



**North
Atlantic**

North Atlantic Energy Service Corporation
P.O. Box 300
Seabrook, NH 03874
(603) 474-9521

The Northeast Utilities System

June 16, 2000

Docket No. 50-443

NYN-00056

Ref.: CR 00-06708

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

Seabrook Station
Licensee Event Report (LER) 00-003-00
Shutdown Bank Rods Mis-alignment During Quarterly Rod Operability Surveillance

Enclosed is Licensee Event Report (LER) 00-003-00 for an event that occurred at Seabrook Station on May 29, 2000. This event is being reported pursuant to 10 CFR 50.73(a)(2)(i).

Should you require further information regarding this matter, please contact Mr. James M. Peschel, Manager-Regulatory Programs at (603) 773-7194.

Very truly yours,

NORTH ATLANTIC ENERGY SERVICE CORP.


Ted C. Feigenbaum
Executive Vice President and
Chief Nuclear Officer

cc: H. J. Miller, NRC Regional Administrator
R. M. Pulsifer, NRC Project Manager, Project Directorate 1-2
R. K. Lorson, NRC Senior Resident Inspector

RSN-001

IE22

ENCLOSURE TO NYN-00056

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1) <p style="text-align: center;">Seabrook Station</p>	DOCKET NUMBER (2) <p style="text-align: center;">05000443</p>	PAGE (3) <p style="text-align: center;">1 of 4</p>
--	--	---

TITLE (4)

Shutdown Bank Rods Mis-alignment During Quarterly Rod Operability Surveillance

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)		
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER	
05	29	00	00	003	00	06	16	00	FACILITY NAME	DOCKET NUMBER	
OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)									
1		20.2201(b)			20.2203(a)(2)(v)			<input checked="" type="checkbox"/> 50.73(a)(2)(i)		50.73(a)(2)(viii)	
POWER LEVEL (10)		100									
		20.2203(a)(1)			20.2203(a)(3)(I)			50.73(a)(2)(ii)		50.73(a)(2)(x)	
		20.2203(a)(2)(i)			20.2203(a)(3)(ii)			50.73(a)(2)(iii)		73.71	
		20.2203(a)(2)(ii)			20.2203(a)(4)			50.73(a)(2)(iv)		OTHER	
		20.2203(a)(2)(iii)			50.36(c)(1)			50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A	
		20.2203(a)(2)(iv)			50.36(c)(2)			50.73(a)(2)(vii)			

LICENSEE CONTACT FOR THIS LER (12)

NAME <p style="text-align: center;">Jeffrey E. Sobotka, Regulatory Compliance Supervisor</p>	TELEPHONE NUMBER (Include Area Code) <p style="text-align: center;">(603) 773-7152</p>
---	---

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)				EXPECTED SUBMISSION			MONTH	DAY	YEAR
<input checked="" type="checkbox"/> YES (If yes, complete EXPECTED SUBMISSION DATE).	<input type="checkbox"/> NO						12	18	00

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On May 29, 2000, North Atlantic determined that a mis-alignment of two of the four Shutdown Bank E rods occurred during the quarterly rod operability surveillance performance. This resulted in a condition prohibited by plant's Technical Specifications (TS) as the two mis-aligned rods were found to be not fully withdrawn. This condition is prohibited by TS 3.1.3.5 and is reportable pursuant to the requirements of 10CFR50.73(a)(2)(i)(B). The root cause of this event has not yet been determined. Based on discussions with the Control Rod Drive Mechanisms (CRDM) vendor and review of other similar types of events at other utilities, two potential root causes were identified, one electrical and one mechanical. The postulated electrical cause is a one-time or intermittent degradation of portions of the rod control system circuitry such that when out motion was demanded by the system, the control rod drive mechanism gripper timing was off and the rods slightly descended into the core. The postulated mechanical cause is physical sluggishness that also would affect timing of the moveable and/or stationary grippers on the rods due to increased friction acting on moving parts or physical interference due to the temporary presence of debris in the vicinity of the CRDM grippers. Subsequent movement of the rods would have likely facilitated dislodging the debris. Additional troubleshooting to explore the root cause will be performed prior to the startup from the seventh refueling outage.

**LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION**

FACILITY NAME (1) Seabrook Station	DOCKET NUMBER (2) 05000443	LER NUMBER (6)			PAGE (3) 2 of 4
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
		00	-- 003 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

I. Description of Event

On May 29, 2000, with the plant operating at 100% power (operational mode 1), North Atlantic Energy Service Corporation (North Atlantic) determined that a mis-alignment of two of the four Shutdown Bank E (SBE) rods [AA] occurred during the performance of the quarterly rod operability surveillance (OX1410.02, "Quarterly Rod Operability Check and Monthly New Full Out Position Surveillance"). This resulted in a condition prohibited by the plant's Technical Specifications (TS) as two shutdown bank rods were found to be not fully withdrawn.

Specifically, at approximately 0427 hours EDT on May 29, 2000, while SBE was being pulled to a demand position of 233 steps from its initial demand position of 229 steps as part of the rod operability surveillance, Control Room Operators observed that two (D8 and M8) of the four SBE rods displayed a position of 228 steps while the other two SBE rods (H4 and H12) displayed a position of 222 steps on the Digital Rod Position Indicator (DRPI). This 222 steps DRPI displayed position was not what the operators expected. At a demand of 233 steps, SBE should be pulled to the rod mechanical full-out position of 231 steps with its corresponding DPRI display indicating 228 steps for all four rods in that bank.

Control Room Operators continued the surveillance by inserting SBE rods to a demand position of 219 steps, and then pulling them to a final demand position of 229 steps. The DRPI display indicated that all four SBE rods inserted but again rods H4 and H12 did not move to the full-out position as they were being withdrawn. The DRPI display again indicated a position of 222 steps on these two rods. At 0530 hours, after verifying that all SBE rod positions displayed on the DRPI were within the rod alignment TS limits (TS 3.1.3.1) of +/-12 steps as compared to its group step counter demand, the surveillance was completed with a final condition of demand left at 229 steps.

North Atlantic generated a work request to investigate the cause of the difference between the demand position and DRPI display, and to determine whether the problem was associated with the DRPI or the Rod Control System. Since there had been a failure of DRPI detector/encoder card for rod indication in 1999, the investigation initially concentrated on finding any DRPI component failures. At approximately 1250 hours, Instrumentation and Control (I&C) Department technicians started troubleshooting the DRPI cabinet circuits, but no failure of a DRPI component was found.

After a change of the scope of the work request, at approximately 1730 hours, troubleshooting continued at the rod control cabinets where current traces on chart recorders were taken for SBE rods during their withdrawal to determine the actual position when each rod reached the mechanical full-out position. By counting the demand steps for each rod in SBE from the mechanical full-out position, North Atlantic was able to determine that rods H4 and H12 required seven and ten additional steps, respectively, for each rod to reach the mechanical full-out position of 231 steps. Therefore, as a result of using the chart recorders as a third indicating system (in addition to DRPI system and group step counter), it was determined that at the conclusion of the surveillance with a final position demand of 229 steps for rod full-out position, rods H4 and H12 were at 224 steps and 221 steps, respectively.

As a result, the position of rods H4 and H12 was below the fully withdrawn position (225 steps) required by TS 3.1.3.5, which allows for a maximum of one shutdown rod to not be fully withdrawn as specified in the Core Operating Limits Report (COLR). This represents a condition prohibited by the TS and is reportable pursuant to the requirements of 10CFR50.73(a)(2)(i)(B).

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1) Seabrook Station	DOCKET NUMBER (2) 05000443	LER NUMBER (6)			PAGE (3) 3 of 4
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
		00	-- 003 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

At approximately 1835 hours, the surveillance was repeated, and the results were verified to be satisfactory. All four SBE rods moved normally and uniformly, and rods H4 and H12 were verified to be at the rod full out stop position by current trace analysis. At 1848 hours, Control Room Operators reset the rods to 'AUTO'.

II. Cause of Event

The root cause of this event has not yet been determined. Troubleshooting revealed that the DRPI operated properly and provided an accurate indication of the position of SBE rods H4 and H12. North Atlantic concluded that Reactor Coolant System [AB] debris might have been deposited on the Control Rod Drive Mechanisms (CRDM) for rods H4 and H12. The tolerances on these mechanisms may be close enough that the debris eventually affected CRDM gripper timing and therefore rod motion. Subsequent movement of the rods would have likely facilitated dislodging the debris.

Upon discussion with the CRDM vendor, Westinghouse, and review of other similar types of rod mis-alignment events at other utilities, North Atlantic has identified two potential root causes, one electrical and one mechanical. The postulated electrical cause is a one-time or intermittent degradation of portions of the Rod Control System circuitry such that when out motion was demanded by the system, gripper timing was off and the rods slightly descended into the core. The postulated mechanical cause is physical sluggishness that would also affect the timing of the movable and/or stationary grippers on rods H4 and H12. The most likely cause of the physical sluggishness would be increased friction acting on moving parts or physical interference due to the temporary presence of debris in the vicinity of the CRDM grippers.

III. Analysis of Event

There are no safety consequences as a result of this event. The mis-alignment of SBE rods H4 and H12 did not challenge the shutdown margin or power distribution at any time during this event. The margin to safety was never compromised or reduced for any of the power distribution quantities or the shutdown margin.

SBE is composed of four Rod Control Cluster Assemblies (RCCAs). The RCCAs are located in core locations H4, H12, D8 and M8. The total worth of this bank is about 1097 pcm at Hot Full Power (HFP). North Atlantic has estimated the inserted worth of the two misaligned RCCA to be less than 5 pcm. Since the total available shutdown margin at Beginning of Life (BOL) and End of Life (EOL) for operating cycle 7 are 3260 pcm and 3340 pcm and the COLR shutdown margin requirement is 1300 pcm, the excess shutdown margin at BOL and EOL is 1960 and 2040 pcm, respectively. As excess shutdown margin is the amount of excess shutdown reactivity available over and above the shutdown margin requirement, there is negligible loss of excess shutdown reactivity as a result of this rod mis-alignment event, and therefore no loss of shutdown margin occurred during this event.

Additionally, two flux maps were taken to assess the effect of the mis-aligned rods in SBE on the core power distribution. The first flux map was taken just prior to the rod testing surveillance to measure a baseline power distribution. The second flux map was taken well into the above event to give the mis-alignment of SBE H4 and H12 time to affect a change in the core power distribution. Upon comparing the core power distributions, no measurable effect could be seen between the two flux maps in F_{DH} , $F_Q(Z)$, AFD, assembly power and core tilt. TS power distribution surveillance quantities were within their respective limits at all times during the mis-alignment of the rods.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

FACILITY NAME (1) Seabrook Station	DOCKET NUMBER (2) 05000443	LER NUMBER (6)			PAGE (3) 4 of 4
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
		00	-- 003 --	00	

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

The above described event did not adversely affect the ability of the rods to be inserted into the core. The event did not pose any nuclear safety concern, and the safety of the plant, its personnel, and the public was not compromised.

IV. Corrective Action

Upon discovery of this event, North Atlantic conducted immediate corrective actions. Troubleshooting was conducted on both DPRI Data A and Data B cabinets to verify that they were indicating correctly during the surveillance. Additionally, current trace equipment was connected to SBE rods moveable and stationary coils to monitor currents while SBE was withdrawn to verify the required number of steps to get SBE rods to the mechanical full-out position. Infrared thermography was also conducted on the rod control power cabinets, and no anomalies were observed.

Prior to the startup from the seventh refueling outage (OR07), North Atlantic will perform troubleshooting to explore the postulated electrical root cause. Additionally, North Atlantic will test the CRDM control system components/circuitry and will conduct inspections of the associated connectors. If this electrical testing finds no identifiable problems, then the postulated mechanical root cause of physical sluggishness due to debris depositing in the vicinity of the movable and/or stationary grippers is the most likely cause of this mis-aligned rod event.

The performance of the rods will be monitored by connecting current trace equipment to SBE rods during monthly and quarterly rod operability surveillance until OR07.

V. Additional Information

None

Similar Events

This is the first event at Seabrook Station involving a condition prohibited by TS 3.1.3.5. However, this is the second event involving mis-aligned rods. Specifically, LER 91-013-01, "Reactor Protection System Actuation During Rod Position Indication 18-Month Surveillance," dated August 17, 1992, described an occurrence where the DRPI indication for Shutdown Bank C, Rod N5, was greater than plus or minus 12 steps of the position indicated on the demand step counter as required by TS 3.1.3.3. The most probable cause of this earlier event was a sluggish rod drive mechanism due to loose debris.

Manufacturer Data

Not applicable.