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ILLINOIS POWER COMPANY

CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727

August 26, 1985

Docket No. 50-461

Director of Nuclear Reactor Regulation
Attn: Mr. W. R. Butler, Chief
Licensing Branch No.2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Clinton Power Station Unit #1
Effects of Valve Flexibility in
Dynamic Piping Analysis

Dear Mr. Butler:

In your letter dated July 12, 1985, you requested additional information to resolve a follow-up item related to the effects of valve flexibility in dynamic piping analysis resulting from the Clinton Independent Design Review (IDR). The enclosure contains the response to this request which Illinois Power Company believes resolves your questions regarding the modeling of flexible valves and their analysis.

Please contact us should you have any questions regarding this matter.

Sincerely yours,

F. A. Spangenberg

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Director - Nuclear Licensing
Nuclear Station Engineering

JLP/kaf

Enclosure

cc: B. L. Siegel, NRC Clinton Licensing Project Manager
NRC Resident Office
Regional Administrator, Region III, USNRC
Illinois Department of Nuclear Safety

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Enclosure

NRC Questions

A. Explain the apparent inconsistency between the FSAR commitment (Reference FSAR Q&R Chapter 3, response to MEB (DSER) Item No. 49) and the S&L consideration of flexible valves.

B. Provide a list of all valve/operator assemblies with natural frequencies less than 33Hz, the vendor, the acceleration values for which the valves are qualified, and the calculated valve acceleration value.

C. Provide an assessment of the effects of the flexible vs rigid valve modeling in piping stress analyses and include any differences in the calculated valve accelerations, piping stresses, and support loads resulting from the rigid and flexible valve model.

Responses

A. There is no inconsistency between the FSAR commitment and the S&L consideration of flexible valves. S&L has performed a generic study on flexible valves. Representative piping systems were considered using a detailed finite element representation of the valve assembly to account for its flexibility. The results of this study were compared with similar cases where the valves were modeled as rigid in the piping analysis. Amplification factors resulting from this comparison are used to evaluate flexible valves and to qualify the flexible valves. As discussed in item C, flexible valves have minimal effect on piping systems.

B. Attached (Table 1) is a list of all valve/operator assemblies with natural frequencies less than 33 Hz.

C. As discussed with the NRC consultants during the May 6-9, 1985 inspection, it is expected that variations in modeling of valve stiffness have no significant impact on overall piping system behavior. The effects of a more flexible valve model would be local to the valve, and would not significantly impact pipe stresses and support loads. Depending on system frequency, the piping analysis results could increase or decrease, depending on the overall system frequency shift (due to valve modeling differences) relative to the response spectra peak(s). Such variations in the analysis results would be similar to those expected due to other system modeling differences, such as nodalization.

To confirm this position, a piping subsystem (1HP-04) with a flexible valve was analyzed with the standard "rigid" valve model and with the "flexible" valve model. This subsystem is comprised mostly of 20" diameter and 16" diameter piping. The flexible valve (valve no. 1E22F015) is a 20" motor-operated gate valve with a fundamental frequency of 14.9 Hz. It should be noted that in the flexible valve model the geometry of the valve body was simplified for modeling purposes, and conservatively increases the overall flexibility of the valve assembly. Exhibits 1 through 3 document a comparison of the results of these analyses.

Pipe stress differences between the rigid and flexible analysis are minor, and all increased stresses from the flexible analysis are within Code allowables. The analysis also indicates an insignificant change in total system stresses.

Safety-related pipe support load differences for Service Level B response spectra loading between the rigid and flexible analyses are minor, and all increased supports loads from the flexible analysis are within the Service Level B design load values for 1HP-04. The change in total support loading (rigid to flexible) is a net decrease, from 127,000 lb to 111,000 lb.

The effects of the piping analysis valve modeling on valve accelerations are already accounted for in the program described in the response to parts A and B above; i.e., the rigid valve qualification evaluations. Table 1 indicates that the acceleration values used for valve qualification are equal to or greater than the calculated accelerations obtained from the rigid valve piping analysis.

In summary, the valve modeling techniques currently used in piping analysis are adequate and more detailed modeling for flexible valves will have no significant impact on the overall system behavior. Expected variations in analysis results will be similar to those expected from differences in other system modeling parameters. The rigid valve model provides an adequate design basis for pipe stress and support loads, while the local effects of valve accelerations are accounted for in the valve qualification evaluations.

Table 1

Spec.	Vendor	Equipment Number	Nat. Freq.	Type	Accel. Calc. 'g'	Values Qual. 'g'	SQ-CL No.
K-2866A	A/D	1E12-F041A, B, C	26	Tilt Disc Check Valve	T 2.050 V 2.657 L 2.050	T 4.5 V 3.0 L 4.5	089
K-2866A	A/D	1E21-F006	26.3	Tilt Disc Check Valve	T 1.615 V 2.024 L 1.198	T 4.5 V 3.0 L 4.0	090
K-2866A	A/D	1E22-F005	26.3	Tilt Disc Check Valve	T 1.228 V 1.319 L .894	T 4.5 V 3.0 L 4.5	092
K-2868	Posi- Seal	1SX003C,4C	28	But- ter Fly Valves	T 2.4437 V 1.7307 L 1.3183	T 7.75 V 4.5 L 6.75	148
K-2868	Posi- Seal	1FC016A,B 1FC024A,B 1SX017A	20	But- ter Fly Valves	T .67 V .764 L .269	T 7.75 V 4.5 L 6.75	148
K-2868	Posi- Seal	1SX020A,B	32	But- ter Fly Valves	T 2.5619 V 2.3107 L 1.0579	T 7.75 V 4.5 L 6.75	148
K-2868	Posi- Seal	1HG001,4, 5,8	28	But- ter Fly Valves	T V L *	T 7.75 V 4.5 L 6.75	179
K-2868	Posi- Seal	1FC027	32.7	But- ter Fly Valves	T 1.643 V 1.06 L 1.144	T 7.75 V 4.5 L 6.75	191

Table 1

Spec.	Vendor	Equipment Number	Nat. Freq.	Type	Accel. Calc. 'g'	Values Qual. 'g'	SQ-CL No.
K-2801	GE/ Fisher Controls	1C11-F010 1C11-F011	10.6	Globe Valves	T 3.0 V 0.87 L 3.0	T 4.5 V 3.0 L 4.5	720
K-2801	GE/ Anchor Darling	1E22-F015	14.9	Gate Valve	T 6.5 V 3.5 L 6.5	T 6.5 V 3.5 L 6.5	716
K-28C1	GE/ITT Hammal Dahl Conoflow	1C11-F180 1C11-F181	20.0	Globe Valves	T 2.229 V 1.234 L 2.229	T 4.5 V 3.0 L 4.5	629

		* 1HG001	1HG004	1HG005	1HG008
T	- Transverse	T 1.7318	T .8039	T 2.0228	T 2.5646
V	- Vertical	V 1.3117	V 1.1046	V 2.0478	V 1.9098
L	- Longitudinal	L 1.5558	L .6679	L 1.9468	L 2.6446
A/D	- Anchor Darling				

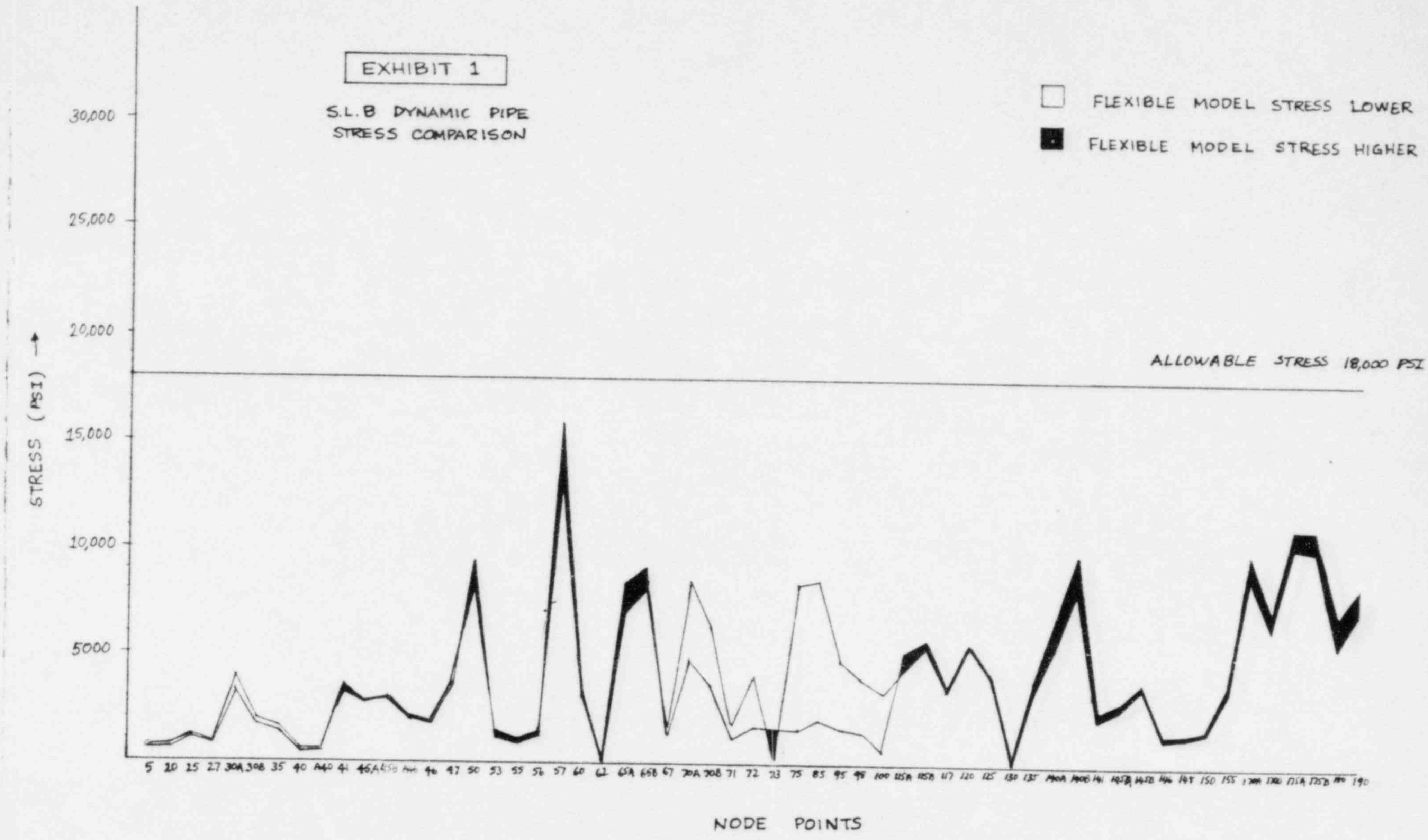
EXHIBIT 1
S.L.B DYNAMIC PIPE
STRESS COMPARISON
FLEXIBLE MODEL STRESS LOWER
FLEXIBLE MODEL STRESS HIGHER
ALLOWABLE STRESS 18,000 PSI
STRESS (PSI)
30,000
25,000
20,000
15,000
10,000
5000
NODE POINTS

EXHIBIT 2

SLB DYNAMIC STRESS COMPARISON

PERCENT CHANGE IN STRESSES

(FLEX MODEL VS. RIGID MODEL)

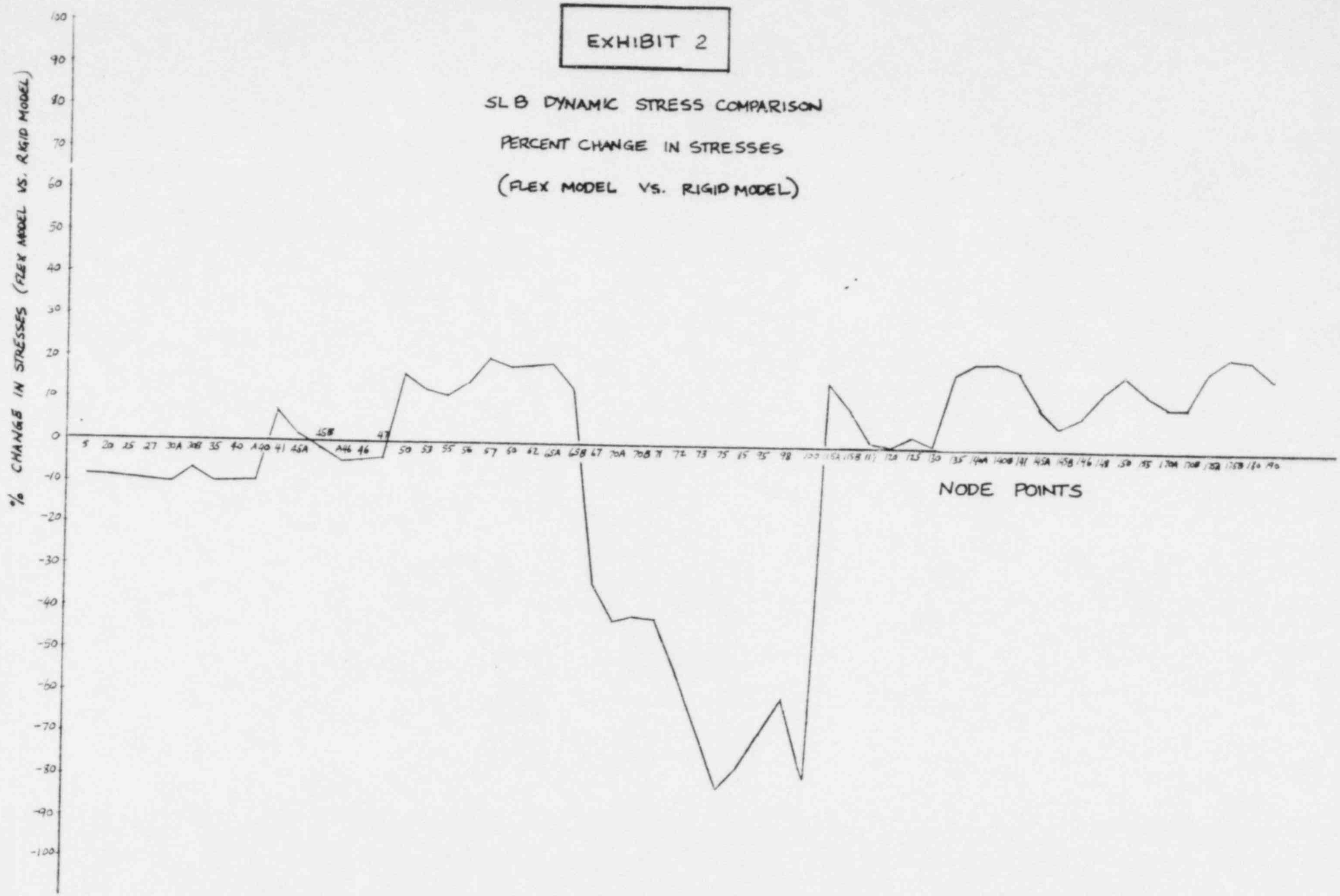

EXHIBIT 3

SL B DYNAMIC SUPPORT LOAD COMPARISON