Lower Tie Plate Flow Area (ft^2)	.058	.060	
Hydraulic Diameter (ft)	.045	.042	

Neutronics Design Parameters	8x8	9x9 Reload	9x9 Leads
Fuel Assembly Avg. Enrichment, (% U-235)			
Batch Avg. Discharge Exposure, GWD/MTU			
Fuel Assembly Loading, KgU			
Fuel Pellet Density, % TD			

---

* Target value for four (4) lead test assemblies.

Table VI

Results of Stability Analysis for 8x8 and 9x9 Reload Fuels *

	Decay Ratio **
9x9 Reload	
Natural Circulation - Rod Block Line (33% rated flow - 58% rated power)	
Natural Circulation - 100% Rod Line (32% rated flow - 47% rated power)	
8x8 Reload	
Natural Circulation - Rod Block Line (33% rated flow - 58% rated power)	
Natural Circulation - 100% Rod Line (32% rated flow - 47% rated power)	

---

* Full core analysis for each reload fuel design.

** Analysis performed as part of EPRI-supported program (EPRI Contract No. RP1580-5) and reported in XN-NF-642, July 1982.

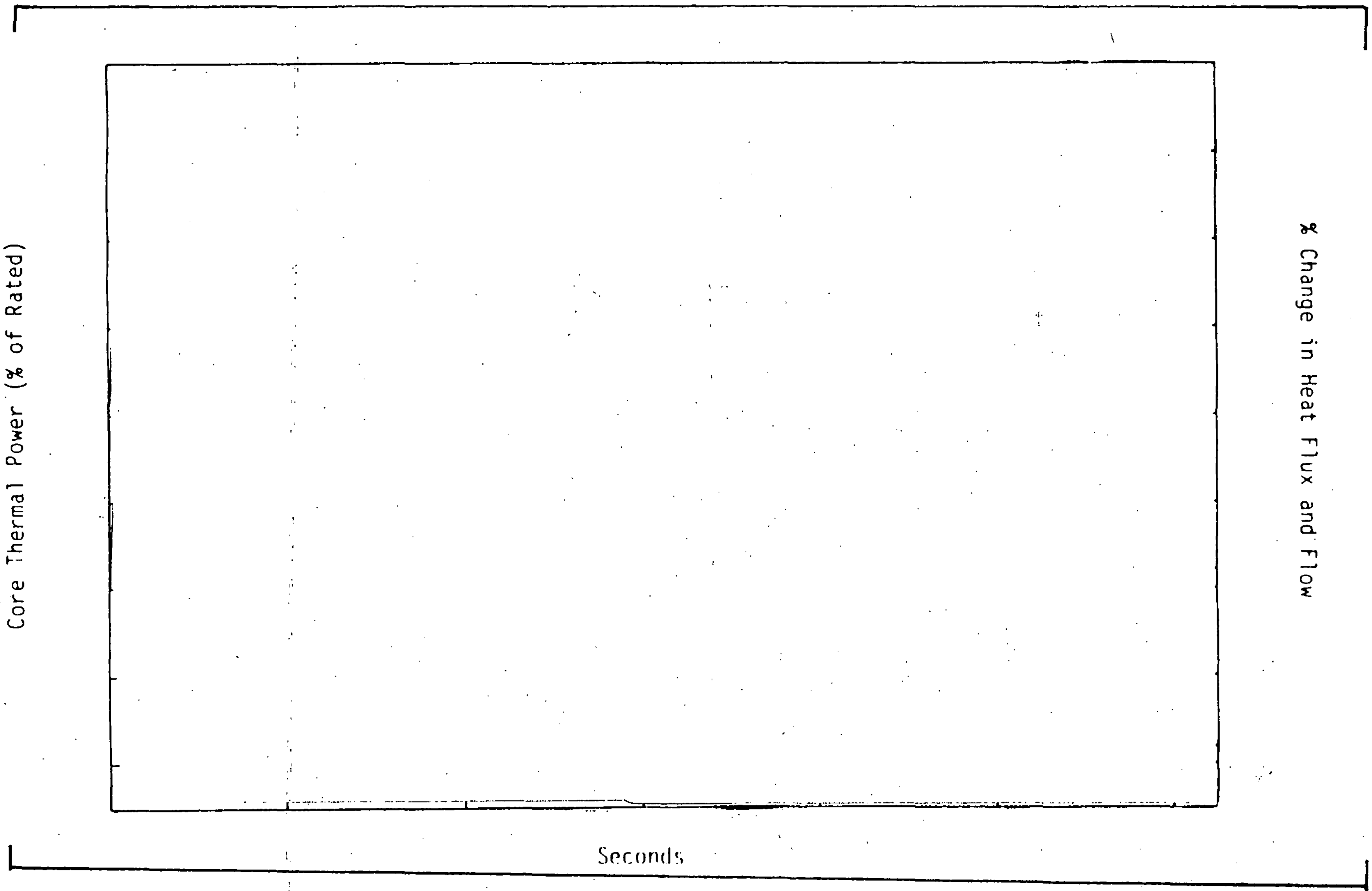

Figure 1 Variation in Heat Flux, Flow and Power versus Time

ATTACHMENT 4

A F F I D A V I T

STATE OF Washington)
ss.
COUNTY OF Benton)

I, Gary J. Busselman, being duly sworn, hereby say and depose:

1. I am Manager, Fuel Design, for Exxon Nuclear Company, Inc. ("ENC"), and as such I am authorized to execute this Affidavit.

2. I am familiar with ENC's detailed document control system and policies which govern the protection and control of information.

3. I am familiar with the document entitled "Additional Analysis in Support of 9x9 Lead Test Assemblies for Dresden 2 Cycle 9," referred to as "Document". Information contained in this Document has been classified by ENC as proprietary in accordance with the control system and policies established by ENC for the control and protection of information.

4. The Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by ENC and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in the Document as being proprietary and confidential.

5. The Document has been made available to the United States Nuclear Regulatory Commission in confidence, with the request that the information contained in the Document not be disclosed or divulged.

6. The Document contains information which is vital to a competitive advantage of ENC and would be helpful to competitors of ENC when competing with ENC.

7. The information contained in the Document is considered to be proprietary by ENC because it reveals certain distinguishing aspects of BWR stability analysis methods which secure competitive economic advantage to ENC for fuel design optimization and improved marketability, and includes information utilized by ENC in its business which affords ENC an opportunity to obtain a competitive advantage over its competitors who do not or may not know or use the information contained in the Document.

8. The disclosure of the proprietary information contained in the Document to a competitor would permit the competitor to reduce its expenditure of money and manpower and to improve its competitive position by giving it extremely valuable insights into BWR stability analysis methods, and would result in substantial harm to the competitive position of ENC.

9. The Document contains proprietary information which is held in confidence by ENC and is not available in public sources.

10. In accordance with ENC's policies governing the protection and control of information, proprietary information contained in the Document has been made available, on a limited basis, to others outside ENC only as required and under suitable agreement providing for non-disclosure and limited use of the information.

11. ENC policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

12. This Document provides information which reveals BWR stability analysis methods developed by ENC over the past several years. ENC has invested millions of dollars and many man-years of effort in developing the analysis methods revealed in the Document. Assuming a competitor had available the same background data and incentives as ENC, the competitor might, at a minimum, develop the information for the same expenditure of manpower and money as ENC.

13. Based on my experience in the industry, I do not believe that the background data and incentives of ENC's competitors are sufficiently similar to the corresponding background data and incentives of ENC to reasonably expect such competitors would be in a position to duplicate ENC's proprietary information contained in the Document.

THAT the statements made hereinabove are, to the best of my knowledge, information, and belief, truthful and complete.

FURTHER AFFIANT SAYETH NOT.

Gary J. Busselman

SWORN TO AND SUBSCRIBED

before me this 16 day of

February, 1983.

Eleanor K. Felts

NOTARY PUBLIC