Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402-2801

April 5, 1996

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

Gentlemen:

In the Matter of	)	Docket Nos. 50-327 50-390
Tennessee Valley Authority	)	50-328

SEQUOYAH NUCLEAR PLANT (SQN) AND WATTS BAR NUCLEAR PLANT (WBN) RESPONSE TO NRC BULLETIN 96-01, "CONTROL ROD INSERTION PROBLEMS" DATED MARCH 8, 1996

The purpose of this letter is to provide TVA's response to the subject bulletin. In accordance with the bulletin, TVA has performed an evaluation of the control rods at both SQN and WBN for the purpose of determining operability. Utilizing current information, we have determined that the control rods at both sites are operable. Additional information requested in the bulletin is contained in the enclosures to this letter.

Enclosure 1 provides the required response for SQN, and Enclosure 2 provides the required response for WBN. Commitments made as a result of this letter are listed in Enclosure 3.

If you have questions regarding this response, please contact Charles Davis at (423) 751-7509.

Sincerely,

Paul Baron

Paul R. Baron
General Manager
Nuclear Licensing

110015

Subscribed to and sworn to before me
this 5th day of April 1996

Janette Harrison

Notary Public

My Commission Expires 10-6-99

Enclosures

JE57

cc (Enclosures):

U.S. Nuclear Regulatory Commission
Region II
101 Marietta Street, NW, Suite 2900
Atlanta, Georgia 30323

Mr. D. E. LaBarge, Senior Project Manager
U.S. Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852

Mr. P. S. Tam, Senior Project Manager
U.S. Nuclear Regulatory Commission
One White Flint, North
11555 Rockville Pike
Rockville, Maryland 20852

Senior Resident Inspector
Sequoyah Nuclear Plant
U.S. Nuclear Regulatory Commission
2600 Igou Ferry Road
Soddy Daisy, Tennessee 37379

Senior Resident Inspector
Watts Bar Nuclear Plant
U.S. Nuclear Regulatory Commission
1260 Nuclear Plant Road
Spring City, Tennessee 37381

WOG Project Office
Attn: Dave Campbell
Wesinghouse Energy Center
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355

ENCLOSURE 1

SEQUOYAH NUCLEAR PLANT (SQN) UNITS 1 AND 2 RESPONSE TO NRC BULLETIN 96-01, "CONTROL ROD INSERTION PROBLEMS"

The following provides the response for SQN on the subject bulletin. Pursuant to Section 182a, Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f), Licensees of Westinghouse-designed plants must submit the following written information.

REQUIRED RESPONSE 1

Within 30 days of the date of this bulletin, a report certifying that control rods are determined to be operable; actions taken for Requested Actions (1) and (2); and the plans for implementing Requested Action (3) and (4).

RESPONSE

Operability Report

The incident at Wolf Creek Nuclear Plant involved five control rods that failed to fully insert and were in "Westinghouse Vantage 5H fuel assemblies; the fuel assemblies had experienced burnup greater than 47,000 MWD/MTU" (refer to INPO SEN 132). The rods initially stuck out 6 to 18 steps. The event that occurred at South Texas Project involved three rods not fully inserting (approximately six steps outs). South Texas fuel is of a different design and is 14 feet long as opposed to 12 feet for Wolf Creek and SQN. Burnup for the South Texas fuel assemblies was approximately 43,000 MWD/MTU.

For SQN, the following data is relevant to the operability determination.

1. The highest projected burnup for Unit 1 Cycle 8 under a control rod is for a Westinghouse Standard fuel assembly with a burnup of 43,700 MWD/MTU. The highest projected burnup for Unit 2 Cycle 7 under a control rod is for a Westinghouse Standard fuel assembly with a burnup of 43,100 MWD/MTU.

2. A review of SQN Unit 1 Cycle 8, Unit 1 Cycle 9, Unit 2 Cycle 7, and Unit 2 Cycle 8 indicates that SQN is projected to not have Vantage 5H fuel burned above approximately 42,700 MWD/MTU under control rod locations.

3. Seven Westinghouse Standard fuel assemblies burned above 47,000 MWD/MTU have operated successfully under control rod locations in previous cycles. The maximum exposure for a Westinghouse Standard fuel assembly under a control rod location was approximately 50,000 MWD/MTU in SQN Unit 1 Cycle 6.

4. No problems were observed with control rods when units were last tripped. All hot rod drop times testing routinely meet the technical specification (TS) requirement with margin.

Vantage 5H fuel assemblies under control rod locations at SQN are not expected to present a problem with rods failing into the core upon a reactor trip. The burnups associated with these Vantage 5H fuel assemblies are less than what has been noted at Wolf Creek.

The Westinghouse Owners Group (WOG) addressed the reactivity effects of rods not fully falling into the core on the design basis shutdown margin (SDM) calculations (refer to WOG Report OG-96-016, dated February 23, 1996).

It was concluded by WOG, "the conservative assumptions of the design basis shutdown margin calculation and the margin assessments performed for the plants (provided in their table), are compelling evidence that the design basis shutdown margin assessments will bound the kinds of trip scenarios that could reasonably be postulated to occur as a result of this issue." The reactivity worth of the single most reactive rod stuck fully out assumption in SDM is greater than the reactivity worth of several rods stuck in the dashpot region of the fuel assembly somewhere between 0 and 30 steps out. WOG also investigated other safety analysis inputs and transients which are affected by rod worth. WOG concluded "that all plants will continue to meet their respective safety limits for the kinds of trip scenarios that could be postulated to occur."

The SQN technical specifications require a minimum SDM of 1800 percent mille (pcm) with the single highest worth control rod stuck fully out of the core. The single highest worth stuck rod has been conservatively calculated to be worth 1,025 pcm for Unit 1 and 1,115 pcm for Unit 2. All rods stuck at 20 steps would be worth approximately 959 pcm for Unit 1 and 1,042 pcm for Unit 2. Therefore, the stuck rod worth included in the SDM calculation would bound the situation of all the rods stuck at 20 steps. In addition, both Unit 1 Cycle 8 and Unit 2 Cycle 7, cores have 300 pcm more SDM than the 1,600 pcm minimum.

It is concluded that with the current information available at this time, the rods are operable at SQN.

REQUESTED ACTION 1

Promptly inform operators of recent events (reactor trips and testing) in which control rods did not fully insert and subsequently provide necessary training, including simulator drills, utilizing the required procedures for responding to an event in which the control rods do not fully insert upon reactor trip (e.g., boration of a pre-specified amount).

RESPONSE

SQN Operations personnel were notified with the release of Standing Order 96-032. This Standing Order contained a copy of the subject bulletin and additional guidance to heighten sensitivity to the event. The Operator Training Program has already reviewed a similar event at Ringhels Unit 4 in a previous requalification cycle. The current requalification cycle is covering the events at South Texas, Wolf Creek, and North Anna. Simulator scenarios are being developed to address multiple partially stuck rods post trip. This new training will be included in the next requalification cycle that begins following the spring Unit 2 Cycle 7 refueling outage and will be completed by July 29, 1996.

REQUESTED ACTION 2

Promptly determine the continued operability of control rods based on current information. As new information becomes available from plant rod drop tests and trips, licensees should consider this new information together with data already available from Wolf Creek, South Texas, North Anna, and other industry experience, and make a prompt determination of control rod operability.

RESPONSE

The current basis for continued operability is as stated above in the operability report.

This determination was made promptly upon receipt of Bulletin 96-01 and has continued to evolve as new information has been made available from the WOG.

TVA's Operating Experience Review section evaluates new industry experience as information becomes available. If the industry event has the potential to effect the TVA nuclear plants, the information is distributed and evaluated for applicability at each of the plants.

REQUESTED ACTION 3

Measure and evaluate at each outage of sufficient duration during calendar year 1996 (end of cycle, maintenance, etc.), the control rod drop times and rod recoil data for all control rods. If appropriate plant conditions exist where the vessel head is removed, measure and evaluate drag forces for all rodded fuel assemblies.

a. Rods failing to meet the rod drop time in the technical specifications shall be deemed inoperable.

b. Rods failing to bottom or exhibiting high drag forces shall require prompt corrective action in accordance with Appendix B to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50).

RESPONSE

SQN will measure and evaluate at each outage (end of cycle or major maintenance) of sufficient duration during calendar year 1996, the control rod drop times and rod recoil data for all control rods, unless there has been less than 2500 MWD/MTU burnup since the last time the drop time data was taken. If appropriate plant conditions exist where the vessel head is removed, drag forces for each rodded fuel assembly will be measured. Evaluations of this data will be made as necessary. Nonconformances will continue to be addressed in accordance with the TVA corrective action program.

REQUESTED ACTION 4

For each reactor trip during calendar year 1996, verify that all control rods have promptly fully inserted (bottomed) and obtain other available information to assess the operability and any performance trend of the rods. In the event that all rods do not fully insert promptly, conduct tests to measure and evaluate rod drop times and rod recoil.

RESPONSE

Control rods are varified to be inserted after each reactor trip. For the analog rod position indication system at SQN, 12 steps or fewer above the 0 steps indication is defined as fully inserted, which is consistent with the technical specifications. Any discrepancies will continue to be addressed in accordance with the TVA corrective action program. If the discrepancies indicate an insertion problem, testing of the rod drop times and rod recoil will be conducted during calendar year 1996.

REQUIRED RESPONSE 2

Within 30 days of the date of this bulletin, a core map of rodded fuel assemblies indicating fuel type (materials, grids, spacers, guide tube inner diameter) and current and projected end of cycle burnup of each rodded assembly for the current cycle; when available, provide the same information for the next cycle.

RESPONSE

SQN currently has Westinghouse rod array of 17 x 17 standard fuel rods with both standard and Vantage 5H (V5H) guide tubes and grid designs. The Cycle 9 cores will add Framatome Cogema Fuel (FCF Mark-BW). Fuel assembly parameters are listed on the attached table. A Unit 1 (Cycle 8) and Unit 2 (Cycle 7) current (as of March 13, 1996) quarter core map is also attached. The projected end of cycle quarter core maps for Unit 1 Cycles 8 and 9 and Unit 2 Cycles 7 and 8 are also provided.

REQUIRED RESPONSE 3

Within 30 days after completing Requested Action (3) for each outage, a report that summarizes the data and that documents the results obtained. This is also applicable to Requested Action (4) when any abnormal rod behavior is observed.

RESPONSE

Within 30 days after Mode 2 entry following completion of each Requested Action (3), TVA will provide a report that summarizes the data and that documents the results obtained. Test results for discrepancies identified in accordance with Requested Action (4) will similarly be provided.

TVA Sequoyah Fuel Assembly Description

Fuel Assembly Parameter	W 17x17 Standard	W 17x17 (V5H)	FCF 17x17 (Mark BW)
Guide Tubes			
• Inner Diameter, upper ($GTID_n$)	0.450	0.442	0.450
dashpot ($GTID_d$)	0.397	0.397	0.397
• Material (guide tubes)	Zirc-4	Zirc-4 (low tin)	Zirc-4 (low tin)
Grids			
• Material - (top/bottom grids) - total of 2	Inconel-718	Inconel-718	Inconel-718
Material - (mixing mid-grids) - 1 of 6 *	Inconel-718	Zirc-4	Zirc-4

* For FCF Mark-BW fuel assemblies, 1 of the 6 zirc-4 mid-grids is a non-mixing mid-grid.

NOTE: All dimensions are in inches.

Sequoyah Unit 1 Cycle 8
Current (as of 3/13/96) Assembly Burnup in Rodded locations
Cycle Average Burnup for Current Cycle is 90 EFPD or 3,445 MWD/MTU

22,200 V5H		4,700 V5H		4,700 V5H		4,200 V5H	
					21,400 V5H		
4,700 V5H		3,500 V5H				4,000 V5H	
					4,400 V5H		
4,700 V5H				20,600 V5H		36,300 Standard	
	21,400 V5H		4,400 V5H				
4,200 V5H		4,000 V5H		36,300 Standard			

Burnup in MWD/MTU

Type of Assembly (Standard or V5H)

Sequoyah Unit 1 Cycle 8
Projected End of Cycle Assembly Burnup in Rodded locations
Cycle Average Burnup for Current Cycle is 433 EFPD or 16,575 MWD/MTU

36,300 V5H		22,100 V5H		21,900 V5H		20,000 V5H	
					34,600 V5H		
22,100 V5H		37,400 V5H				19,900 V5H	
					21,700 V5H		
21,900 V5H				36,000 V5H		43,700 Standard	
	34,600 V5H		21,700 V5H				
20,000 V5H		19,900 V5H		43,700 Standard			

Burnup in MWD/MTU

Type of Assembly (Standard or V5H)

Sequoyah Unit 1 Cycle 9
Projected End of Cycle Assembly Burnup in Rodded locations
Cycle Average Burnup for Current Cycle is 463 EFPD or 17,806 MWD/MTU

Based on Preliminary Design

42,000 Standard		23,700 Mark BW		23,700 Mark BW		21,300 Mark BW	
					41,600 V5H		
23,700 Mark BW		42,700 V5H				20,200 Mark BW	
					22,100 Mark BW		
23,700 Mark BW				39,400 V5H		42,600 Standard	
	41,600 V5H		22,100 Mark BW				
21,300 Mark BW		20,100 Mark BW		42,600 Standard			

Burnup in MWD/MTU

Type of Assembly (Standard, V5H, or Mark BW)

Sequoyah Unit 2 Cycle 7
Current (as of 3/13/96) Assembly Burnup in Rodded locations
Cycle Average Burnup for Current Cycle is 445 EFPD or 16,967 MWD/MTU

39,300 Standard		22,200 V5H		22,500 V5H		20,300 V5H	
					22,600 V5H		
22,200 V5H		38,500 V5H				19,900 V5H	
					21,500 V5H		
22,500 V5H				38,200 V5H		42,400 Standard	
	22,500 V5H		21,500 V5H				
20,300 V5H		19,900 V5H		42,400 Standard			

Burnup in MWD/MTU

Type of Assembly (Standard or V5H)

Sequoyah Unit 2 Cycle 7
Projected End of Cycle Assembly Burnup in Rodded locations
Cycle Average Burnup for Current Cycle is 482 EFPD or 18,390 MWD/MTU

40,600 Standard		24,000 V5H		24,300 V5H		21,900 V5H	
					24,400 V5H		
24,000 V5H		40,000 V5H				21,500 V5H	
					23,300 V5H		
24,300 V5H				39,700 V5H		43,100 Standard	
	24,400 V5H		23,300 V5H				
21,900 V5H		21,500 V5H		43,100 Standard			

Burnup in MWD/MTU

Type of Assembly (Standard or V5H)

Sequoyah Unit 2 Cycle 8
Projected End of Cycle Assembly Burnup in Rodded locations
Cycle Average Burnup for Current Cycle is 430 EFPD or 16,450 MWD/MTU

Based on Preliminary Design

34,700 V5H		21,500 V5H		22,100 V5H		19,600 V5H	
					41,000 V5H		
21,500 V5H		40,500 V5H				18,200 V5H	
					21,200 V5H		
22,100 V5H				42,500 V5H		34,100 V5H	
	41,000 V5H		21,200 V5H				
19,600 V5H		18,200 V5H		34,100 V5H			

Burnup in MWD/MTU

Type of Assembly (Standard or V5H)

ENCLOSURE 2

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 RESPONSE TO NRC BULLETIN 96-01, "CONTROL ROD INSERTION PROBLEMS"

The following provides the response for WBN on the subject bulletin. Pursuant to Section 182a, Atomic Energy Act of 1954, as amended, and 10 CFR 50.54(f), Licensees of Westinghouse-designed plants must submit the following written information.

REQUIRED RESPONSE 1

Within 30 days of the date of this bulletin, a report certifying that control rods are determined to be operable; actions taken for Requested Actions (1) and (2); and the plans for implementing Requested Action (3) and (4).

REQUESTED ACTION 1

Promptly inform operators of recent events (reactor trips and testing) in which control rods did not fully insert and subsequently provide necessary training, including simulator drills, utilizing the required procedures for responding to an event in which the control rods do not fully insert upon reactor trip (e.g., boration of a pre-specified amount).

RESPONSE

Training Letter 96-1 was issued to promptly inform the licensed operators of the problems that occur with stuck control rods. The operator is required to document receipt and review of the training letter. These letters are used as a tool for on-shift training of licensed operators and the issues from the training letters are subject to the requalification testing examination process. Problems with stuck rods in high burnup fuel assemblies will be discussed in the classroom during the upcoming Licensed Operator Requalification Training cycle. It will also be included as a scenario in the simulator drills utilizing the site procedure, "Reactor Trip Response," to respond to the event. This procedure initiates boron if two or more control rods are not fully inserted as indicated by either the rod bottom lights or the rod position indication system.

REQUESTED ACTION 2

Promptly determine the continued operability of control rods based on current information. As new information becomes available from plant rod drop tests and trips, licensees should consider this new information together with data already available from Wolf Creek, South Texas, North Anna, and other industry experience, and make a prompt determination of control rod operability.

RESPONSE

The current basis for continued operability of the rod control system and the control rods was demonstrated as part of the Power Ascension Testing program by performance of the following tests:

Refueling and Core Alterations (includes drag test)
Control Rod Drive Mechanism Timing
Rod Position Indication System
Rod Control System
Rod Drop Testing
Rod Drop Time Measurement

WBN Unit 1 Cycle 1 has accumulated less than 500 MWD/MTU burnup since the tests were performed. WBN has experienced four reactor trips since that time. For each of those trips, the rods were determined to have inserted normally into the core.

From the above testing information and because of the low burnup projections, WBN's control rods have been determined to be operable.

TVA's Operating Experience Review section evaluates new industry experience as information becomes available. If the industry event has the potential to effect the TVA nuclear plants, the information is distributed and evaluated for applicability at each of the plants.

REQUESTED ACTION 3

Measure and evaluate at each outage of sufficient duration during calendar year 1996 (end of cycle, maintenance, etc.), the control rod drop times and rod recoil data for all control rods. If appropriate plant conditions exist where the vessel head is removed, measure and evaluate drag forces for all rodded fuel assemblies.

a. Rods failing to meet the rod drop time in the technical specifications shall be deemed inoperable.

b. Rods failing to bottom or exhibiting high drag forces shall require prompt corrective action in accordance with Appendix B to Part 50 of Title 10 of the Code of Federal Regulations (10 CFR Part 50).

RESPONSE

TVA does not consider this requested action to be applicable to WBN. As stated in the response to Requested Action (2), drag test and control rod testing were recently performed. Since WBN Unit 1 has fresh fuel with burnup of less than 500 MWD/MTU and the problem with stuck rods appears to effect fuel with high burnup, information gained from the test would have little influence in the NRC's evaluation of this problem. At the end of Cycle 1, scheduled to be in October 1997, it is projected that peak burnup will be 18,900 MWD/MTU in rodded core locations. Cycle 1 has >1% delta K/K excess shutdown margin. WBN does not expect to have high burnup fuel assemblies in rodded locations until the end of Cycle 3. Therefore, WBN does not plan to measure and evaluate the control rod drop times during each outage in calendar year 1996.

REQUESTED ACTION 4

For each reactor trip during calendar year 1996, verify that all control rods have promptly fully inserted (bottomed) and obtain other available information to assess the operability and any performance trend of the rods. In the event that all rods do not fully insert promptly, conduct tests to measure and evaluate rod drop times and rod recoil.

RESPONSE

Control rods are verified to be inserted after each reactor trip. For the analog rod position indication system at WBN, 12 steps or fewer above the 0 steps indication is defined as fully inserted. Any discrepancies will continue to be addressed in accordance with the TVA corrective action program. If the discrepancies are of the nature which would indicate an insertion problem, testing of the rod drop times will be conducted.

REQUIRED RESPONSE 2

Within 30 days of the date of this bulletin, a core map of rodded fuel assemblies indicating fuel type (materials, grids, spacers, guide tube inner diameter) and current and projected end of cycle burnup of each rodded assembly for the current cycle; when available, provide the same information for the next cycle.

RESPONSE

WBN has a Westinghouse rod array of 17 x 17 Standard fuel rods with Vantage 5H (V5H) guide tubes and grid design. Fuel assembly parameters for WBN are listed on the attached table. A WBN Unit 1 quarter core map of Cycle 1 (current) end of cycle burnup of rodded fuel assemblies is also attached. Current burnup is less than 500 MWD/MTU. Preliminary estimates of peak burnup for Cycle 2 is projected to be 36,000 MWD/MTU in rodded core locations. A core map for WBN Unit 1, Cycle 2 is not yet available.

REQUIRED RESPONSE 3

Within 30 days after completing Requested Action (3) for each outage, a report that summarizes the data and that documents the results obtained. This is also applicable to Requested Action (4) when any abnormal rod behavior is observed.

RESPONSE

A report that summarizes rod operability data during reactor trips on WBN Unit 1 for the calendar year of 1996, would provide little value to the NRC because of the low burnup on the fuel rods. Therefore, TVA does not plan to submit that information for WBN. If there is any abnormal rod behavior observed following a reactor trip during the calendar year 1996, the results of the evaluation will be captured in the monthly operating report that follows the completion of the rod operability assessment.

TVA Watts Bar Fuel Assembly Description

Fuel Assembly Parameter	W 17x17 (V5H)
Guide Tubes	
• Inner Diameter, upper ($GTID_n$)	0.442
dashpot ($GTID_d$)	0.397
• Material (guide tubes)	Zirc-4 (low tin)
Grids	
• Material - (top/bottom grids) - total of 2	Inconel-718
• Material - (mixing mid-grids) - total of 6	Zirc-4

NOTE: All dimensions are in inches.

Watts Bar Unit 1 Cycle 1
Projected End of Cycle Assembly Burnup in Rodded locations
Cycle Average Burnup for Current Cycle is 407 EFPD or 15,675 MWD/MTU

Note: Current Total Core Average Burnup is Very Low - Currently Less Than 500 MWD/MTU

18,100 V5H		18,000 V5H		17,900 V5H		15,600 V5H	
					17,300 V5H		
18,000 V5H		18,000 V5H				15,300 V5H	
			18,000 V5H		16,700 V5H		
17,900 V5H				18,700 V5H		12,900 V5H	
	17,300 V5H		16,700 V5H				
15,600 V5H		15,300 V5H		12,900 V5H			

Burnup in MWD/MTU

Type of Assembly (V5H)

ENCLOSURE 3

SEQUOYAH NUCLEAR PLANT (SQN) UNITS 1 AND 2 RESPONSE TO NRC BULLETIN 96-01, "CONTROL ROD INSERTION PROBLEMS"

LIST OF COMMITMENTS

1. Simulator scenarios are being developed to address multiple partially stuck rods post trip. This new training will be included in the next requalification cycle that begins following the spring Unit 2 Cycle 7 refueling outage and will be completed by July 29, 1996.

2. SQN will measure and evaluate at each outage (end of cycle or major maintenance) of sufficient duration during calendar year 1996, the control rod drop times and rod recoil data for all control rods unless there has been less than 2,500 MWD/MTU burnup since the last time the drop time data was taken. If appropriate plant conditions exist where the vessel head is removed, drag forces for each rodded fuel assembly will be measured. Evaluations of this data will be made as necessary. Nonconformances will continue to be addressed in accordance with the TVA corrective action program.

3. Control rods are verified to be inserted after each reactor trip. If the discrepancies indicate an insertion problem, testing of the rod drop times and rod recoil will be conducted during calendar year 1996.

4 Within 30 days after Mode 2 entry following each completion of Requested Action (3), TVA will provide a report that summarizes the data and that documents the results obtained. Test results for discrepancies identified in accordance with Requested Action (4) will similarly be provided.

WATTS BAR NUCLEAR PLANT (WBN) UNIT 1 RESPONSE TO NRC BULLETIN 96-01, "CONTROL ROD INSERTION PROBLEMS"

LIST OF COMMITMENTS

1. Problems with stuck rods in high burnup fuel assemblies will be discussed in the classroom during the upcoming Licensed Operator Requalification Training cycle and will also be included as a scenario in the simulator drills utilizing the site procedure, "Reactor Trip Response," to respond to the event.