VIRGINIA ELECTRIC AND POWER COMPANY
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W. L. STEWART
VICE PRESIDENT
NUCLEAR OPERATIONS

February 27, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
Attn: Mr. D. G. Eisenhut, Director
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Serial No. 060
PSE/NAS/cdk/0022N
Docket Nos. 50-280
50-281
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50-339
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DPR-37
NPF-4
NPF-7

Gentlemen:

VEPCO REACTOR SYSTEM TRANSIENT ANALYSES
SUPPLEMENTAL INFORMATION

In our letter to you of April 14, 1981, Serial No. 215, we transmitted our Topical Report VEP-FRD-41, "Vepco Reactor System Transient Analyses Using The RETRAN Computer Code". The report, which was provided for review by your staff, describes the system transient analysis capability developed by Vepco for analysis of certain transients which are determined to require reanalysis as a result of core reloads or other operational or design changes at our nuclear units.

In November of 1982 Mr. James L. Carter of the Division of Systems Integration informally provided us with a request for additional information which would be required to complete the review. The information requested fell into five general categories outlined in Attachment 1.

Attachment 2 provides a portion of the requested information. Specifically, the information is intended to address the request of item (1) on Attachment 1. We are currently assembling the additional information requested. Our intent is to submit this additional data by mid-1984.

If you have any questions on this material or on our topical report, please contact us.

Very truly yours,

W. L. Stewart

cc: Mr. J. L. Carter
Division of Systems Integration

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ATTACHMENT 1

ADDITIONAL INFORMATION REQUESTED
TO COMPLETE VEPCO RETRAN TOPICAL REVIEW

Plant Models

1. Volume and flow path network description, including heat slabs.

2. Component models used; description of user modifications to default models.

3. Discussion, description, and qualification of control system models.

4. Discussion of RETRAN input options selected.

Model Qualification

5. Provide additional comparison to actual plant data and/or other similar code calculations and supporting discussions.

ATTACHMENT 2

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TABLE 1-1

SINGLE LOOP MODEL CONTROL VOLUME DESCRIPTION

Volume ID	Description	Mixture Type	Temperature Transport Delay
1	Vessel upper plenum	H	No
2	Reactor hot leg	H	Yes
3	S/G inlet plenum	H	No
4	S/G tube volume 1	H	No
5	S/G tube volume 2	H	No
6	S/G tube volume 3	H	No
7	S/G tube volume 4	H	No
8	Pump suction piping*	H	Yes
9	Reactor coolant pump	H	No
10	Reactor cold leg	H	Yes
11	Downcomer	H	Yes
12	Vessel lower plenum	H	No
13	Core bypass	H	Yes
14	Core section 1	H	No
15	Core section 2	H	No
16	Core section 3	H	No
17	Pressurizer	N	No
18	Pressurizer surge line	H	Yes
19	S/G secondary side	T	No

Abbreviations:
S/G - steam generator
H - homogeneous equilibrium
N - two-phase non-equilibrium
T - two-phase equilibrium

*Includes S/G outlet plenum

TABLE 1-2

SINGLE LOOP MODEL JUNCTION DESCRIPTION

Junction ID	Description	Type	Two-Phase Fanning Friction Multiplier	Valve Index	H/V
1	Vessel outlet nozzle	Normal	Baroczy	No	V
2	Hot leg outlet	Normal	Baroczy	Yes	H
3	S/G inlet plenum	Normal	Baroczy	No	H
4	S/G tubes	Normal	Baroczy	No	H
5	S/G tubes	Normal	Baroczy	No	V
6	S/G tubes	Normal	Baroczy	No	H
7	S/G-pump suction	Normal	Baroczy	No	H
8	Pump intake	Normal	Baroczy	No	H
9	Pump discharge	Normal	Baroczy	No	V
10	Vessel inlet nozzle	Normal	Baroczy	No	V
11	Downcomer outlet	Normal	Baroczy	No	H
12	Bypass inlet	Normal	Baroczy	No	H
13	Lower plenum - core	Normal	Baroczy	No	H
14	Core internal	Normal	Baroczy	No	H
15	Core internal	Normal	Baroczy	No	H
16	Core - upper plenum	Normal	Baroczy	No	H
17	Bypass outlet	Normal	Baroczy	No	H
18	Cold leg spray intake	Fill	Baroczy	No	V
19	Przr. spray	Spray	Baroczy	No	H
20	Przr. - surge line	Normal	Baroczy	No	H
21	Surge line - hot leg	Normal	Baroczy	No	H
22	Feedwater fill	Fill	Baroczy	No	V
23	S/G outlet	Fill	Homog.	Yes	H
24	PORV 1	Fill	Baroczy	No	H
25	PORV 2	Fill	Baroczy	No	H

TABLE 1-2 (cont.)

SINGLE LOOP MODEL JUNCTION DESCRIPTION

Junction ID	Description	Type	Two-Phase Fanning Friction Multiplier	Valve Index	H/V
26	S/G atm. steam relief	Fill	Homog.	No	H
27	Przr. safety valve	Fill	Baroczy	No	H
28	Steamline safety valve 1	Fill	Homog.	No	H
29	Steamline safety valve 2	Fill	Homog.	No	V

Notes:
All junctions have single-stream compressible flow except junction 21 which is incompressible flow.

Abbreviations:
PORV - power operated relief valve
atm. - atmospheric
S/G - steam generator
Przr. - pressurizer
Homog. - homogeneous
V - vertically distributed junction area
H - horizontally distributed junction area

TABLE 1-3
SINGLE LOOP MODEL HEAT CONDUCTOR DESCRIPTION

Conductor ID	Description	Left Volume	Right Volume	Geometry	Heat Exchg. No.
1	Bottom core	0	14	Cylind.	-
2	Middle core	0	15	Cylind.	-
3	Top core	0	16	Cylind.	-
4	S/G tubes 1(inlet)	4	19	Cylind.	1
5	S/G tubes 2	5	19	Cylind.	1
6	S/G tubes 3	6	19	Cylind.	1
7	S/G tubes 4(outlet)	7	19	Cylind.	1

TABLE 1-4

SINGLE LOOP MODEL TRIP DESCRIPTION

Trip ID	Cause of Trip Activation	Trip Action
1	End of transient time	End calculation
2	High flux (normalized power)	Scram
3	Overtemperature delta-T	Scram
4	Overpower delta-T	Scram
5	High pressurizer pressure	Scram
6	Low pressurizer pressure	Scram
7	High pressurizer level	Scram
8	Low coolant flow	Scram
9	User specified time *	Close loop isolation valves
10	Low backup heater setpoint	Turn pressurizer heaters on
11	High backup heater setpoint	Turn pressurizer heaters off
12	User specified time *	Shut off reactor coolant pumps
13	Transient time = 0 sec	Trip initialization
14	User specified time *	Uncontrolled rod withdrawal
15	User specified time *	Scram
16	High pressurizer pressure	Open PORV # 1
17	Low pressurizer pressure	Close PORV # 1
18	High spray setpoint	Open PORV # 2
19	Low spray setpoint	Close PORV # 2
20	High S/G pressure	Open atm. steam relief valve
21	Low S/G pressure	Close atm. steam relief valve
22	High S/G pressure	Open S/G safety valves
23	Low S/G pressure	Close S/G safety valves
24	High pressurizer pressure	Open pressurizer safety valves
25	Low pressurizer pressure	Close pressurizer safety valves

TABLE 1-4 (cont.)

SINGLE LOOP MODEL TRIP DESCRIPTION

Trip ID	Cause of Trip Activation	Trip Action
26	User specified time *	Turbine trip
27	Low power	End calculation
28	Low-low steam generator mass	Scram
29	Low-low steam generator mass	Auxiliary feedwater on
30	Scram	Turbine trip

Notes:
* Not applicable for most transients.

Abbreviations:
PORV - power operated relief valve
atm. - atmospheric
S/G - steam generator

TABLE 2-1

TWO LOOP MODEL CONTROL VOLUME DESCRIPTION

Volume ID	Description	Mixture Type	Temperature Transport Delay	Two-phase Fanning Friction Multiplier
ONE LOOP SIDE				
101	Vessel upper plenum	H	No	Baroczy
102	Reactor hot leg	H	Yes	Baroczy
103	S/G inlet plenum	H	No	Baroczy
104	S/G tube volume 1	H	No	Baroczy
105	S/G tube volume 2	H	No	Baroczy
106	S/G tube volume 3	H	No	Baroczy
107	S/G tube volume 4	H	No	Baroczy
108	Pump suction piping*	H	Yes	Baroczy
109	Reactor coolant pump	H	No	Baroczy
110	Reactor cold leg	H	Yes	
111	Downcomer	H	Yes	Baroczy
112	Vessel lower plenum	H	No	Baroczy
113	Core section 1	H	No	Baroczy
114	Core section 2	H	No	Baroczy
115	Core section 3	H	No	Baroczy
116	Core section 4	H	No	Baroczy
701	S/G Secondary side riser	N	No	Baroczy
702	S/G Secondary side dome	H	No	Homog.

*Includes S/G outlet plenum

TABLE 2-1 (cont.)

TWO LOOP MODEL CONTROL VOLUME DESCRIPTION

Volume ID	Description	Mixture Type	Temperature Transport Delay	Two-phase Fanning Friction Multiplier
TWO LOOP SIDE				
201	Vessel upper plenum	H	No	Baroczy
202	Reactor hot leg	H	Yes	Baroczy
203	S/G inlet plenum	H	No	Baroczy
204	S/G tube volume 1	H	No	Baroczy
205	S/G tube volume 2	H	No	Baroczy
206	S/G tube volume 3	H	No	Baroczy
207	S/G tube volume 4	H	No	Baroczy
208	Pump suction piping *	H	Yes	Baroczy
209	Reactor coolant pump	H	No	Baroczy
210	Reactor cold leg	H	Yes	Baroczy
211	Downcomer	H	Yes	Baroczy
212	Vessel lower plenum	H	No	Baroczy
213	Core section 1	H	No	Baroczy
214	Core section 2	H	No	Baroczy
215	Core section 3	H	No	Baroczy
216	Core section 4	H	No	Baroczy
703	S/G Secondary side riser	N	No	Baroczy
704	S/G Secondary side dome	H	No	Homog.
300	Core bypass	H	Yes	Baroczy
400	Upper head region	H	No	Baroczy
500	Pressurizer + Surge line	N	No	Baroczy
800	Containment Sink	H	No	Baroczy

Abbreviations:
S/G - steam generator
H - homogeneous equilibrium
N - two-phase non-equilibrium
T - two-phase equilibrium
HOMOG - homogeneous

*Includes S/G outlet plenum

TABLE 2-2

TWO LOOP MODEL JUNCTION DESCRIPTION

Junction ID	Description	Type	Valve Index	H/V
101	Vessel outlet nozzle	Normal	No	V
102	Hot leg outlet	Normal	No	H
103	S/G inlet plenum	Normal	No	H
104	S/G tubes	Normal	No	H
105	S/G tubes	Normal	No	H
106	S/G tubes	Normal	No	H
107	S/G-pump suction	Normal	No	H
108	Pump intake	Normal	No	H
109	Pump discharge	Normal	No	V
110	Vessel inlet nozzle	Normal	No	V
111	Downcomer outlet	Normal	No	H
112	Bottom plenum - core	Normal	No	H
113	V113 - V114 -core internal	Normal	No	H
114	V114 - V115 -core internal	Normal	No	H
115	V115 - V116 -core internal	Normal	No	H
116	Core - upper plenum	Normal	No	H
117	Core - upper plenum	Normal	No	H
**********				
701	Riser - drum	Normal	No	H
801	Drum - containment	Normal	Yes	H
802	Drum - containment	Normal	Yes	H
901	Feedwater fill	Fill	No	H
**********				

TABLE 2-2 (cont.)

TWO LOOP MODEL JUNCTION DESCRIPTION

Junction ID	Description	Type	Valve Index	H/V
201	Vessel outlet nozzle	Normal	No	V
202	Hot leg outlet	Normal	No	H
203	S/G inlet plenum	Normal	No	H
204	S/G tubes	Normal	No	H
205	S/G tubes	Normal	No	V
206	S/G tubes	Normal	No	H
207	S/G-pump suction	Normal	No	H
208	Pump intake	Normal	No	H
209	Pump discharge	Normal	No	V
210	Vessel inlet nozzle	Normal	No	V
211	Downcomer outlet	Normal	No	H
212	Bottom plenum - core	Normal	No	H
213	V213 - V214 -core internal	Normal	No	H
214	V214 - V215 -core internal	Normal	No	H
215	V215 - V216 -core internal	Normal	No	H
216	Core - upper plenum	Normal	No	H
217	Core - upper plenum	Normal	No	H
**********				
702	Riser - drum	Normal	No	H
803	Drum - containment	Normal	No	H
804	Drum - containment	Normal	No	H
902	Feedwater fill	Fill	Yes	V
903	Safety Injection fill	Fill	Yes	H
**********				

TABLE 2-2 (cont.)

TWO LOOP MODEL JUNCTION DESCRIPTION

Junction ID	Description	Type	Valve Index	H/V
301	Bypass - upper plenum(1l)	Normal	No	H
302	Bypass - upper plenum(2l)	Normal	No	H
303	Bottom plenum - bypass(1l)	Normal	No	H
304	Bottom plenum - bypass(2l)	Normal	No	H
402	Upper plenum - Head	Normal	Yes	H
403	V110-V211	Normal	No	H
404	V210-V111	Normal	No	H
500	Pressurizer - Hot Leg	Normal	No	H

Abbreviations:
- PORV - power operated relief valve
- Atm. - atmospheric
- S/G - steam generator
- Przr. - pressurizer
- Homog. - homogeneous
- V - vertically distributed junction area
- H - horizontally distributed junction area
- 1l - one loop
- 2l - two loop

TABLE 2-3
TWO LOOP MODEL HEAT CONDUCTOR DESCRIPTION

Conductor ID	Description	Left Volume	Right Volume	Geometry	Heat Exchg. No.
	Single Loop Side				
101	Bottom core	0	113	Cylind.	-
102	Middle core 1	0	114	Cylind.	-
103	Middle core 2	0	115	Cylind.	-
104	Top core	0	116	Cylind.	-
105	S/G tubes 1(inlet)	104	701	Cylind.	1
106	S/G tubes 2	105	701	Cylind.	1
107	S/G tubes 3	106	701	Cylind.	1
108	S/G tubes 4(outlet)	108	701	Cylind.	1
	Double Loop Side				
201	Bottom core	0	213	Cylind.	-
202	Middle core 1	0	214	Cylind.	-
203	Middle core 2	0	215	Cylind.	-
204	Top core	0	216	Cylind.	-
205	S/G tubes 1(inlet)	204	703	Cylind.	2
206	S/G tubes 2	205	703	Cylind.	2
207	S/G tubes 3	206	703	Cylind.	2
208	S/G tubes 4(outlet)	208	703	Cylind.	2

TABLE 2-4

TWO LOOP MODEL TRIP DESCRIPTION

Trip ID	Cause of Trip Activation	Trip Action
1	End of transient time	End calculation
2	Transient time = 0 sec	Trip Initialization
3	Low pressurizer pressure	Safety Injection actuation
4	Blank	For future use
5	Steamline high delta - P	No credit taken
6	High steam flow	------
7	Low Tavg	------
8	Low steam pressure	------
9	Coincidence trips 6 and 7	Safety Injection actuation
10	Coincidence trips 6 and 8	Safety Injection actuation
11	Coincidence trips 6 and 7	Isolate steamlines
12	Coincidence trips 6 and 8	Isolate steamlines
13	Low pressurizer pressure	Heaters on
14	High pressurizer pressure	Heaters off
15	User specified time	Pumps off
16	User specified time	Isolate feedline
17	Transient time = 0 second	Steamline break initiation