SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT □ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

August 16, 1982
EQC 82-472

DIRECTOR OF NUCLEAR REACTOR REGULATION
ATTENTION JOHN F STOLZ CHIEF
OPERATING REACTORS BRANCH 4
U S NUCLEAR REGULATORY COMMISSION
WASHINGTON D C 20555

DOCKET 50-312
RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1
AUXILIARY FEEDWATER HEADER REPAIR--ADDITIONAL INFORMATION

During a meeting held on August 13, 1982 in Washington, D. C., it was agreed that additional information regarding the cracks known to exist in the Internal Auxiliary Feedwater Headers at Rancho Seco would be provided to the NRC.

The enclosed analysis done by B&W provides this information.

J. J. Mattimoe

J. J. Mattimoe
Assistant General Manager
and Chief Engineer

Attachment

A001

RESPONSE TO AUGUST 13, 1982 NRC QUESTIONS

INTERNAL AFW HEADER

1. Stress Profiles With and Without Crack

These MSLB stresses for representative elements around the internal header are shown in Table 1. Figures 1, 2, and 3 show the element orientation. Of these elements, the maximum stress intensities (14.8 ksi without crack and 15.3 ksi with crack) occur at element 6 which is approximately 100° from the center of the crack. The ASME Section III allowable stress intensity for this condition is 42.0 ksi.

2. Circumferential Crack Growth

The largest loading on a corner weld is a moment about the tangential axis due to differential thermal expansion. If a through-wall crack were present this moment would be relieved, lowering the thermal stresses.

A critical crack length in the circumferential direction cannot be determined by Section XI fracture mechanics methods. However, a fatigue crack growth rate could be calculated using fracture mechanics methods if the proper material properties were known. This would be expected to show a longer life than the fatigue analysis already performed since the fracture analysis considers only the stress component driving the crack (2300 psi) while the fatigue analysis considers the total stress intensity (11,000 psi) which was conservatively calculated assuming no relief in the thermally induced stresses due to the presence of the through-wall crack. Therefore the existing fatigue analysis using a fatigue strength reduction factor of four is deemed adequate to demonstrate that the crack will not propogate.

GENERAL CALCULATIONS

SUMMARY OF SELECTED MID-ELEMENT EDGE* STRESSES (WITH AND WITHOUT THE WELD CRACK) TABLE 1 MSL BRK PRESSURE

EL. NO.	WELD CRACK	S_x (PSI)	S_y (PSI)	τ_{XY} (PSI)	S_{MAX} (PSI)	S_{MIN} (PSI)	APPROX. ANGLE θ TO CENTER OF ELEM
6	NO	-13,329.	-1645.	4568.	-71.	-14,903.	3.4°
	YES	-13,587.	-1873.	4921.	-80	-15,380.	
102	NO	3354.	-335.	1925.	4104.	-1085.	80.6°
	YES	3312.	-333.	1913.	4132.	-1153.	
198	NO	-12,783.	-241.	843.	-185.	-12,839.	162.4°
	YES	-13,014.	-143.	1204.	-31.	-13,126.	
262	NO	2463.	791.	-3020.	4761.	-1507.	215.1°
	YES	3911.	1464.	-3240.	6151.	-776.	
294	NO	1768.	62.8	-1301.	2471.	-640.	240.9°
	YES	-1206.	109.	-571.	322.	-1419.	
302	NO	4977.	31.8	-1341.	5317.	-308.	247.3°
	YES	2257.	895.	-1492.	3216.	-64.	
310	NO	7330.	205.	-1484.	7627.	-92.	253.7°
	YES	-6982.	-691.	-1882.	-171.	-7502.	

REF. COMPUTER RUNS AEOACBG AND AEOACBN* *WITH WELD CRACK

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SUMMARY OF SELECTED MID-ELEM. EDGE STRESSES – CONT'D
TABLE 1 MSL BEK PRESSURES

EL. No.	WELD CRACK	S_x (PSI)	S_y (PSI)	τ_{xy} (PSI)	S_{max} (PSI)	S_{min} (PSI)	APPROX. ANGLE θ TO CENTER OF ELEM.
342	NO	-6818.	165.	-691.	233.	-6886.	281.3°
	YES	-4704.	-486.	-977.	-271.	-4919.	
350	NO	-3716.	117.	-639.	221.	-3820.	288.8°
	YES	-1127.	132.	-287.	194.	-1189	
382	NO	1385.	2615.	-2020.	4112.	-112.	318.4°
	YES	2586.	3003.	-2163.	4968.	621.	
406	NO	-322.	363.	1446.	1507.	-1466.	337.7°
	YES	-359.	354.	1844.	1876	-1881	

REF. COMP. RUNS AEOACBG AND AEOACBN

PREPARED BY JOHN R. BIDDGE DATE 8-16-82
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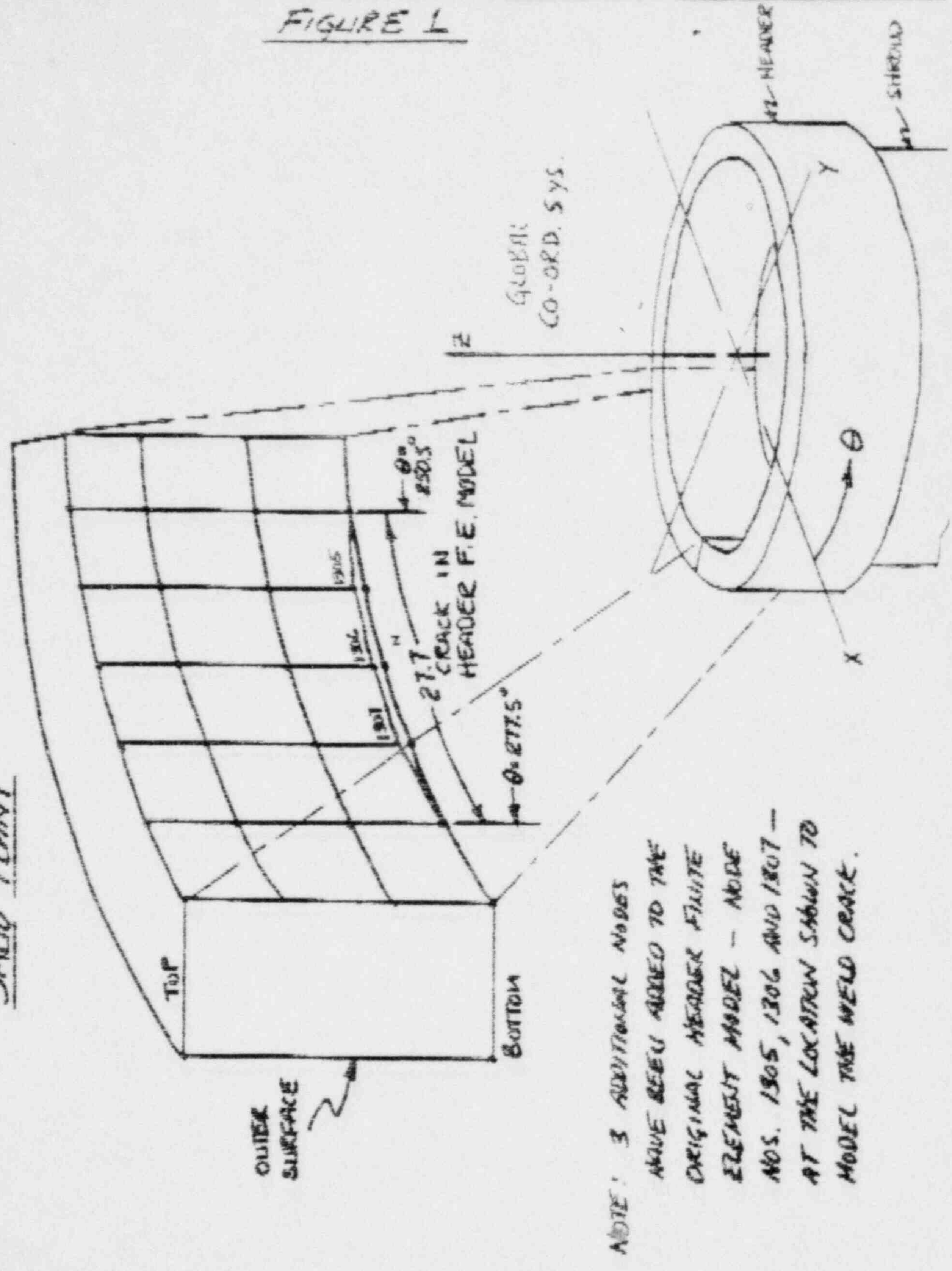
FIGURE 1

LOCATION OF WELD CRACK IN HEADER MODEL FOR SMUD PLANT



NOTE: 3 ADDITIONAL NODES HAVE BEEN ADDED TO THE ORIGINAL HEADER FINITE ELEMENT MODEL - NODE NOS. 1305, 1306 AND 1307 - AT THE LOCATION SHOWN TO MODEL THE WELD CRACK.

FIGURE 2

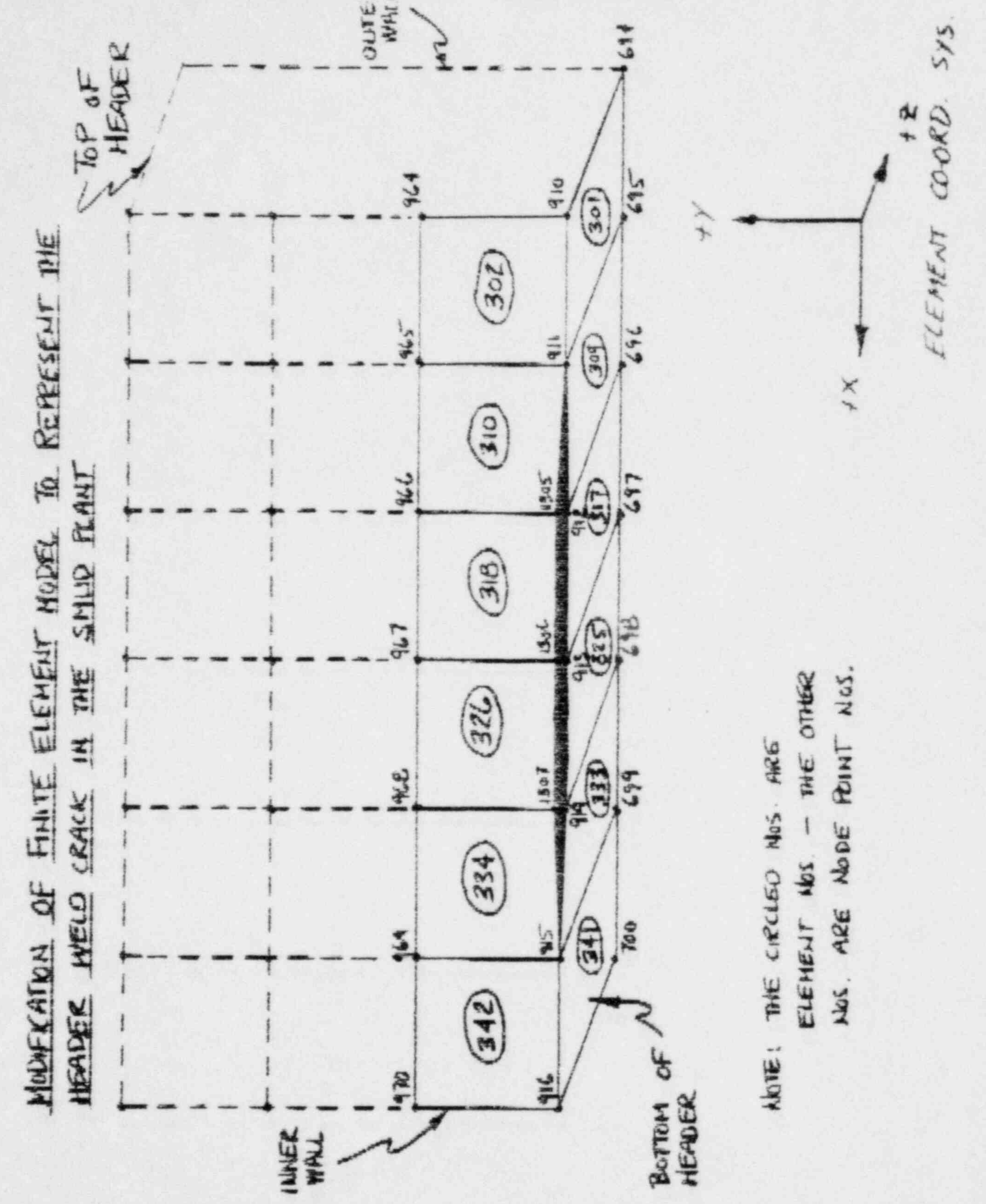

MODIFICATION OF FINITE ELEMENT MODEL TO REPRESENT THE HEADER WELD CRACK IN THE SMUD PLANT
TOP OF HEADER
OUTER WALL
INNER WALL
BOTTOM OF HEADER
964
965
966
967
968
969
970
910
911
1305
912
1306
913
1307
914
915
916
614
695
696
697
698
699
700
301
302
309
310
317
318
325
326
333
334
341
342
+Z
+Y
+X
ELEMENT COORD. SYS.
NOTE: THE CIRCLED NOS. ARE ELEMENT NOS. - THE OTHER NOS. ARE NODE POINT NOS.

FIGURE 3

TOP VIEW OF HEADER (INNER WALL) SHOWING CIRCUMFERENTIAL LOCATION OF TABULATED ELEMENTS