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CALVERT CLIFFS NUCLEAR POWER PLANT DEPARTMENT
CALVERT CLIFFS NUCLEAR POWER PLANT
LUSBY, MARYLAND 20657

August 11, 1989

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

Docket No. 50-318
License No. DPR 69

Dear Sirs:

The attached LER 89-011 is being sent to you as required under 10 CFR 50.73 guidelines.

Should you have any questions regarding this report, we would be pleased to discuss them with you.

Very truly yours,

L. B. Russell
Manager-Calvert Cliffs Nuclear Power Plant Department

LBR:sdw

cc: William T. Russell
Director, Office of Management Information
and Program Control
Messrs: G. C. Creel
C. H. Cruse

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LICENSEE EVENT REPORT (LER)

FACILITY NAME (1) Calvert Cliffs Unit 2	DOCKET NUMBER (2) 0 5 0 0 0 3 1 8	PAGE (3) 1 OF 0 5
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TITLE (4) Fractured Nut Caused by Inadequate Nut Material and Dimensional Properties Results in Inoperable Steam Generator Snubbers

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 NAMES		DOCKET NUMBER(S)
0 7	1 0	8 9	8 9	0 1 1	0 0	0 8	1 0	8 9	Calvert Cliffs Unit 1		0 5 0 0 0 3 1 7
									0 5 0 0 0		

OPERATING MODE (9) 6

POWER LEVEL (10) 0 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 5: (Check one or more of the following) (11)

<input type="checkbox"/> 20.402(b)	<input type="checkbox"/> 20.405(c)	<input type="checkbox"/> 50.73(a)(2)(iv)	<input type="checkbox"/> 73.71(b)
<input type="checkbox"/> 20.405(a)(1)(i)	<input type="checkbox"/> 50.36(c)(1)	<input checked="" type="checkbox"/> 50.73(a)(2)(v)	<input type="checkbox"/> 73.71(c)
<input type="checkbox"/> 20.405(a)(1)(ii)	<input type="checkbox"/> 50.36(c)(2)	<input type="checkbox"/> 50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 365A)
<input type="checkbox"/> 20.405(a)(1)(iii)	<input type="checkbox"/> 50.73(a)(2)(i)	<input type="checkbox"/> 50.73(a)(2)(viii)(A)	
<input type="checkbox"/> 20.405(a)(1)(iv)	<input type="checkbox"/> 50.73(a)(2)(ii)	<input type="checkbox"/> 50.73(a)(2)(viii)(B)	
<input type="checkbox"/> 20.405(a)(1)(v)	<input type="checkbox"/> 50.73(a)(2)(iii)	<input type="checkbox"/> 50.73(a)(2)(ix)	

LICENSEE CONTACT FOR THIS LER (12)

NAME: Craig D. Sly - Engineer; Licensing

TELEPHONE NUMBER: 3 0 1 2 6 0 4 4 8 5 8

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
B	S/B	S/N/B	X 9 9 9	N					

SUPPLEMENTAL REPORT EXPECTED (14)

YES (If yes, complete EXPECTED SUBMISSION DATE) NO

EXPECTED SUBMISSION DATE (15)

MONTH	DAY	YEAR

ABSTRACT (Limit to 1400 sps. i.e., approximately fifteen single space typewritten lines) (16)

On July 10, 1989 a condition was discovered at Calvert Cliffs which could have prevented the fulfillment of the safety function of structures or systems needed to mitigate the consequences of an accident. We discovered that the tie rod nuts holding the piston/cylinder assembly of our Steam Generator snubbers intact were of inadequate material and dimensional properties. One nut fractured upon being torqued to its specified value. At the time of discovery both units were shutdown. Unit 1 was in cold shutdown and Unit 2 was in refueling with the core off-loaded.

We determined the cause of the nut failure to be inadequate material properties and physical dimensions. The nuts had been installed with a marginal safety factor, when torqued to their specified values.

All of our S/G Snubbers and steam generators were declared inoperable. Prior to restarting either unit, all inadequate S/G snubber nuts for that unit will be replaced with nuts meeting or exceeding current material and dimensional standards for such nuts. We have also visually inspected other snubbers from the same manufacturer and have found no similar nuts.

The snubber vendor has been requested to supply us with other incidences where this material is specified by the particular supplier of the S/G snubbers. Additional corrective action will be implemented as required.

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		89	011	00	02	OF 05

TEXT (If more space is required, use additional NRC Form 386A's) (17)

I. DESCRIPTION OF EVENT

On July 10, 1989 a condition was discovered at Calvert Cliffs Nuclear Power Plant which could have prevented the fulfillment of the safety function of systems needed to mitigate the consequences of an accident. We discovered that nuts which hold the piston/cylinder assembly of our Steam Generator (S/G) Snubbers together were of inadequate material and dimensional properties. One nut fractured upon being torqued to its specified value. At the time of discovery, both units were shutdown. Unit 1 was in Mode 5 with reactor coolant temperature at 110 degrees Fahrenheit and pressure at 0 PSIG. Unit 2 was in Mode 6 with the core off-loaded and reactor coolant temperature at 85 degrees Fahrenheit.

On April 17, 1989 a S/G snubber was being reassembled after it had been reconditioned to extend its service life in accordance with Technical Specification 4.7.8.1.e "Snubber Service Life Monitoring." The snubber is an early 1970 vintage 10 inch bore by 5 inch stroke hydraulic snubber supplied by Grinnell. The S/G snubbers are safety related. The snubbers were manufactured to a special Combustion Engineering Specification. The snubber's cylindrical piston/cylinder assembly is held together by twelve one-inch external tie rods which compress face plates on both ends. The assembly is compressed by torquing nuts on one end of the tie rods to 560 ft-lbs. Torquing consists of five rounds in a cross-bolting sequence at 112 ft-lbs increments per round.

The nut failed during the final torquing round. The first nut in the cross-bolting sequence had been torqued to 560 ft-lbs. The second nut was about to reach 560 ft-lbs when the first nut suddenly failed. The nut failure was described as a "popping off" by personnel in the area. The nut fractured approximately in half and flew in opposite directions. The nut halves were found approximately 20 feet and 40 feet away from the snubber. This indicates that they attained a considerable velocity upon fracturing.

The fractured nut and nine similar unfractured nuts were sent to our Materials Engineering and Analysis Unit for testing. Grinnell was contacted to obtain the original material specification for the nuts. Grinnell indicated the piston/cylinder assembly was manufactured by Tomkins-Johnson. The nut was specified to be "e.t.d." 150 material, which is a proprietary alloy of LaSalle Steel Co.

The nuts are one-inch hex flange nuts with 14 threads per inch. They were machined from bar stock. The fractures were approximately 180° apart, one through the thick part (ridge) and one through the thin part (flat) of the nut. The wall dimensions at the failed surfaces were approximately 0.185 inches and 0.125 inches, respectively.

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

The fracture surface revealed a brittle fracture with a woody texture typical of a fracture following a microstructurally preferred path. Fracture tests revealed a more ductile fractures in the opposite direction of the original fracture. The fracture surface was examined under a microscope. An abundance of inclusions high in Manganese and Sulfur, typical of MnS₂ inclusions, were noted.

A chemical analyses of the failed nut and nine other nuts was performed. The results indicate that the nuts are nominally an AISI 1140 alloy. The material specifications of "e.t.d." 150 correspond to approximately an AISI 4140 alloy. We have concluded that the nuts are not of the same material as specified by the vendor.

Upon receipt of the preliminary analysis results on July 10, 1989 all S/G snubbers were declared inoperable. An engineering determination was completed on July 13, 1989. It concluded the material deficiency was reportable per 10CFR Part 21 as a defect in a basic component. NRC Region I was notified on July 12, 1989 and a written report was issued the next day. There were no other components or systems which were inoperable and/or out of service which contributed to this event. No plant systems or other component failures resulted from this event.

II. CAUSE OF EVENT

It is our opinion that the original nuts have been operating with a marginal safety factor. We determined the cause of the nut failure to be inadequate material properties and marginal physical dimensions.

ANSI B18.2.2, "Square and Hex Nuts" specifies one inch hex nuts have a thickness of the flat of 0.25 inches. The failed nut was 0.125 inches in this dimension. We feel the thin wall contributed to the failure. If the nut had been machined to dimensions meeting the ANSI 18.2.2 standard it may have withstood the stresses of the final torquing sequence.

The material properties of the nut were not adequate. The material was not the same as specified by the vendor and it was extremely brittle. Its brittleness caused it to fail in a catastrophic manner. The specification on "e.t.d." 150 lists the mean material elongation as 10% and the mean reduction of area as 37%. The nut showed no signs of this type of ductility. The abundance of manganese sulfide (MnS₂) inclusions in nut material resulted in low strength and ductility in the cross grain direction.

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

III. ANALYSIS OF EVENT

This event is reported in accordance with 10CFR50.73(a)(2)(v)(D), "Any event or condition that alone could have prevented the fulfillment of the safety function of structures or systems that are needed to mitigate the consequences of an accident". The inadequate snubber nuts could possibly have failed if the S/G snubbers were subjected to significant percentages of full design load. Postulated events including steam line ruptures and earthquakes would subject S/G snubbers to loads of these magnitudes.

Technical Specifications require safety related snubbers be operable when the system they provide support to is required to be operable. Safety related snubbers ensure the structural integrity of the reactor coolant system and other safety related systems is maintained during and following an event initiating dynamic loads.

We believe no safety consequences resulted from this condition. Repeated functional tests of all Steam Generator snubbers has been completed in the past at Calvert Cliffs. No failures of the nuts have been noted. The functional tests are performed as part of our snubber surveillance program and subjects the snubbers to design loading conditions.

The inadequate nuts were installed on the S/G snubbers during original manufacturing. The snubbers were installed in Calvert Cliffs as part of original construction. Calvert Cliffs Unit 1 received its operating license on July 31, 1974 and Unit 2 on August 13, 1976.

IV. CORRECTIVE ACTIONS

All of the S/G snubbers were immediately declared inoperable for the purposes of satisfying Technical Specifications.

A 10 CFR 21 written notification was issued on July 13, 1989. The inadequate nuts are considered to be a defect in a basic component as defined in 10 CFR 21.

Prior to restart of either unit all S/G snubbers for that unit will have all of the inadequate nuts replaced. The new nuts are made from ASTM A-194 2H material and meet the dimensional requirements of ANSI 18.2.2. Grinnell's current stock replacement nut, specified as an A194GR2H nut, meets these specifications.

We have visually verified that all other TJ manufactured snubbers at Calvert Cliffs have none of the subject nuts. The inadequate nut material is easily identifiable due to its silvery appearance with respect to normal hardened nuts.

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TEXT (If more space is required, use additional NRC Form 386A's) (17)

Grinnell indicated they have had no reports of similar nut failures. They also indicated it is permissible to replace one nut at a time by removing an old nut, installing and torquing a new nut to proper final torque. Then, after all nuts on a snubber are replaced, verifying all nuts are at the proper torque.

Grinnell has been requested to inform us of other incidences where Tomkins-Johnson-supplied snubbers are specified to contain "e.d.t." 150 material. Additional corrective action shall be implemented as required.

V. ADDITIONAL INFORMATION

There have been no previous similar reportable events at Calvert Cliffs involving inadequate snubber nuts. The deficient snubber nuts were found on Grinnell Co. T.J. 10" X 5" snubber tie rods. The snubber/cylinder assembly was supplied by Tomkins-Johnson (TJ). The nut material was "e.t.d." 150, a proprietary alloy, of LaSalle Steel Co.

Identification of Components Referred to in this LER

Component	IEEE 803 EIS Funct.	IEEE 805 System ID
Snubber	SNB	SB
Nut	N/A	SB
Steam Generator	S/G	SB
Reactor Coolant System	N/A	AB