ST. LUCIE-2

DOCKET 50-389

CEN-187(L)-NP

PRELIMINARY ASSESSMENT OF ST. LUCIE-2 FUEL STRUCTURAL INTEGRITY UNDER FAULTED CONDITIONS

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INTRODUCTION

This document formally transmits the preliminary assessment of the St. Lucie-2 fuel structural integrity under faulted conditions. The contents of this document are similar to Reference (1) presented on the Waterford-3 docket.

The seismic analysis methods and models presented utilize the methodology of the C-E fuel topical report, CENPD-178 (Ref. 2). The LOCA analysis methods and models represent an initial improvement over the LOCA methodology in CENPD-178, and are essentially based on the fuel seismic models from the topical report. These results represent the best information for St. Lucie-2 available at this time.

The final assessment of the St. Lucie-2 fuel structural integrity under seismic and LOCA loadings will be provided in May 1982. The final assessment will utilize the recently developed methods and models presented in CENPD-178 - Rev. 1 (Ref. 3).

Ref. 1 - CEN-159(C)-P, "Preliminary Assessment of Waterford-3 Fuel Structural Integrity Under Faulted Conditions", C-E Proprietary Report, May 4, 1981

Ref. 2 - CENPD-178, "Structural Analysis of Fuel Assemblies for Combined Seismic and Loss of Coolant Accident Loading", C-E Proprietary Report, August 1976

Ref. 3 - CENPD-178 Rev. 1, "Structural Analysis of Fuel Assemblies for Seismic and Loss of Coolant Accident Loading", C-E Proprietary Report, August 1981

PRELIMINARY SEISMIC ANALYSIS OF FUEL

The preliminary seismic analysis of the St. Lucie-2 fuel assemblies was performed by the procedure outlined in CENPD-178 (Ref. 2). In the first step of the procedure, input excitation to be used for the reactor internals plus core was developed. This consisted of the horizontal, vertical and rotational (rocking) time history responses of the reactor vessel determined from the reactor coolant system seismic analysis. Next, this excitation was input into separate horizontal and vertical models of the reactor internals plus core. For the horizontal direction, the analysis of the coupled internals and core yielded the time history responses of the core plates and the core shroud. The responses of the core plates and the core shroud were input into a detailed core model representing the longest row across the core (17 fuel assemblies). For the vertical direction, the core response was obtained directly from the coupled internals plus core analyses.

The results of the St. Lucie-2 core preliminary seismic analysis are shown on Figures 1 and 2. They consist of peak one-sided and through-grid spacer grid impact loads for the Safe Shutdown Earthquake (SSE). These results are for the longest row across the core.

PRELIMINARY LOCA ANALYSIS OF FUEL

Structural analyses of the St. Lucie-2 reactor coolant system were performed for a full power postulated 200 in^2 guillotine break at the reactor vessel inlet nozzle, a 135 in^2 break at the reactor vessel outlet nozzle, and a 1000 in^2 break at the steam generator inlet nozzle. The model and methods of analysis used are described in Section 3.9.1.4.1 of the St. Lucie-2 FSAR. The analysis provided reactor vessel motions at the flange and snubber elevations for each of the cases. Response spectra plots for these locations are provided in Figures 3 through 6 for the postulated cold leg break and the 1000 in^2 hot leg break. Results of the 135 in^2 hot leg break are less conservative than the 1000 in^2 break and are not included.

The asymmetric LOCA loads evaluation of the fuel assemblies was performed using detailed core models with single load path representations of the spacer grids. The fuel assemblies were subjected to the resultant displacements of the fuel alignment plate and core support plate which were obtained from the response analyses of the internals and fuel. The LOCA results of the fuel which include both one-sided and through-grid loads are presented in Figures 7 through 10 for the longest row across the core.

COMPARISON OF SPACER GRID IMPACT LOADS WITH Pcrit VALUES

NUREG-0609, "Asymmetric Blowdown Loads on PWR Primary Systems, Resolution of Generic Task Action Plan A-2, January 1981", states that it is a sufficient LOCA acceptance criterion to show that combined loads on the grids remain below Pcrit. It is our position that it is not necessary to combine seismic and LOCA loads on the grids. For the convenience of the NRC review, the seismic and LOCA loads on the grids have been combined (by SRSS*) and compared to values of Pcrit.

	Peak LOCA Load (Lbs)	Peak SSE Load (Lbs)	Peak Combined Load (Lbs)	Pcrit (Lbs)
One-Sided	[ ]	[ ]	[ ]	[ ]
Through-Grid				

* The combined loads are obtained from the square root of the squares of the SSE and LOCA loads for the same grid (function of grid location).

ST. LUCIE-2 - SINGLE-LOAD PATH MODEL
PEAK ONE SIDED LOADS ARE SHOWN (SSE)

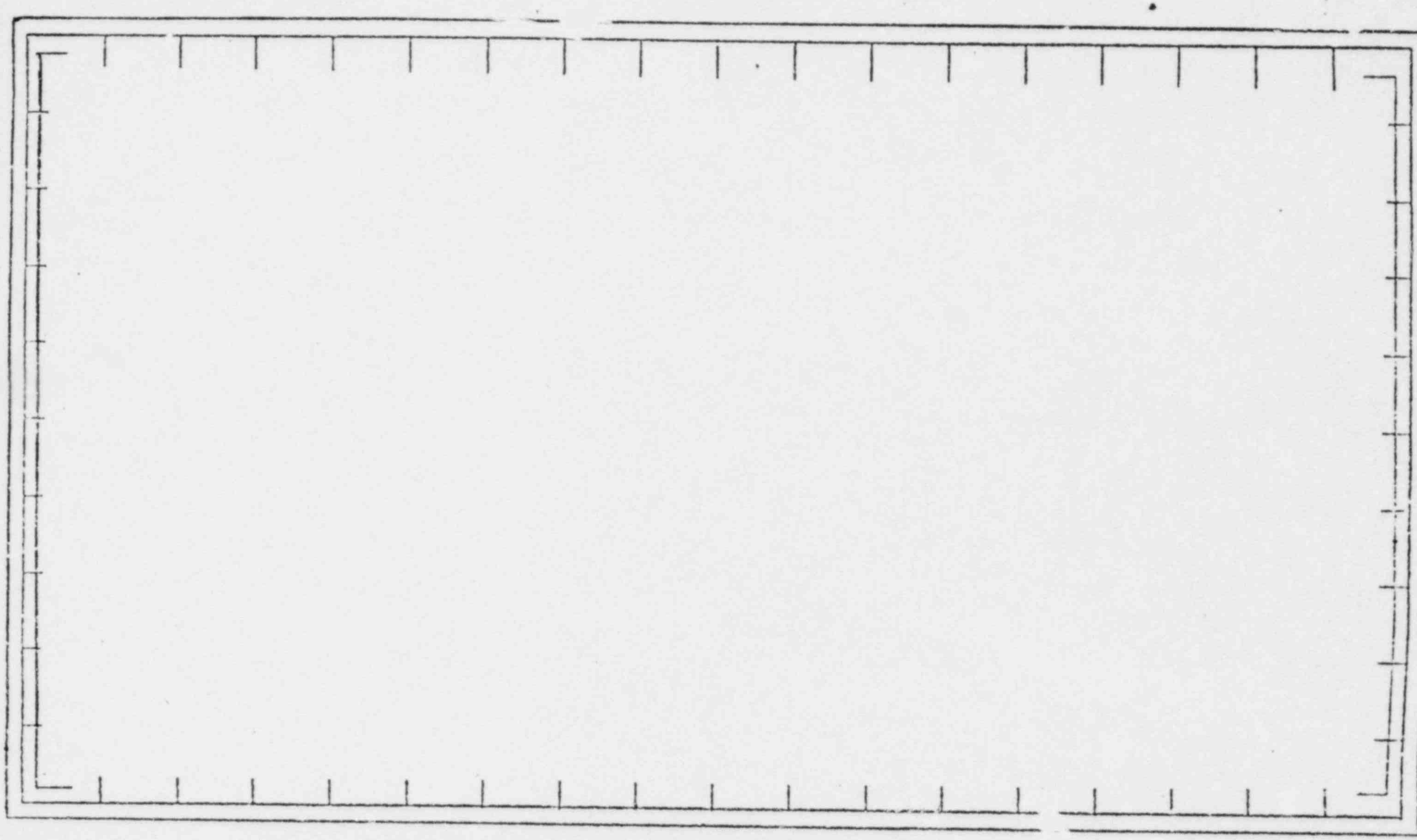

FIG 1.

ST. LUCIE-2 - SINGLE LOAD PATH MODEL

PEAK THROUGH GRID LOADS ARE SHOWN (SSE)

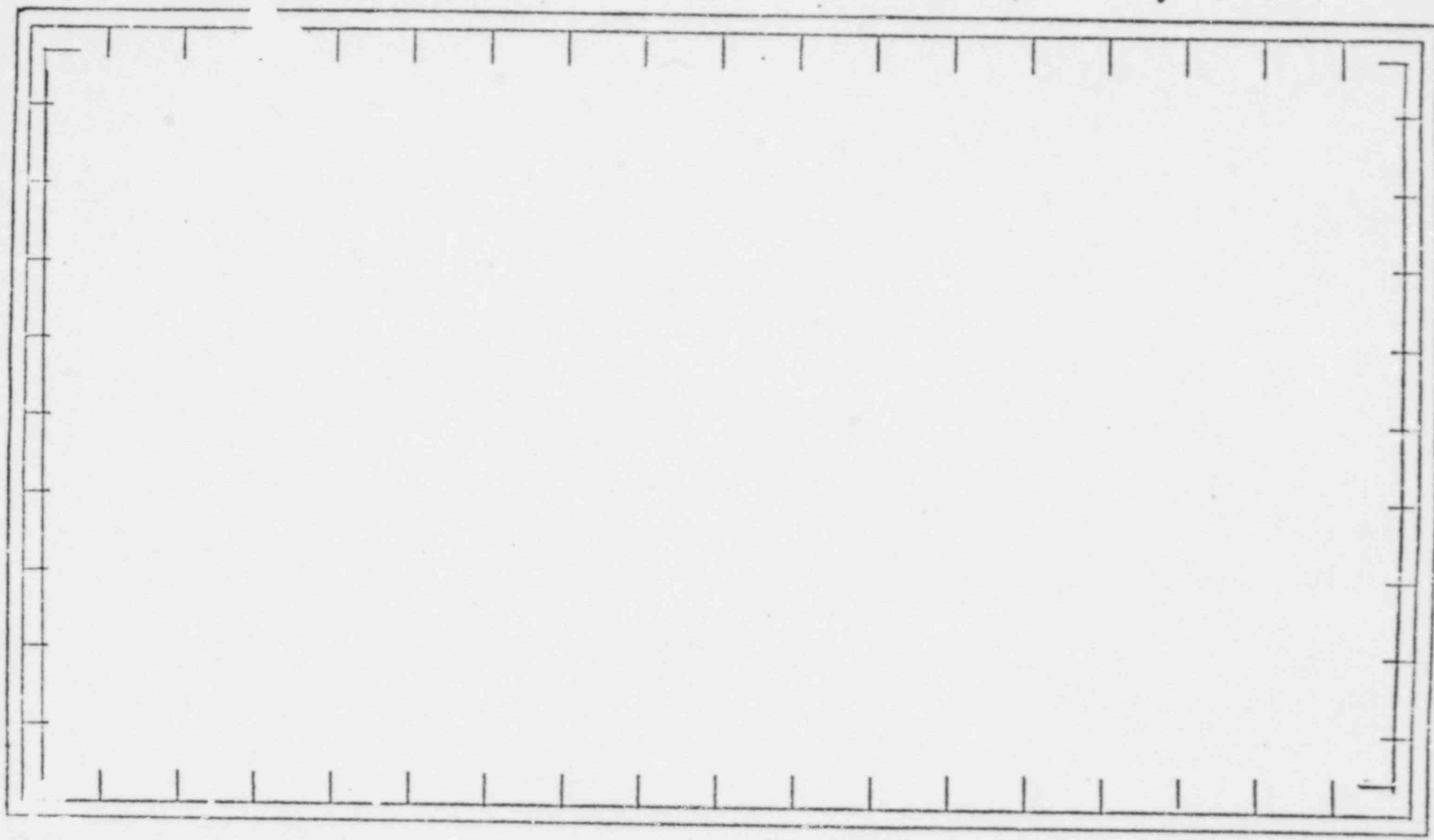

FIG 2.

ST LUCIE 2 FLANGE RESPONSE SPECTRUM.EMB 200 - (ACC) DAMP=.02

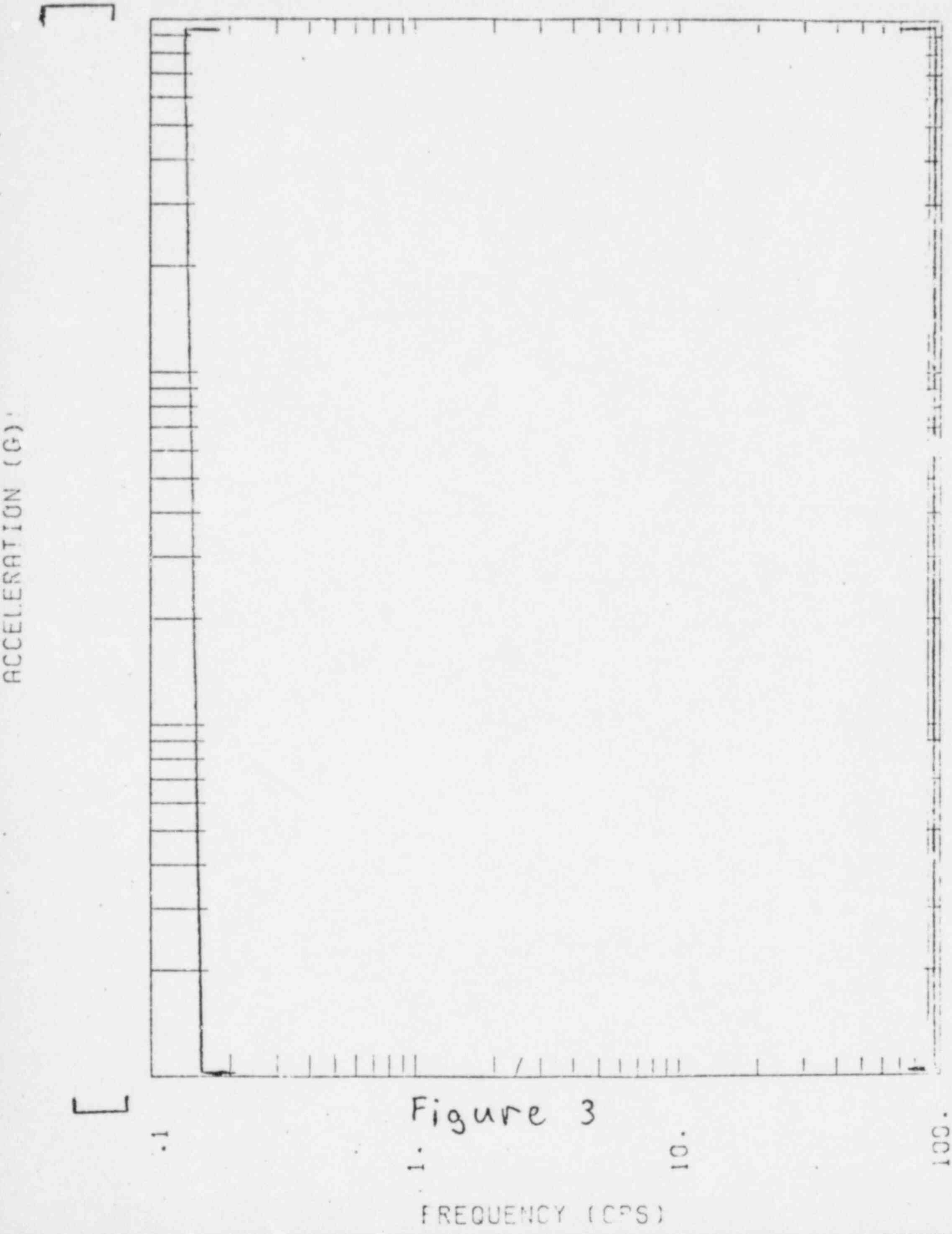

Figure 3

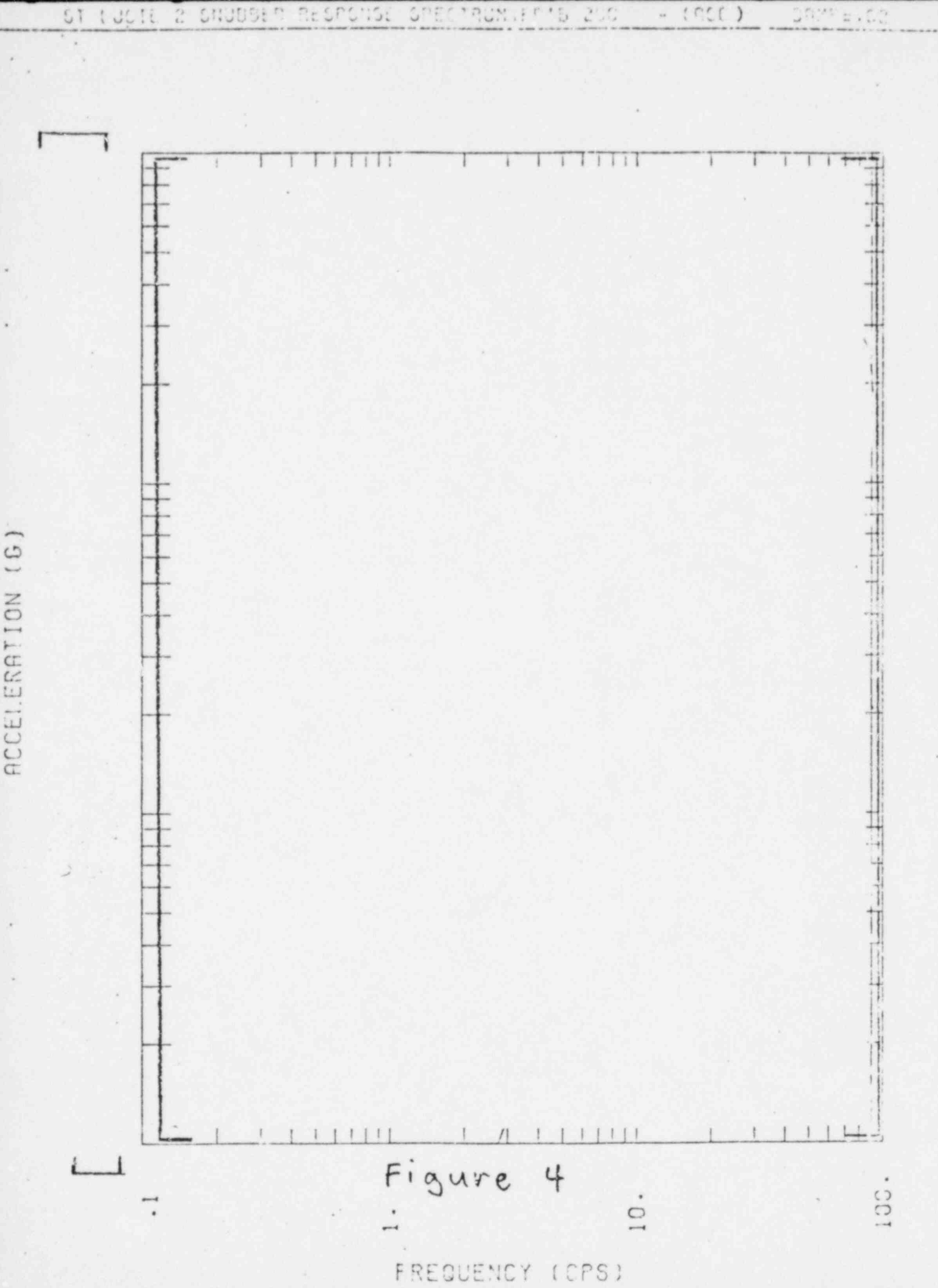
ST LUCIE 2 SNUBBER RESPONSE SPECTRUM
ACCELERATION (G)
.1
1.
10.
100.
FREQUENCY (CPS)

Figure 4

ST LUCIE 2 FLANGE RESPONSE SPECTRUM,FPOB 1000 - (ACC) DAMP=.02

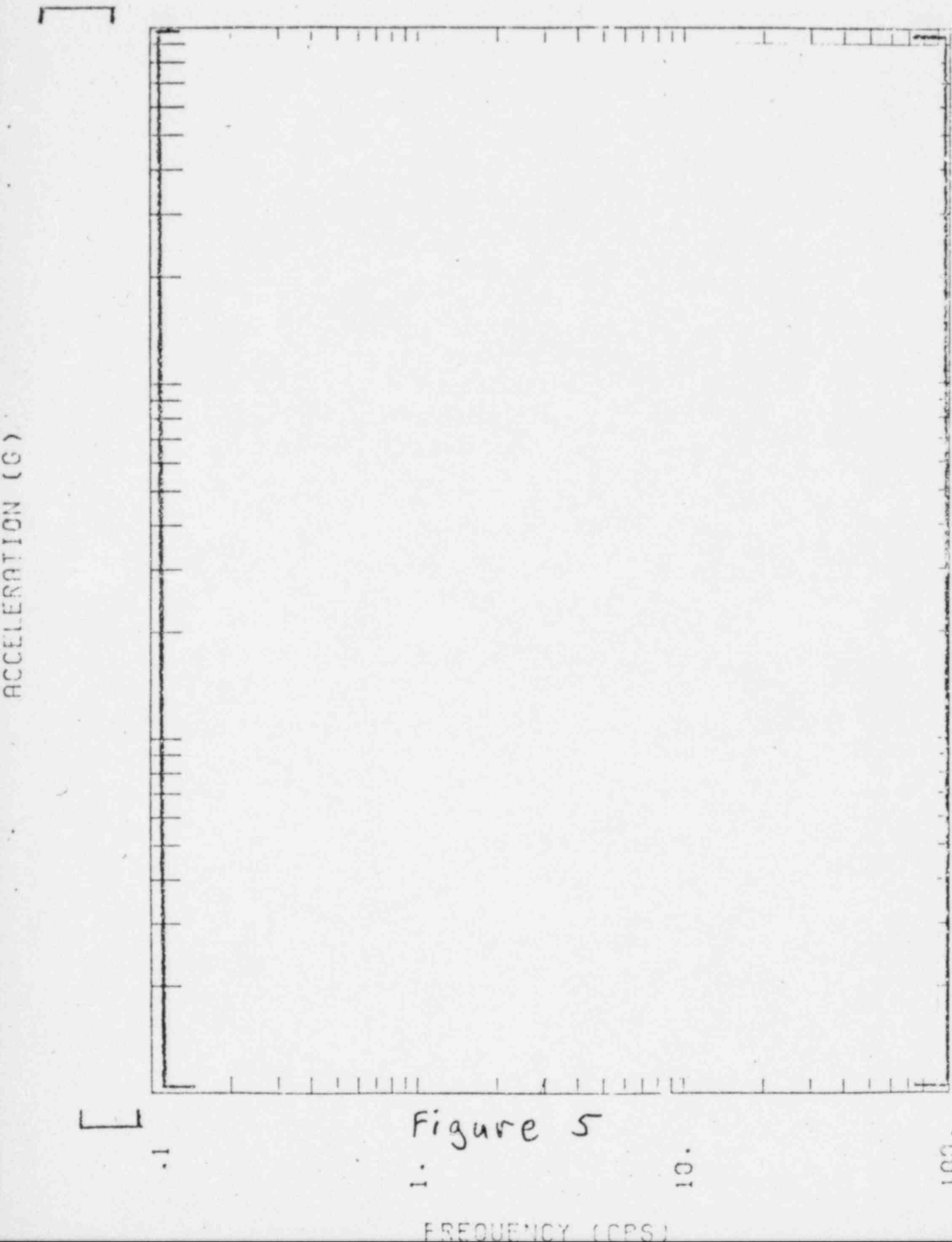

Figure 5

ST LUCIE 2 SNUBBER RESPONSE SPECTRUM.FOB 1000 - (ACC) DAMP=.02

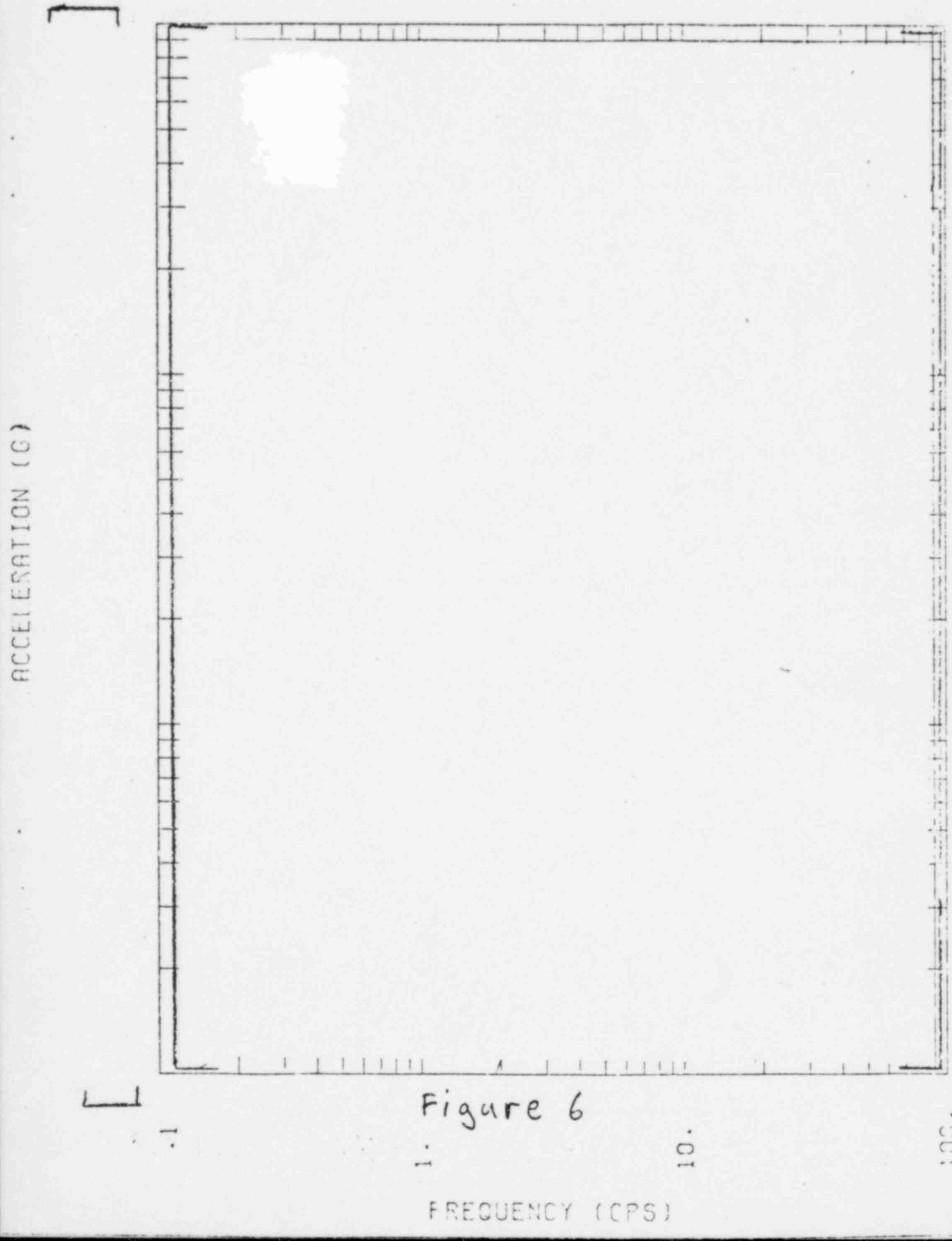

Figure 6

ST LUCIE 2 - SINGLE LOAD PATH MODEL

PEAK ONE SIDED LOADS ARE SHOWN (FPIB 200 IN^2 -LOCA)

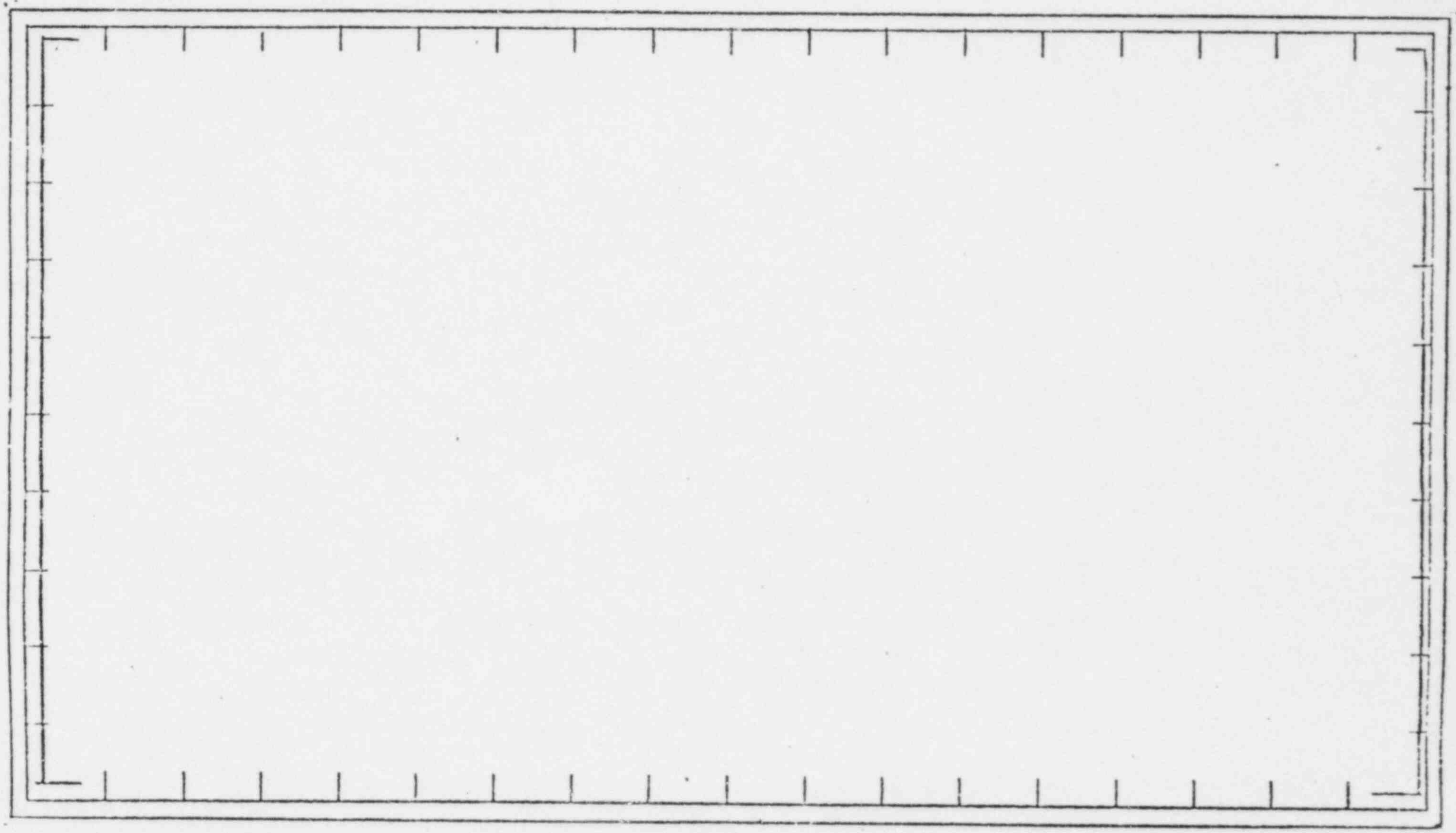

Figure 7

ST LUCIE 2 - SINGLE LOAD PATH MODEL

PEAK THROUGH GRID LOADS ARE SHOWN (FPIB 200 IN^2-LOCA)

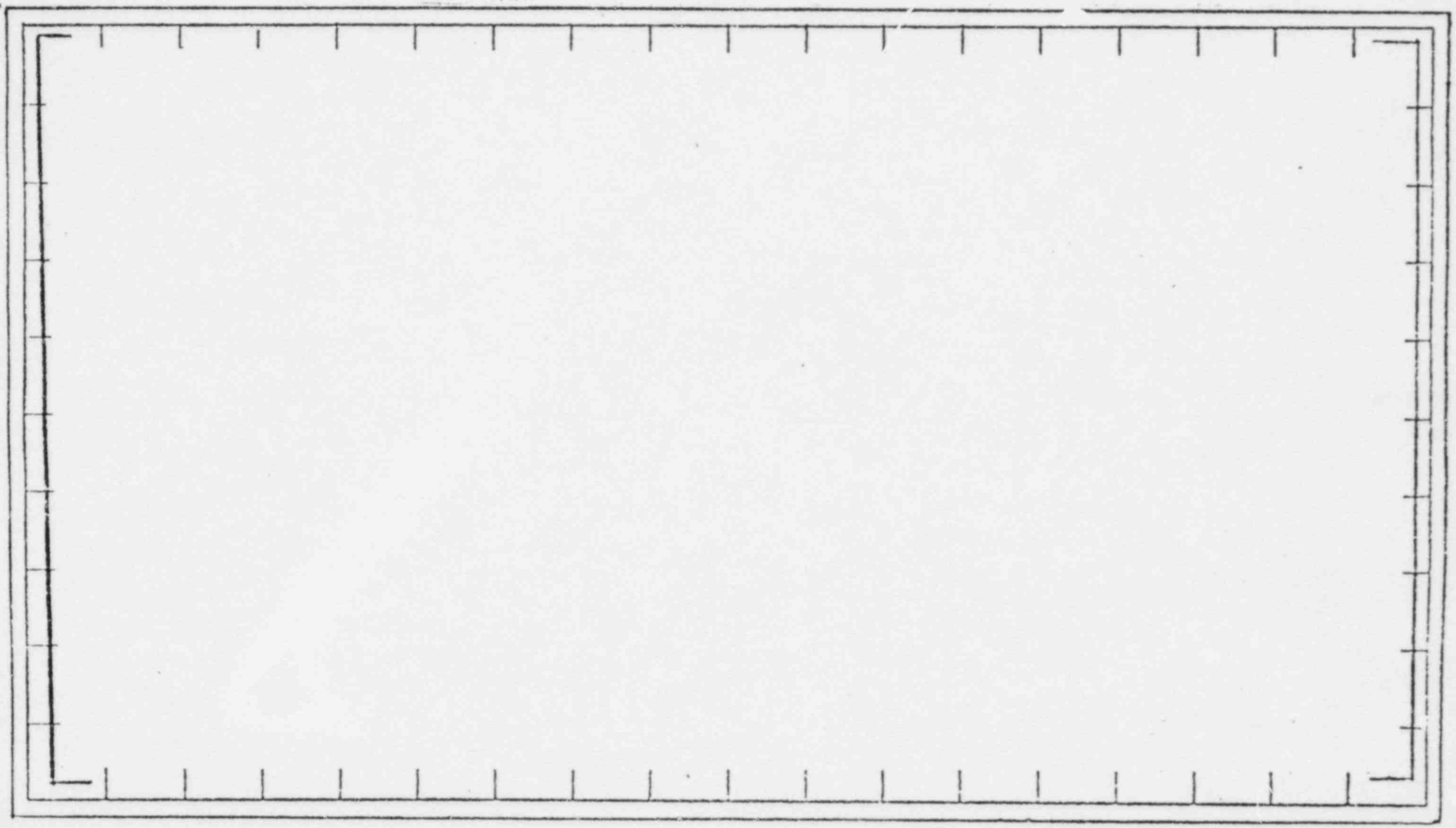

Figure 8

ST LUCIE 2 - SINGLE LOAD PATH MODEL

PEAK ONE SIDED LOADS ARE SHOWN (FPOB 1000 IN^2 - LOCA)

Figure 9

ST LUCIE 2 - SINGLE LOAD PATH MODEL

PEAK THROUGH GRID LOADS ARE SHOWN (FPOB 1000 IN^2 LOCA)

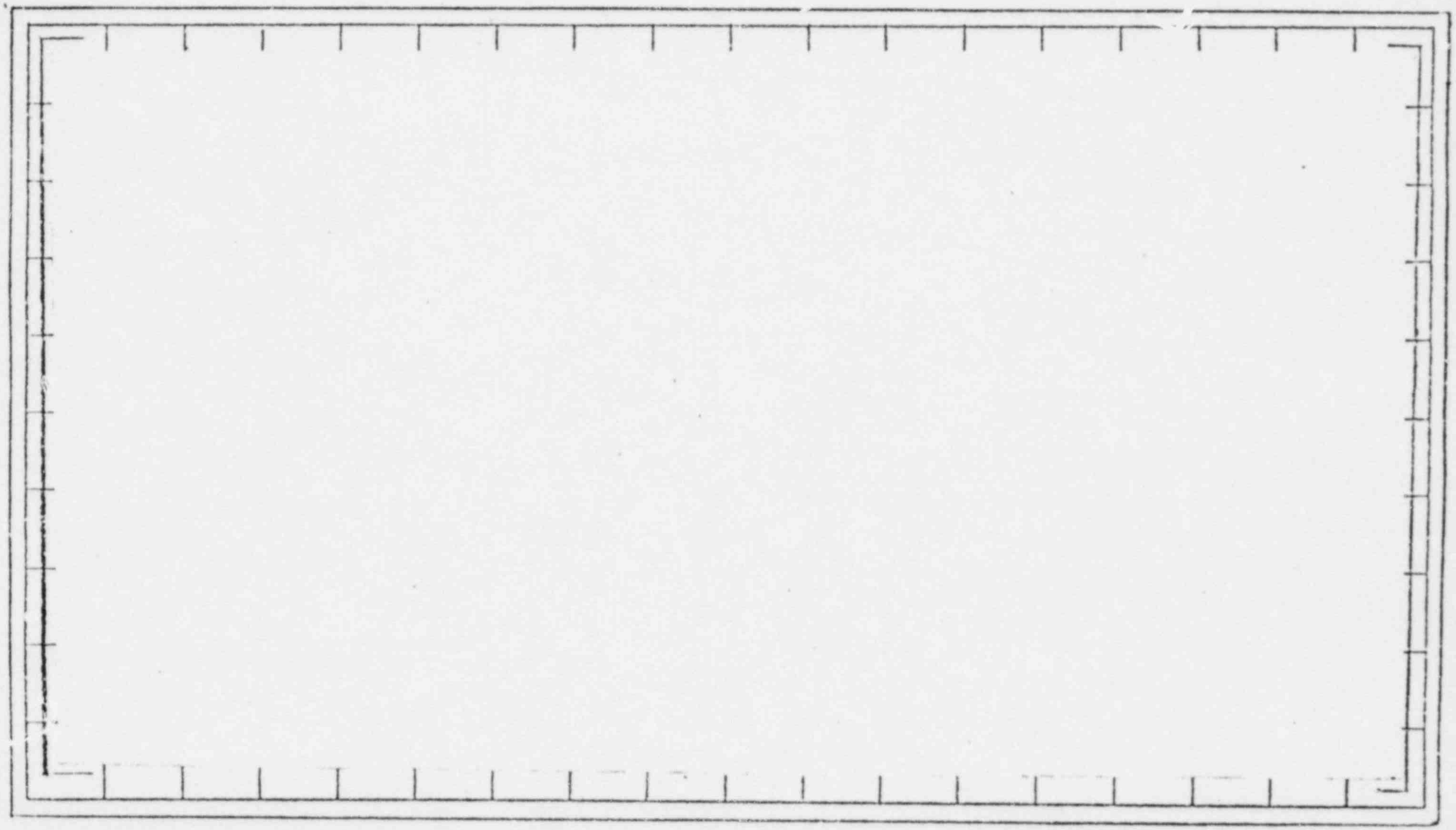

Figure 10