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Proprietary Notice
This letter forwards proprietary information in accordance with 10CFR2.390. Upon the removal of Enclosure 1, the balance of this letter may be considered non-proprietary.

MFN 09-007

Docket No. 52-010

February 6, 2009

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, D.C. 20555-0001

Subject: **Response to Portion of NRC Request for Additional Information Letter No. 253 Related to the ESBWR Design Certification – Licensing Topical Report (LTR) NEDO-33337 "ESBWR Initial Core Transient and Accident Analyses – RAI Numbers 15.2-50 and 15.2-52**

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) responses to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter dated September 10, 2008 (Reference 1). GEH responses to RAI Numbers 15.2-50 and 15.2-52 are addressed in Enclosure 1. Enclosure 3 contains DCD markups and LTR markups associated with the subject responses.

Enclosure 1 contains GEH proprietary information as defined by 10 CFR 2.390. GEH customarily maintains this information in confidence and withholds it from public disclosure. Enclosure 2 is a non-proprietary version that is suitable for public disclosure.

The affidavit contained in Enclosure 4 identifies that the information contained in Enclosure 1 has been handled and classified as proprietary to GEH. GEH hereby requests that the information of Enclosure 1 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17.

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NRO

If you have any questions or require additional information, please contact me.

Sincerely,

Richard E. Kingston

Richard E. Kingston
Vice President, ESBWR Licensing

Reference:

1. MFN 08-699, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, GEH, *Request For Additional Information Letter No. 253 Related To ESBWR Design Certification Application*, dated September 10, 2008

Enclosures:

1. Response to Portion of NRC Request for Additional Information Letter No. 253 Related to ESBWR Design Certification Application – LTR NEDO-33337 "ESBWR Initial Core Transient and Accident Analyses" – RAI Numbers 15.2-50 and 15.2-52 – GEH Proprietary Information
2. Response to Portion of NRC Request for Additional Information Letter No. 253 Related to ESBWR Design Certification Application – LTR NEDO-33337 "ESBWR Initial Core Transient and Accident Analyses" – RAI Numbers 15.2-50 and 15.2-52 – Non-Proprietary Version
3. Response to Portion of NRC Request for Additional Information Letter No. 253 Related to ESBWR Design Certification Application – LTR NEDO-33337 "ESBWR Initial Core Transient and Accident Analyses" – RAI Numbers 15.2-50 and 15.2-52 – DCD and LTR Markups
4. Affidavit – Larry J. Tucker – February 6, 2009

cc:	AE Cubbage	USNRC (with enclosures)
	RE Brown	GEH/Wilmington (with enclosures)
	DH Hinds	GEH/Wilmington (with enclosures)
	LJ Tucker	GEH/Wilmington (with enclosures)
	eDRFs	0000-0091-6013

Enclosure 2

MFN 09-007

Response to Portion of NRC Request for Additional Information Letter No. 253 Related to ESBWR Design Certification Application

LTR NEDO-33337 ESBWR Initial Core Transient and Accident Analyses

RAI Numbers 15.2-50 and 15.2-52

Non-Proprietary Version

NRC RAI 15.2-50:

Explain whether the equilibrium core steam flow rate oscillation is numerical or physical compared to initial core steam flow rate for the feedwater controller failure, maximum demand transient. DCD, Tier 2, Rev 5, Figure 15.3-2a, for the Feedwater Controller Failure, (Maximum Demand transient), the equilibrium core steam flow oscillates significantly, while the initial core steam flow shown in Figure 2.4-2a of NEDO-33337 does not. Explain whether the oscillation is numerical or physical.

GEH Response:

The equilibrium core steam flow oscillation is not the expected behavior of the steam flow rate, rather it is a numerical TRACG behavior. The cause of the difference is the hydraulics time step. The equilibrium core analysis allows a maximum time step of 0.05 seconds; whereas, the initial core analysis limits the maximum time step to 0.005 seconds. The smaller time step in the initial core analysis results in a smoother steam flow plot.

The analysis in the DCD for the equilibrium core is recalculated using a 0.005-second maximum time step consistent with the initial core analysis. As expected, the oscillations are reduced, and there is no change in the ΔCPR result. Figures 15.3-2a through 2g and Tables 15.3-1a and 15.3-3 will be updated for the DCD Tier 2, Rev 6 as shown in the attached. The numbers in legend of Figure 15.3-2g represents channel groups in TRACG. The TRACG channel grouping map is shown in Figure 15.2-50-1.

The updated analysis does not include the updated TRACG channel pressure drop. The same TRACG analysis model (Feedwater Controller Failure – Maximum Flow Demand) documented in NEDO-33337 Rev 0 was re-analyzed with the updated pressure drop. Comparisons of the results between the two cases show that the ΔCPR/ICPR, peak pressure and minimum water level are not appreciably affected. This same conclusion also applies for the equilibrium core.

DCD or LTR Impact:

DCD Tier 2, Figures 15.3-2a through 15.3-2g and Tables 15.3-1a and 15.3-3 will be revised as noted on the attached markup.

No changes to the subject LTR will be made in response to this RAI.

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Figure 15.2-50-1 – Channel Grouping Map for Equilibrium Core at EOC

<u>NRC RAI 15.2-52</u>:

NEDO-33337, for those transients with rapid changes in the early portion (e.g., t = 0 seconds to t=1 or 2 seconds), provide additional plots with expanded scale. plots with expanded scale. Also provide the energy deposition and peak cladding temperature for those cases where the core flow is very low.

<u>GEH Response</u>:

<u>1) *For those transients with rapid changes in the early portion, provide additional plots with expanded scale.*</u>

Expanded-scaled plots are added to NEDO-33337 for the following cases:

- Generator Load Rejection with Single Failure in the Turbine Bypass System - Fig 2.3-5h (expanded "a" plot)
- Generator Load Rejection with Single Failure in the Turbine Bypass System - Fig 2.3-5i (expanded "f" plot)
- Turbine Trip with Turbine Bypass - Fig 2.3-6h (expanded "a" plot)
- Turbine Trip with Single Failure in the Turbine Bypass System - Fig 2.3-7h (expanded "a" plot)
- MSIV Closure - Fig 2.3-9h (expanded "a" plot)
- MSIV Closure - Fig 2.3-9i (expanded "f" plot)
- Loss of Condenser Vacuum - Fig 2.3-10h (expanded "a" plot)
- Opening of One Turbine Control or Bypass Valve - Fig 2.3-14h (expanded "a" plot)
- Loss of Non-Emergency AC Power to Station Auxiliaries - Fig 2.3-15i (expanded "f" plot)

Expanded-scaled plots are replaced with a shorter x-axis timescale consistent with the timescale (5 seconds) provided in the figures above for these cases:

- Generator Load Rejection with Turbine Bypass - Fig 2.3-4h (expanded "a" plot)
- Loss of Non-Emergency AC Power to Station Auxiliaries - Fig 2.3-15h (expanded "a" plot)

These two events already show short-term plots in NEDO-33337 Rev 0:

- Loss of All Feedwater Flow - Fig 2.3-16h
- Turbine Trip with Turbine Bypass Failure - Fig 2.3-6a

It is noted that the "Generator Load Rejection with Single Failure in the Turbine Bypass System" event has been updated to be consistent with the updated steam line model used in the same analysis in the DCD. Figure 2.3-5h is from this updated analysis. The updated analysis does not include the updated TRACG channel pressure drop. This same TRACG analysis was re-performed with the model with the updated pressure drop. A comparison between the two cases shows that the ΔCPR/ICPR, peak pressure and minimum water level are not appreciably affected.

<u>2a) *Also provide the energy deposition and peak cladding temperature for those cases where the core flow is very low.*</u>

Similar to the response to RAIs 15.2-2 S01 and 15.3-11 S01 (Reference 15.2-52-1) and for the same reasons, energy deposition and peak cladding temperature are not provided. To summarize that response, to be consistent with our current methodology, the energy deposition and peak cladding temperature are not used [[

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<u>2b) *Also provide .... for those cases where the core flow is very low.*</u>

Due to the ESBWR natural circulation design, for an event to result in very low core flow there must be very low power. In the transient analysis event, very low flows occur after the rapid power reduction from a scram. After the scram, the core flow will reduce along with decay heat power. Natural circulation is sufficient to remove decay heat.

As can be seen in the NEDO-33337 fuel-average-temperature figures (see Figures ending in "f"), in all cases with a scram, the fuel average temperature reduces below the initial temperature after the scram. There can be no increase in PCT because there is ample thermal margin, and the saturation temperature is decreasing along with the vessel pressure. After a reactor scram the main concern is maintaining level above active fuel to ensure long term cooling.

<u>References</u>

15.2-52-3. MFN 07-641, "Response to Portion of NRC Request for Additional Information Letter Nos. 25 and 69 Related to ESBWR Design Certification Application - Safety Analyses - RAI Numbers 15.2-2S01 and 15.3-11S01," dated December 5, 2007.

15.2-52-4. NEDE-33083P Supplement 3, "TRACG Application for ESBWR Transient Analysis," dated December 2007, Section 8.3.

DCD or LTR Impact:

LTR NEDO-33337 will be revised for Rev 1 as noted in the attached markup.

No DCD changes will be made in response to this RAI.

Enclosure 3

MFN 09-007

Response to Portion of NRC Request for Additional Information Letter No. 253 Related to ESBWR Design Certification Application

LTR NEDO-33337 ESBWR Initial Core Transient and Accident Analyses

RAI Numbers 15.2-50 and 15.2-52

DCD and LTR Markups

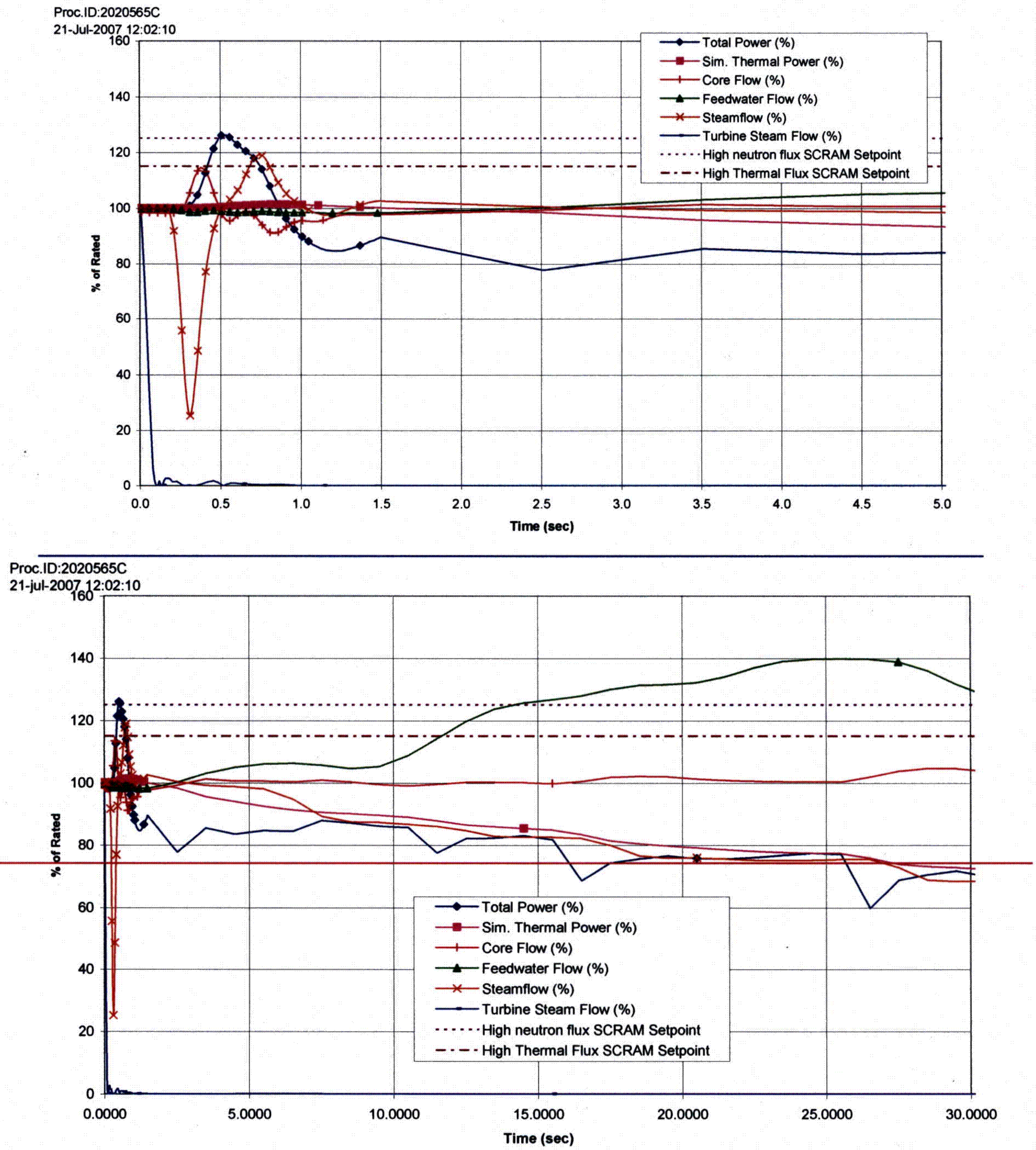


Figure 2.3-4h. Generator Load Rejection with Turbine Bypass (fig a from 0 to ~~30~~5s)

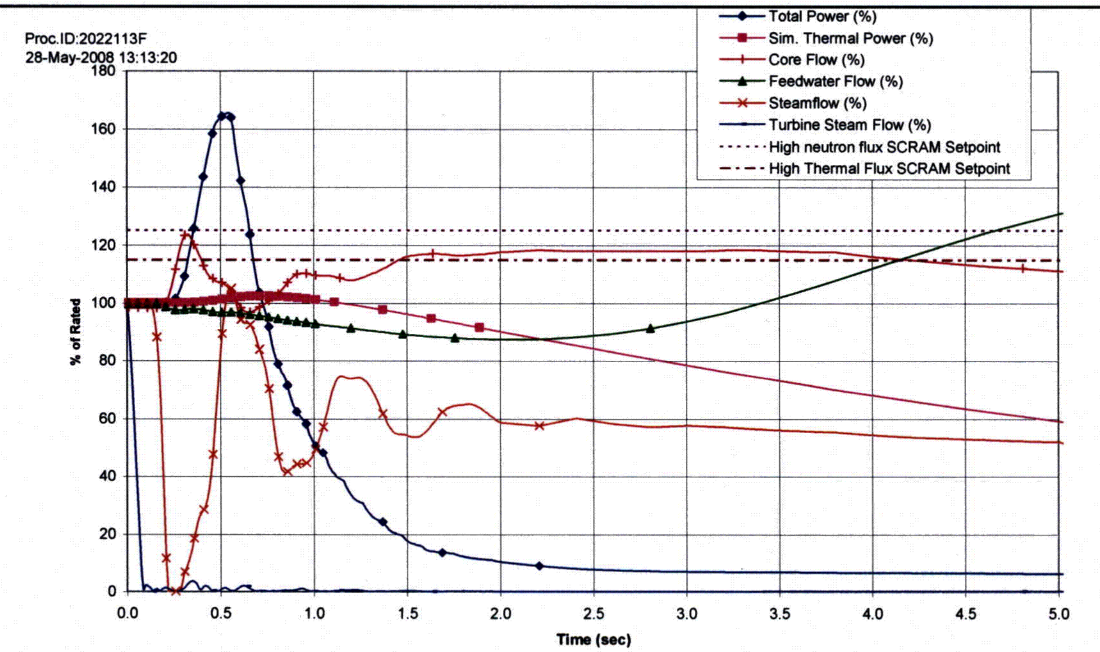


Figure 2.3-5h. Generator Load Rejection with a Single Failure in the Turbine Bypass System (fig a from 0 to 5s)

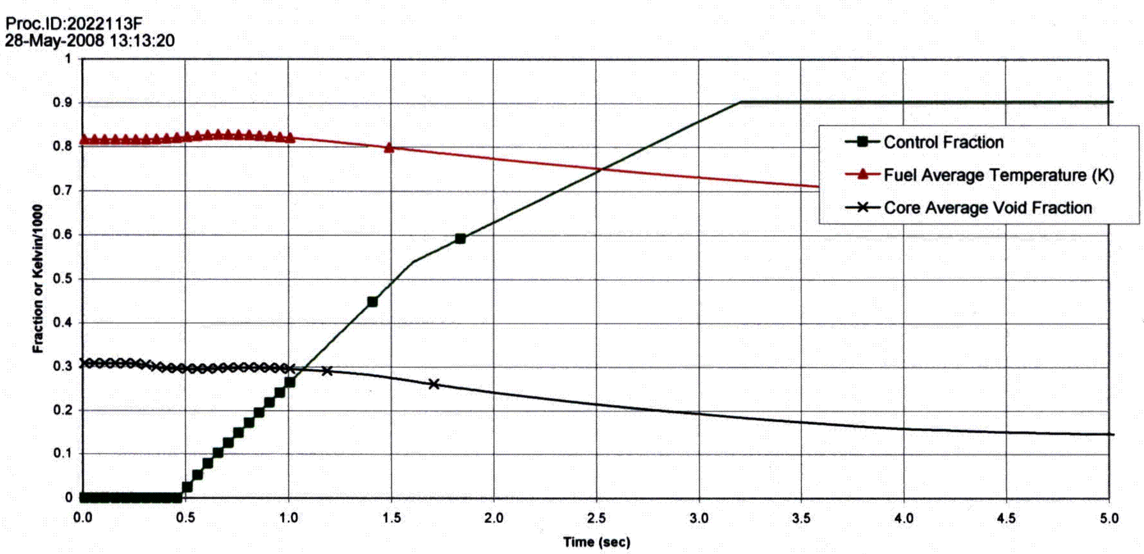


Figure 2.3-5i. Generator Load Rejection with a Single Failure in the Turbine Bypass System (fig f from 0 to 5s)

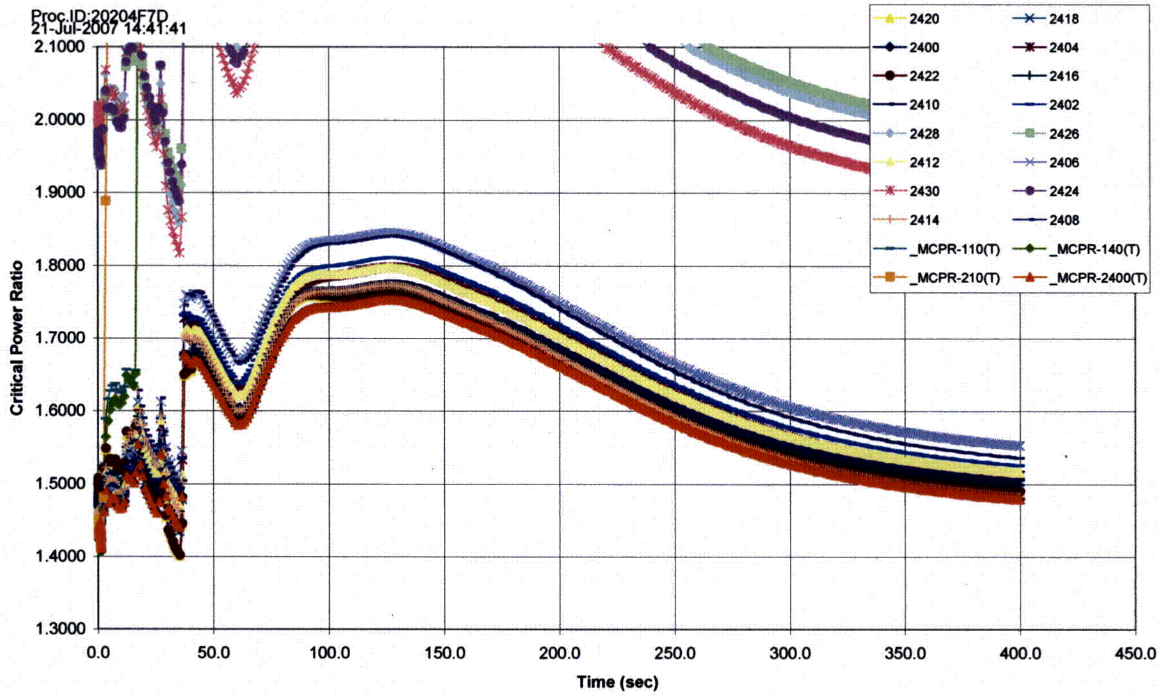


Figure 2.3-6g. Turbine Trip with Turbine Bypass

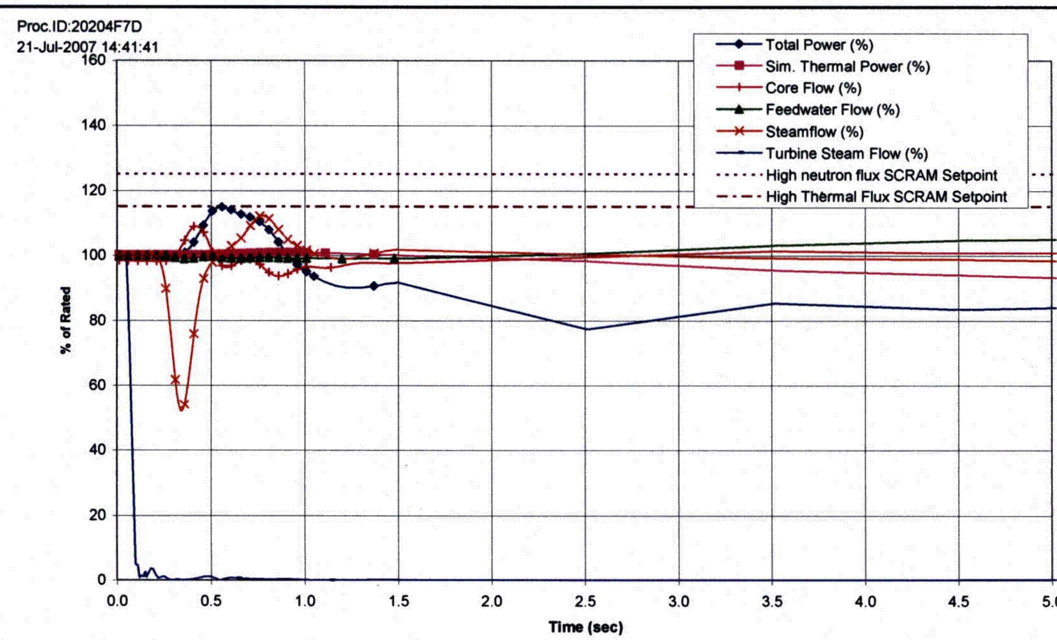


Figure 2.3-6h. Turbine Trip with Turbine Bypass (fig a from 0 to 5s)

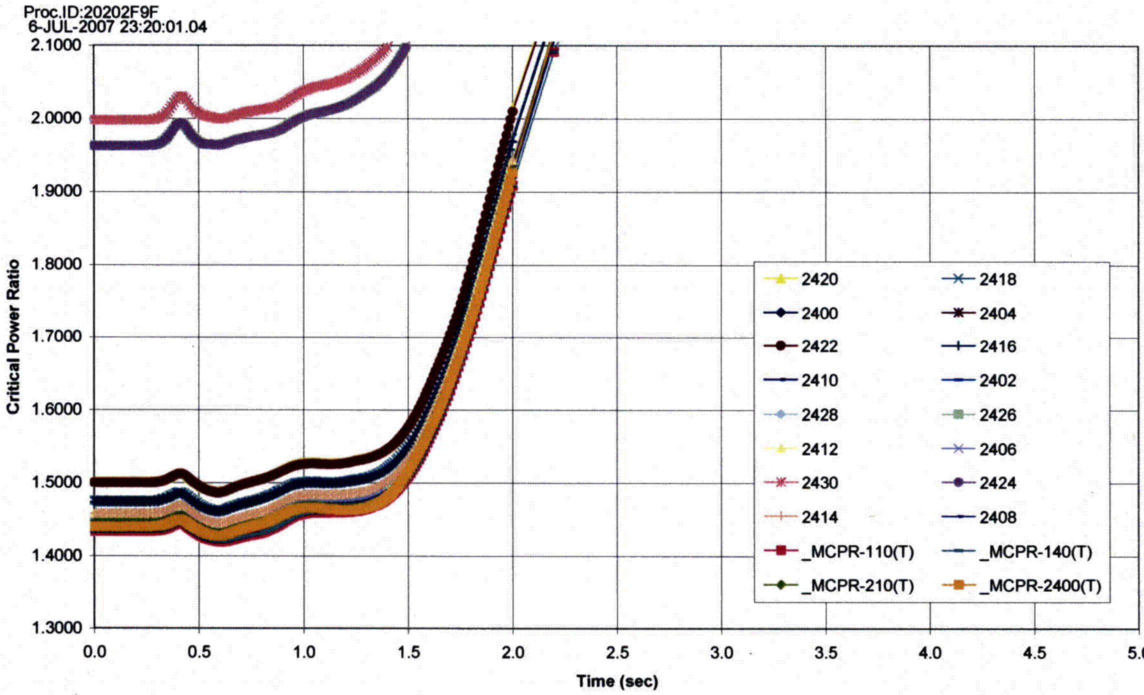


Figure 2.3-7g. Turbine Trip with a Single Failure in the Turbine Bypass System

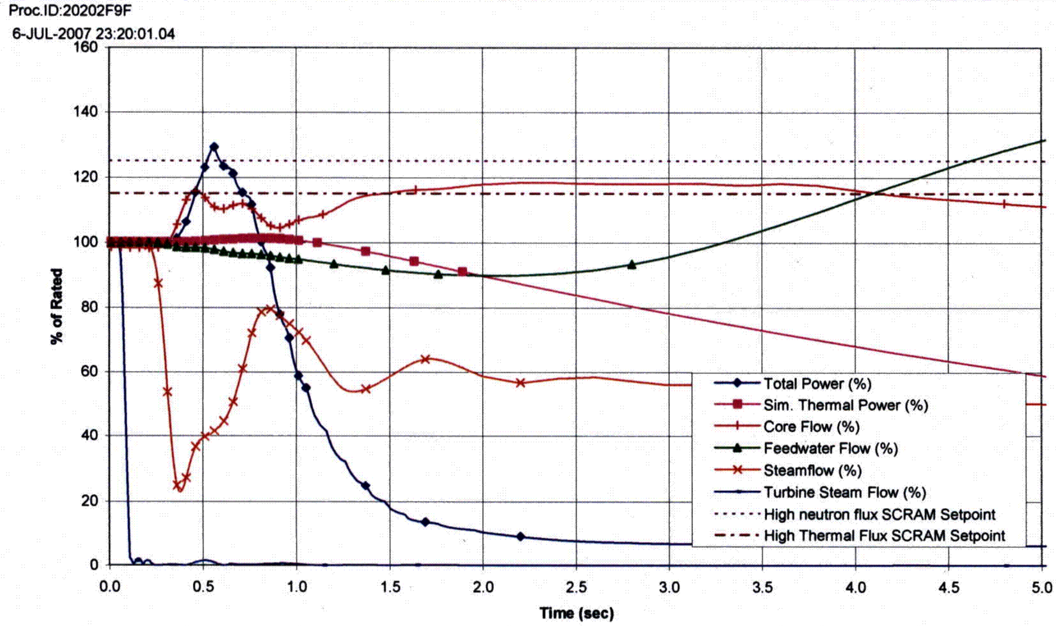


Figure 2.3-7h. Turbine Trip with a Single Failure in the Turbine Bypass System (fig a from 0 to 5s)

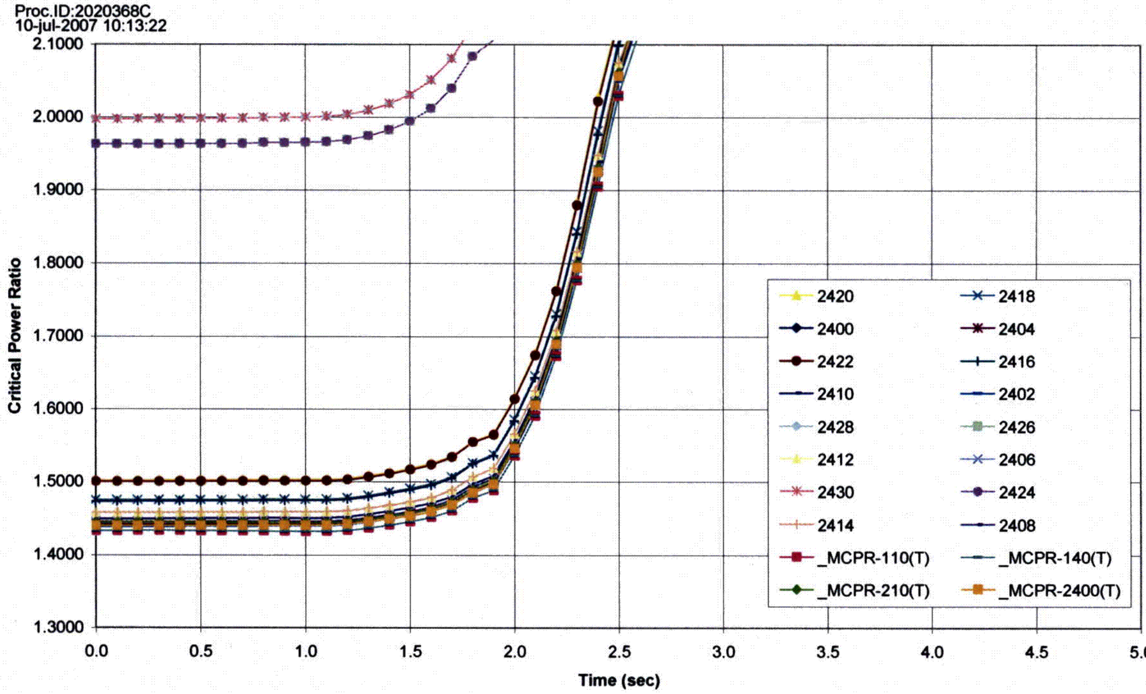


Figure 2.3-9g. MSIV Closure

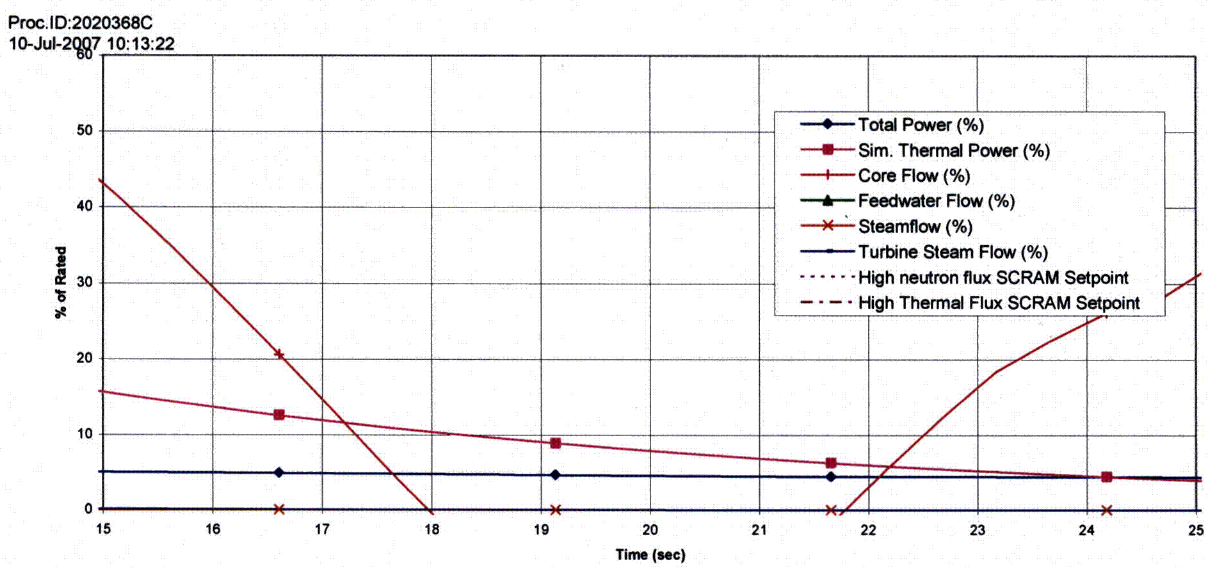


Figure 2.3-9h. MSIV Closure
(fig a from 15 to 25s)

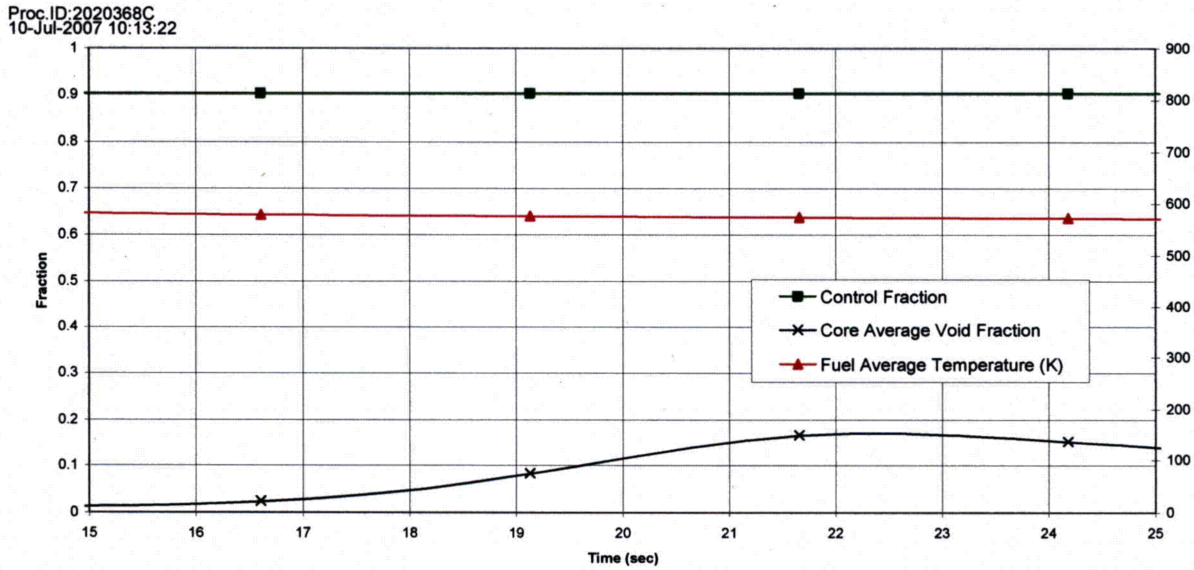


Figure 2.3-9i. MSIV Closure (fig f from 15 to 25s)

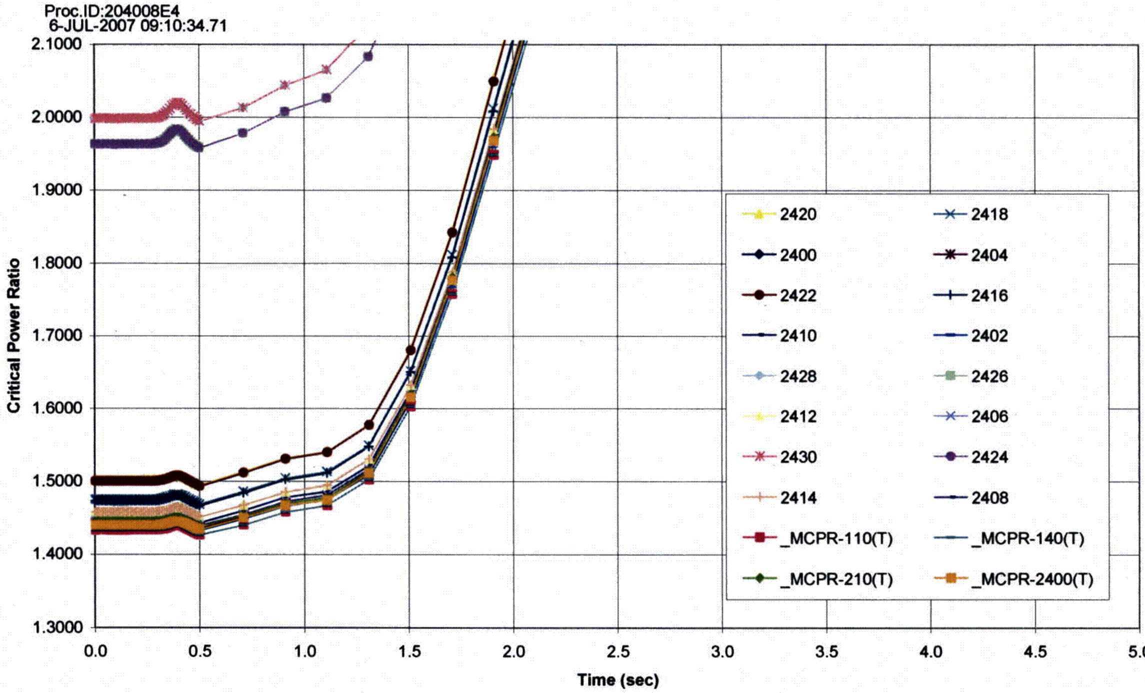


Figure 2.3-10g. Loss of Condenser Vacuum

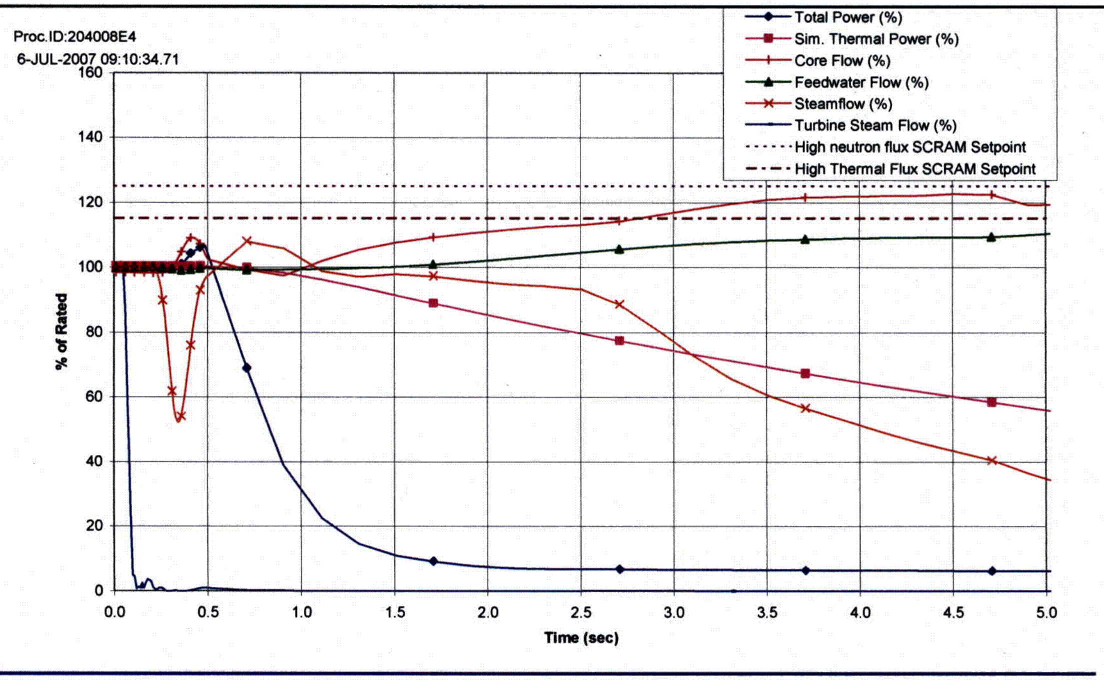


Figure 2.3-10h. Loss of Condenser Vacuum (fig a from 0 to 5s)

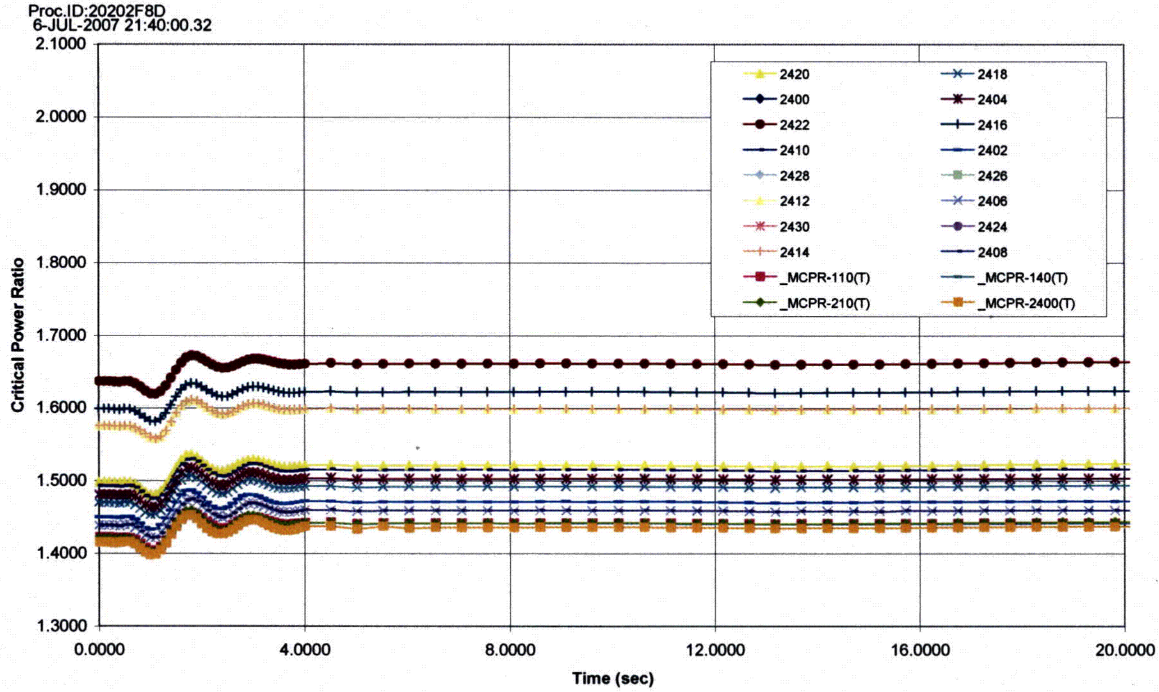
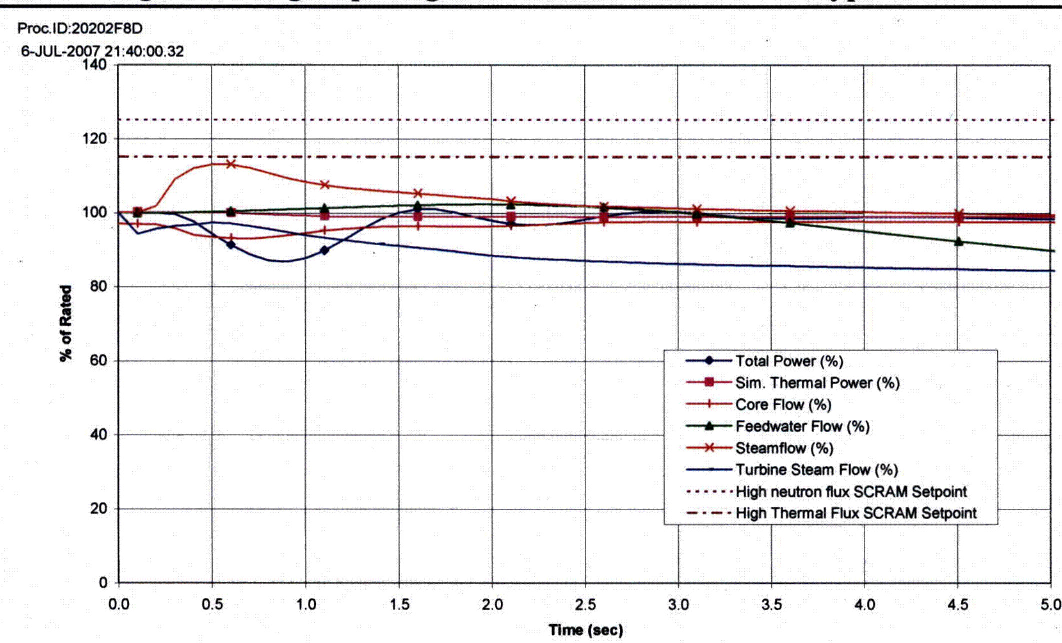


Figure 2.3-14g. Opening of One Turbine Control or Bypass Valve



<u>Figure 2.3-14h. Opening of One Turbine Control or Bypass Valve (fig a from 0 to 5s)</u>

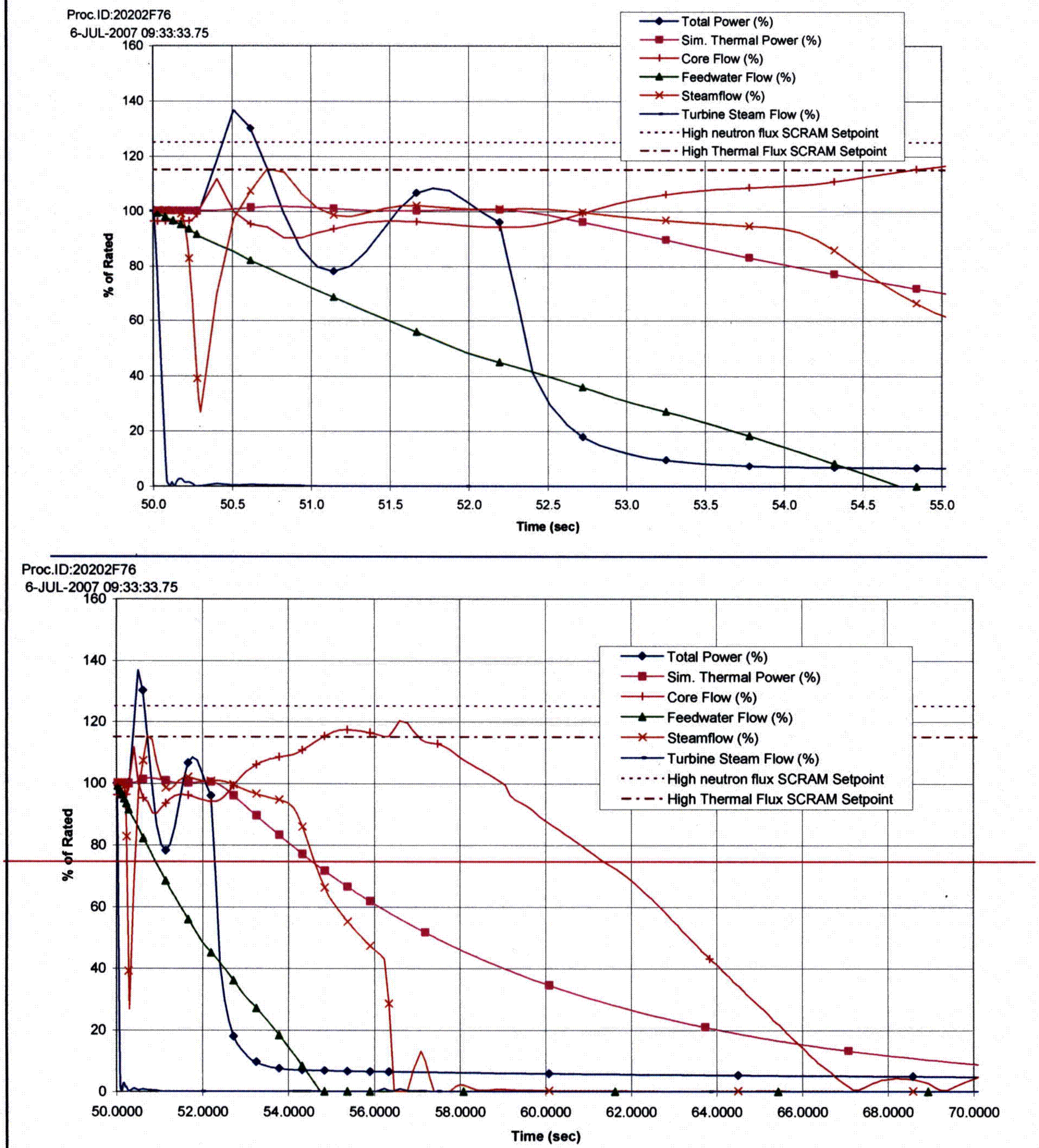


Figure 2.3-15h. Loss of Non-Emergency AC Power to Station Auxiliaries (fig. a from 50 to 55~~70~~s)

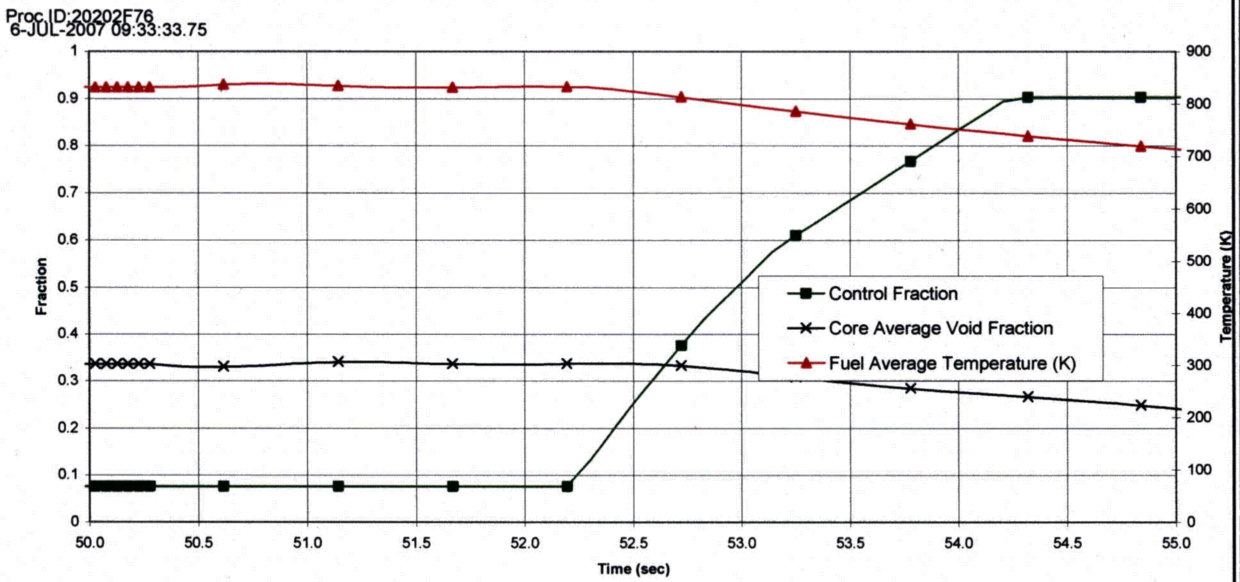


Figure 2.3-15i. Loss of Non-Emergency AC Power to Station Auxiliaries (fig. f from 50 to 55s)

Table 15.3-1a

Results Summary of Infrequent Events [1] [2]

Sub-section I.D.	Description	Max. Neutron Flux, % NBR	Max. Dome Pressure, MPaG (psig)	Max. Vessel Bottom Pressure, MPaG (psig)	Max. Steamline Pressure, MPaG (psig)	Max. Simulated Thermal Power, % of Initial	ΔCPR/ ICPR	Maximum Calculated TEDE
15.3.1	Loss of Feedwater Heating with SCRRI failure	115.4	7.10 (1030)	7.24 (1050)	6.96 (1009)	115.4	0.09	(Note 4)
15.3.2	FW Controller Failure – Maximum Flow Demand	117	7.~~29~~25 (1052~~7~~))	7.~~43~~40 (1073~~8~~	7.~~25~~27 (1055~~2~~)	~~109~~108	0.04	--
15.3.3	Pressure Regulator Failure – Opening of all TCVs and Bypass Valves	100	7.08 (1027)	7.21 (1046)	7.04 (1021)	100	0.00	--
15.3.4	Pressure Regulator Failure – Closing of all TCVs and Bypass Valves	137	8.06 (1169)	8.19 (1188)	8.06 (1169)	104	0.05	--
15.3.5	Load Rejection with total bypass failure[5]	425	8.23 (1194)	8.36 (1212)	8.22 (1192)	109	0.14	(Note 4)
15.3.6	Turbine Trip with total bypass failure	295	8.13 (1179)	8.26 (1198)	8.13 (1179)	108	0.11	(Note 4)
15.3.13	Inadvertent SRV open	101	7.08 (1027)	7.21 (1046)	6.99 (1014)	101	<0.01	--
15.3.15	Stuck open SRV (~~2~~3)	100.0	7.08 (1027)	7.21 (1046)	7.04 (1021)	100.0	N/A	--

(1) The input parameters and initial conditions used to perform the analysis in this table are located in Table 15.2-1.

(2) This table summarizes the events calculated with the TRACG code. Table 15.3-1b contains the summary of the remaining Infrequent Events.

(3) The initiating event can produce some over power, but the Stuck open SRV should not produce any appreciable overpower or MCPR reduction.

(4) The 1000 fuel-rod failure case bounds this event. Results are shown in Table 15.3-16.

(5) Results are provided for bounding steamline inputs.

Table 15.3-3

Sequence of Events for Feedwater Controller Failure – Maximum Flow Demand

Time (sec)	Event *
0	Initiate simulated runout of all FW pumps (170% at rated vessel pressure).
~~12.4~~12.7	Main turbine bypass valves opened to control vessel pressure.
~~15.4~~14.5	L8 vessel level setpoint is reached.
~~16.3~~15.4	Scram, trip of main turbine and FW pump runback is activated.
~~16.43~~15.5	Turbine Bypass fast opening activation limits the pressurization of the vessel.
~~16.5~~15.6	The rods begin to enter inside the core.
~~Later~~>20.0	L2 is reached because no FW availability, activating isolation condenser and HP CRD to recover the level and isolating MSIV's.

* See Figure 15.3-2.

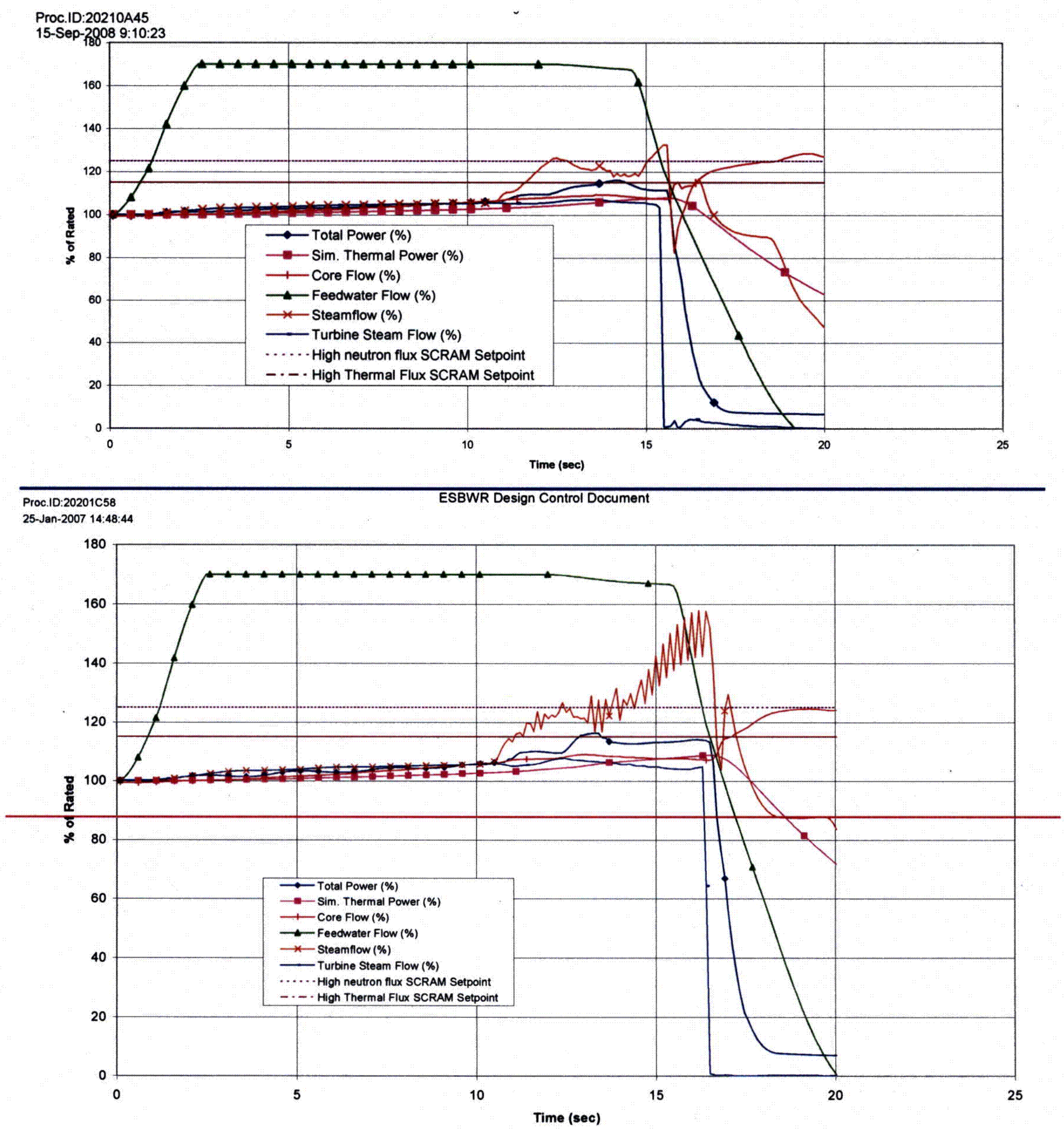


Figure 15.3-2a. Feedwater Controller Failure – Maximum Flow Demand

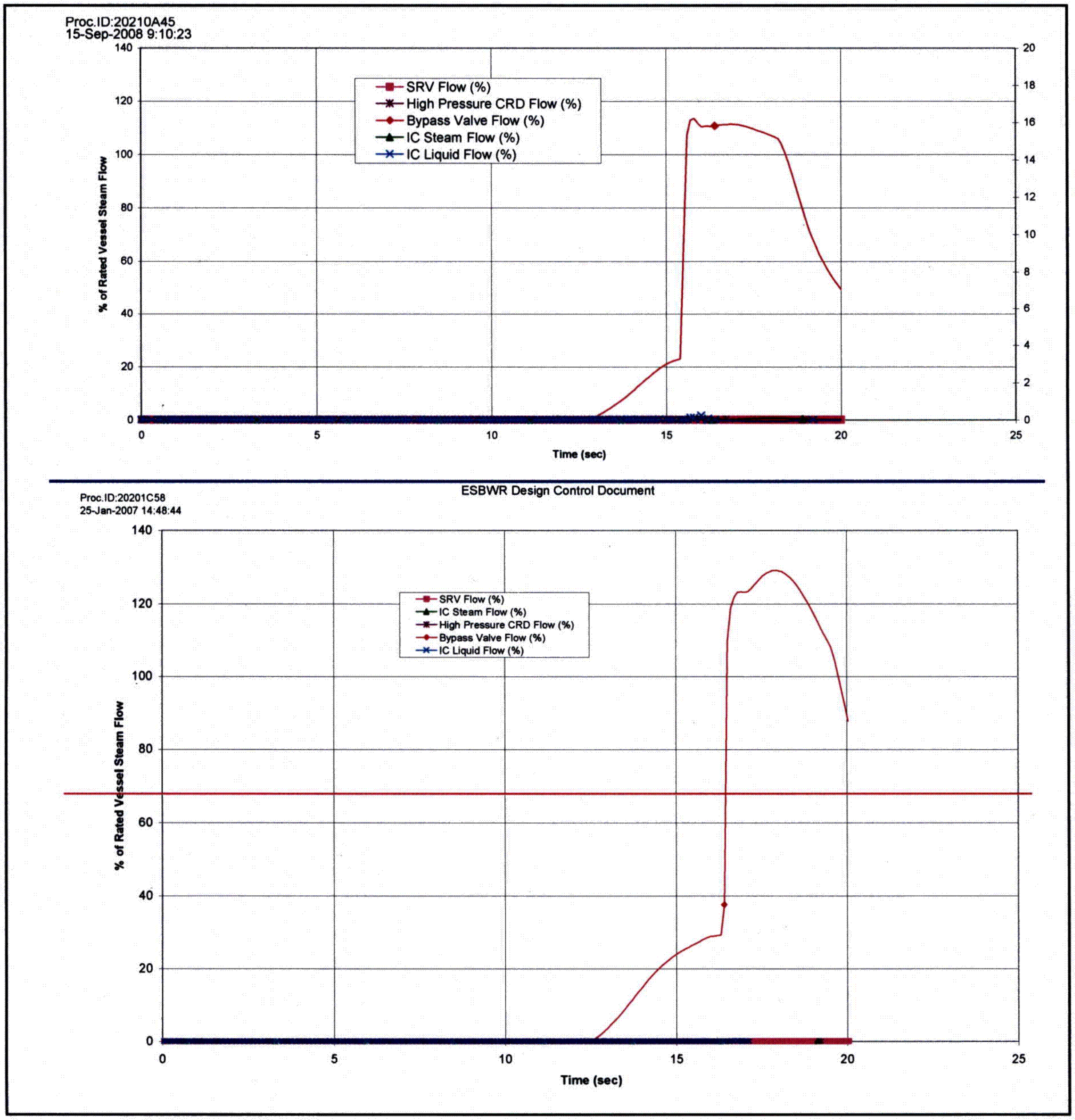
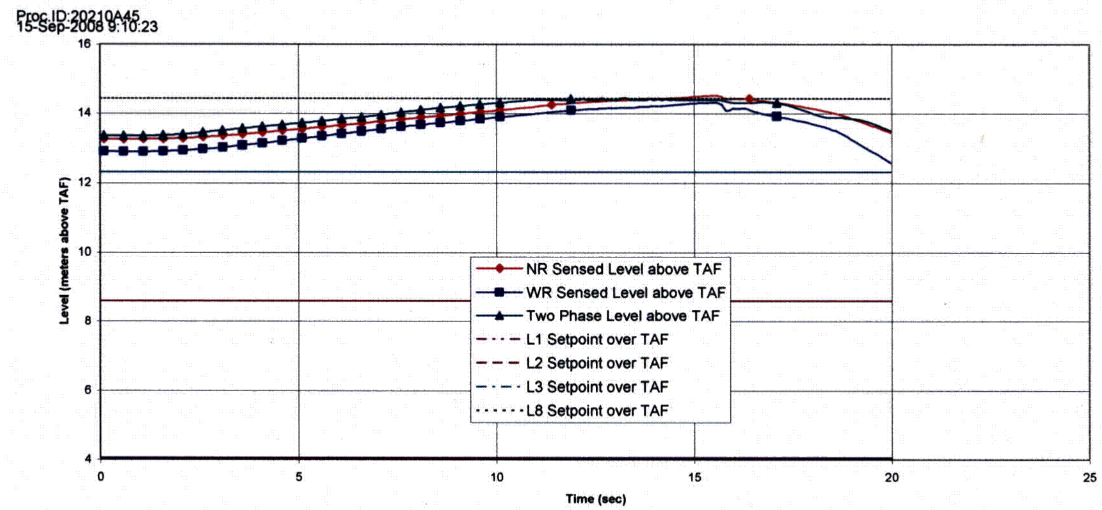


Figure 15.3-2b. Feedwater Controller Failure – Maximum Flow Demand



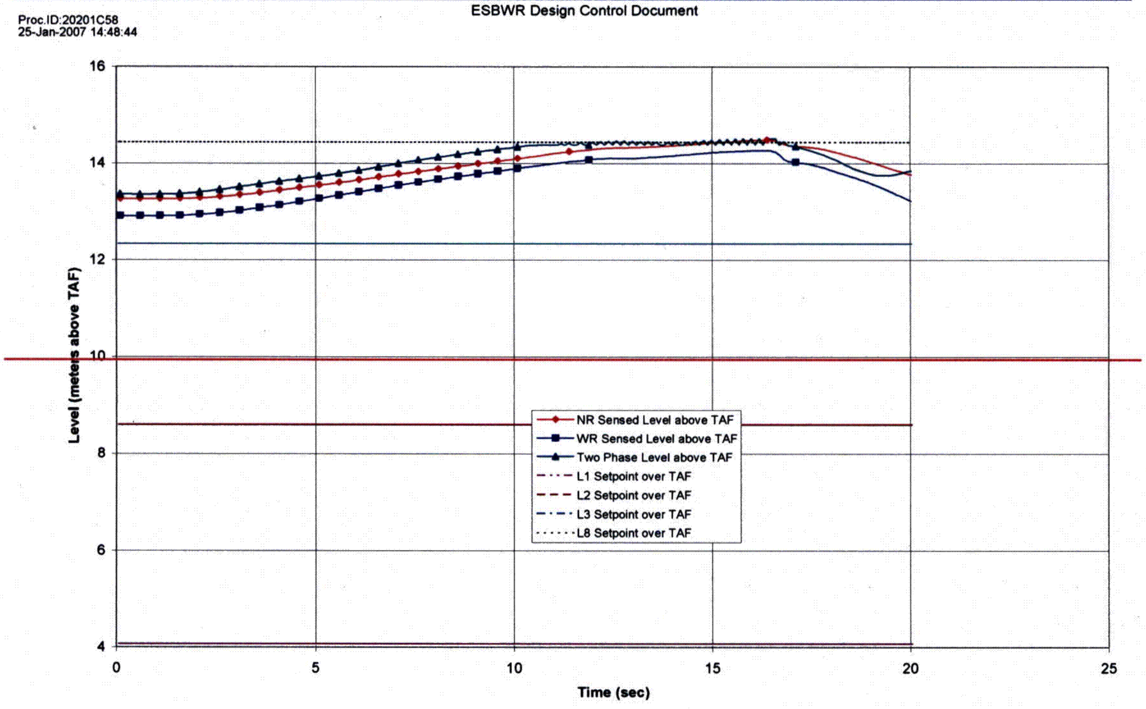


Figure 15.3-2c. Feedwater Controller Failure – Maximum Flow Demand

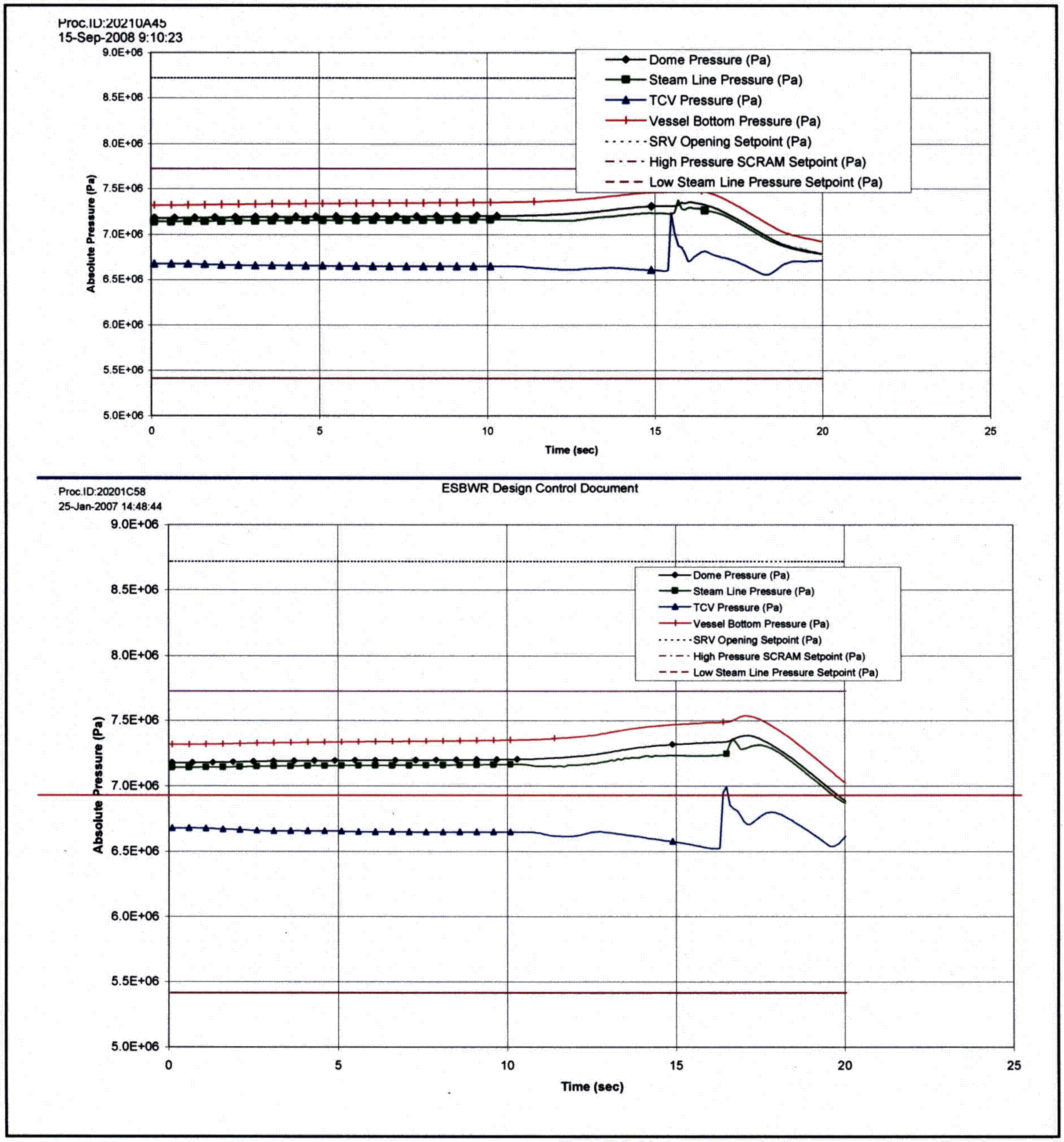


Figure 15.3-2d. Feedwater Controller Failure – Maximum Flow Demand

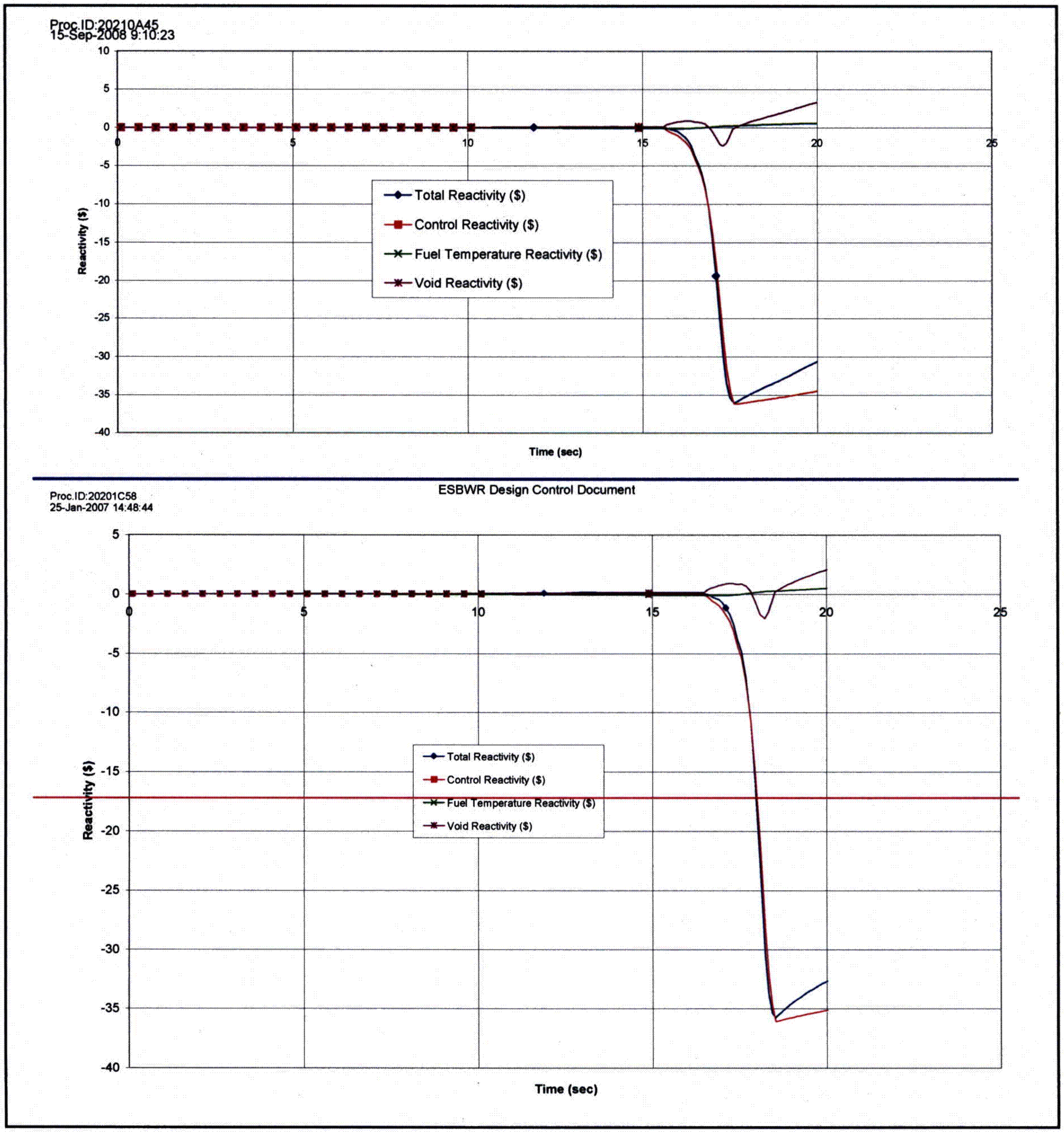


Figure 15.3-2e. Feedwater Controller Failure – Maximum Flow Demand

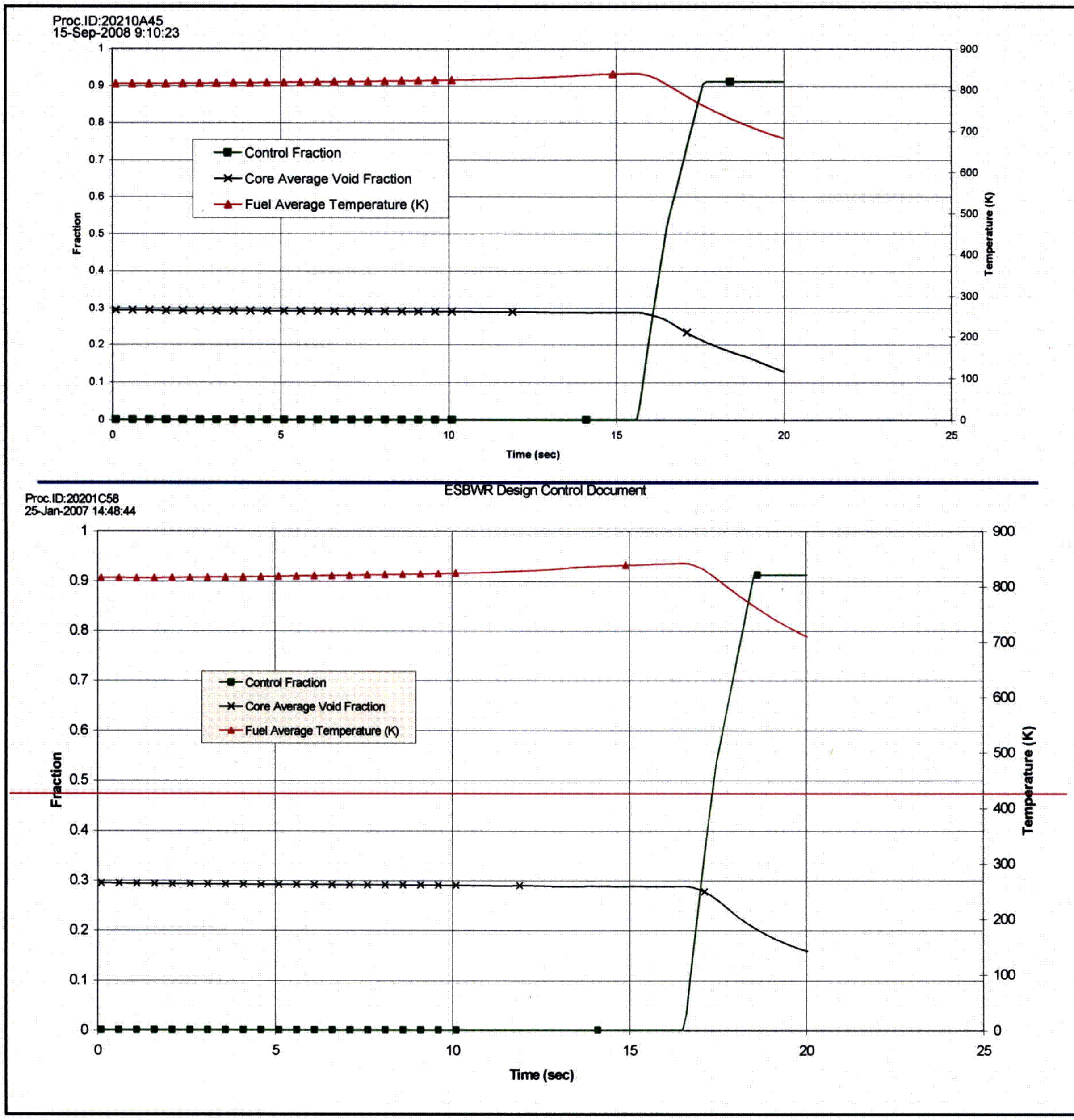


Figure 15.3-2f. Feedwater Controller Failure – Maximum Flow Demand

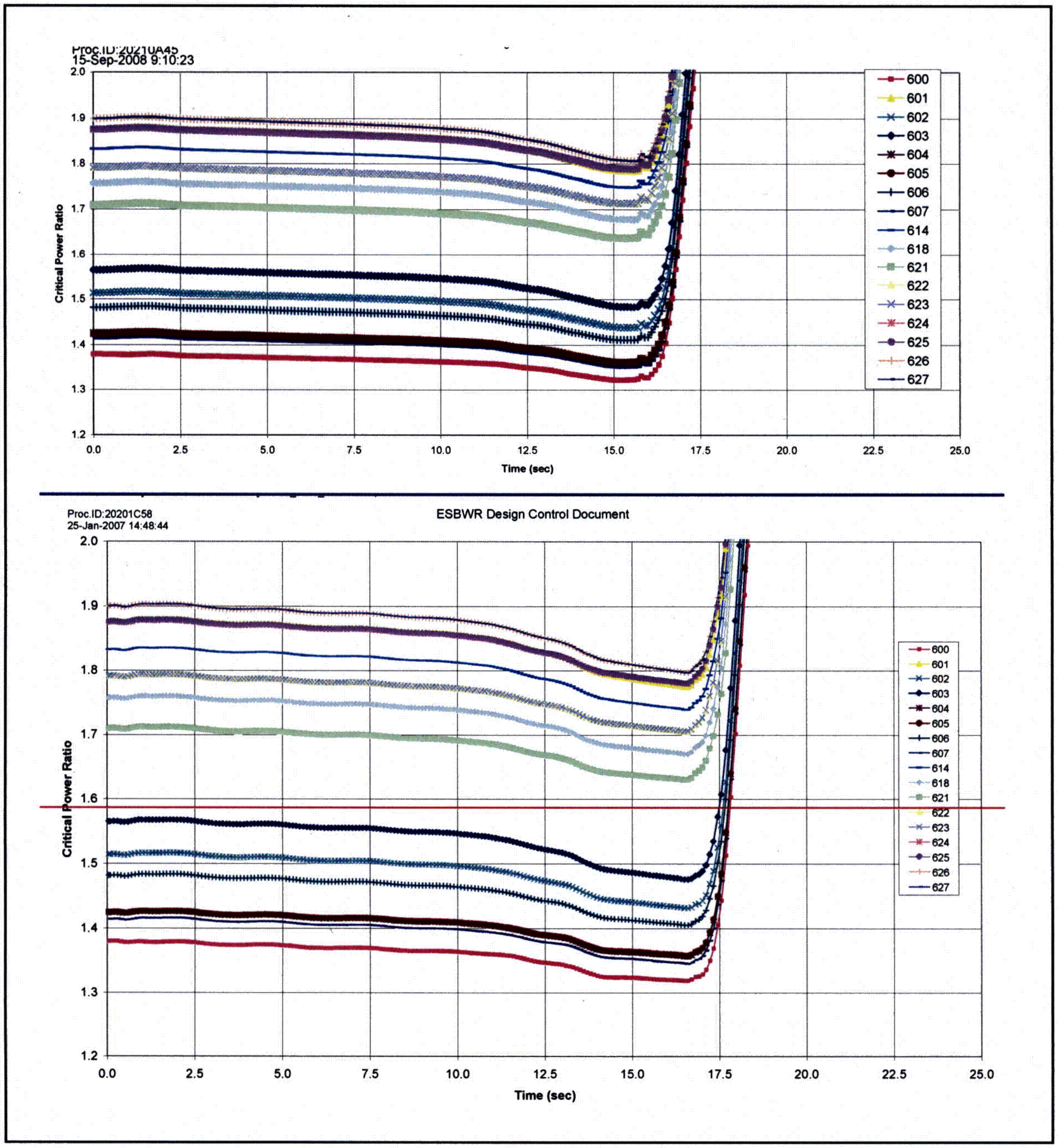


Figure 15.3-2g. Feedwater Controller Failure – Maximum Flow Demand

Enclosure 4

MFN 09-007

Affidavit

Larry J. Tucker – February 6, 2009

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, Larry J. Tucker, state as follows:

(1) I am Manager, ESBWR Engineering, GE Hitachi Nuclear Energy Americas LLC ("GEH"), have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.

(2) The information to be discussed and sought to be withheld is delineated in the letter from Mr. Richard E. Kingston to U.S. Nuclear Regulatory Commission, entitled "*Response to Portion of NRC Request for Additional Information Letter No. 253 Related to ESBWR Design Certification Application – Licensing Topical Report (LTR) NEDO-33337 "ESBWR Initial Core Transient and Accident Analyses" – RAI Numbers 15.2-50 and 15.2-52,*" dated February 6, 2009. The information in Enclosure 1, which is entitled "*Response to Portion of NRC Request for Additional Information Letter No. 253 Related to ESBWR Design Certification Application – LTR NEDO-33337 "ESBWR Initial Core Transient and Accident Analyses" – RAI Numbers 15.2-50 and 15.2-52" – GEH Proprietary Information,* contains proprietary information, and is identified by [[dotted underline inside double square brackets{3}]]. Figures and other large objects are identified with double square brackets before and after the object. In each case, the superscript notation {3} refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.

(3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for "trade secrets" (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

(4) Some examples of categories of information which fit into the definition of proprietary information are:

a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;

b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;

d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

(5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

(6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on a "need to know" basis.

(7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.

(8) The information identified in paragraph (2) above is classified as proprietary because it contains TRACG Computer Code development methodology inputs and assumptions developed by GEH. Development of this TRACG Computer Code methodology was achieved at a significant cost to GEH, and is considered a major GEH asset.

(9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the

availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 6th day of February 2009.

Larry J. Tucker

Larry J. Tucker
GE-Hitachi Nuclear Energy Americas LLC