UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

July 7, 1992

Docket Nos. 50-369
and 50-370

LICENSEE: Duke Power Company

FACILITY: McGuire Nuclear Station, Units 1 and 2

SUBJECT: SUMMARY OF MEETING WITH DUKE POWER COMPANY ON SEISMIC STOPS PILOT PROGRAM

On June 18, 1992, the NRC staff met with representatives of Duke Power Company (DPC) to discuss their plans to implement a pilot program at McGuire Nuclear Station using seismic stops in lieu of snubbers. The benefits of seismic stops are primarily the reduction of O&M costs (ISI, Snubber Testing) and the reduction of personnel radiation exposure. Meeting attendees are listed in Enclosure 1. The handouts distributed during the meeting are provided as Enclosure 2.

DPC plans to implement the seismic stop pilot program on a McGuire Unit 2 piping system designated as FW-350 which is composed of portions of the refueling water, containment spray, and residual heat removal systems. Following the pilot program, DPC wants to changeout snubbers for seismic stops throughout both McGuire units. DPC presented test data (refer to slides) to support their contention that seismic stop performance is comparable to snubber performance under seismic conditions and that both snubber and seismic stop performance fall well within the current seismic analysis margin. With regard to the performance of seismic stops during normal operation, the NRC staff expressed its concern that this piping system selected (FW-350) may not be indicative of the entire range of thermal cycling (primarily expansion/contraction) that the various piping systems at McGuire Nuclear Station undergo during the various operational modes. DPC noted this concern and is attempting to identify additional piping where the implementation of seismic stops will enable DPC to acquire a greater range of pilot program data to address this concern. The staff also expressed a concern that seismic stops may cause an increase in the transmission of high frequency noise/vibration and thereby detrimentally affect installed instrumentation. DPC noted that an increase of this sort is not expected and that the pilot program should identify this phenomenon if it exists.

DPC plans to submit the proposed pilot program to the staff for review prior to implementation.

/s/

Timothy A. Reed, Project Manager
Project Directorate II-3
Division of Reactor Projects - I/II

Enclosures:
1. List of Attendees
2. DPC Handouts

cc w/enclosures:
See next page

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EJordan
DTerao
RMartin
ACRS (10)
JWechselberger, EDO
LReyes, RII
M. Hartzman, 7E23

OFC	:PDII-3/LA	:PDII-3/PM	:PDII-3/D	:	:	:
NAME	: LBERRY	: TREED	: DMATTHEWS:		:	:
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Timothy A. Reed, Project Manager
Project Directorate II-3
Division of Reactor Projects - I/II

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1. List of Attendees
2. DPC Handouts

cc w/enclosures:
See next page

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ENCLOSURE 1

LIST OF ATTENDEES
MCGURIE - SEISMIC STOPS MEETING

NAME	ORGANIZATION
T. REED	NRC/McGUIRE PROJECT MANAGER
D. TERAO	NRC/NRR/DET
B. TAYLOR	DUKE/NGD/McGUIRE
J. LEUNG	RLCA
B. MORGAN	DUKE/NGD/McGUIRE
B. FULBRIGHT	DUKE/COMPONENT ENGINEER/McGUIRE
R. L. CLOUD	RLCA
P. GUILL	DUKE
R. MARTIN	NRC/CATAWBA PROJECT MANAGER
M. Hartzman	NRC/NRR/DET

ENCLOSURE 2

McGUIRE
SNUBBER REPLACEMENT PROGRAM
USING SEISMIC STOPS

MEETING PURPOSE:

- To Describe Program
- To Solicit Comments

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AGENDA

Introduction	WHT
McGuire Program	
- Overview & Objectives	WHT
- Background	WHT
- Program Description	JL
- Technical Rationale	JL
- Benefits	JL
- Implementation Rules	JL
- Schedule	WHT
Summary	WHT
Open Discussion	All

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OVERVIEW

IT IS NOW GENERALLY RECOGNIZED THAT:

- o There are Excessive Numbers of Snubbers in Nuclear Piping Systems
- o Snubber Failures Have Had Adverse Effects on Plant Performance & Economics
- o Reanalysis Can Reduce the Number of Snubbers at Existing Plants
- o Reduction Effort is Tedious and Expensive; Snubber Problems Remain Since Complete Elimination is Not Achievable Unless Alternate Supports are Used

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OBJECTIVES

THE OBJECTIVES OF THE McGUIRE PROGRAM ARE:

- Demonstrate the One-to-One Replacement Can be Implemented Without Line by Line Reanalysis
- Replace ALL Snubbers at McGuire 1 & 2 With Seismic Stop Pipe Supports on a One-to-One Substitution Basis
- Prove Hardware Performance and Reliability by In-Plant Installation and Inspection
- Define the Regulatory Process for Replacing All Snubbers with Seismic Stop Pipe Supports

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BACKGROUND

- There Are Approximately 3000 Snubbers at McGuire 1 & 2
  - High ISI and Testing Costs
  - High Radiation Exposure to Personnel
  - Unacceptable Level of Unreliability
  - Create Outage Uncertainties

- Design Basis for McGuire Piping is Reg. Guide 1.61 Damping
  - Majority Actually Used 1% Damping Value
  - N-411 Damping Applicable & Approved
  - Large Design Margins Exist

- Seismic Stop Pipe Supports are Ideal Alternatives to Existing Snubbers
  - Concept is Earthquake Proven and Used in Older Power Plants
  - Performance Proven by Shake Table and In-Situ Testing
  - Passive Design Provides Convenient Pin-to-Pin Replacement
  - Analysis Method Reviewed and Accepted by NRC
  - Application Demonstrated at Other Nuclear Plants

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PROGRAM DESCRIPTION

THE FOLLOWING ELEMENTS FORM THE BASIS OF THE McGUIRE SNUBBER REPLACEMENT PROGRAM:

- Utilize Experience Data and Experimental Results
- Perform Detail Analysis and Design for a Demonstration Piping System at McGuire
- Obtain NRC Concurrence of Pilot Program
- Implement Hardware Changes for the Demonstration Piping System Prior to Next Scheduled Outage
- Conduct Post-Implementation Verification of Hardware Performance
- Develop Plant-Wide Implementation Rules for One-to-One Replacement
- Define Regulatory Process for Plant-Wide Implementation
- Implement Systematic Snubber Replacement for All Piping Systems

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SEISMIC PERFORMANCE OF PIPING SYSTEMS
RESTRAINED BY SEISMIC STOPS
DEMONSTRATED BY:

- o NRC-Sponsored Full-Scale In-Situ Tests, 1986
- o NRC-Sponsored Full-Scale In-Situ Tests, 1988
- o Shake-Table Tests; 1987 and 1988

CONCLUSION:

SEISMIC STOP PERFORMANCE COMPARABLE
OR SUPERIOR TO SNUBBERS
IN ONE-FOR-ONE SUBSTITUTION

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SHAG TEST DESCRIPTION

- EXCITATION PRODUCED BY A ROTATING ECCENTRIC MASS COASTDOWN SHAKER ATTACHED TO THE BUILDING STRUCTURE
- EXCITATION OF BUILDING AND ALL INTERNAL SYSTEMS
- STRESSES IN ALL MECHANICAL SYSTEMS TO REMAIN IN LINEAR-ELASTIC RANGE
- SEISMIC STOP HARDWARE UTILIZED ON EARLY PROTOTYPE IMPACT STOP

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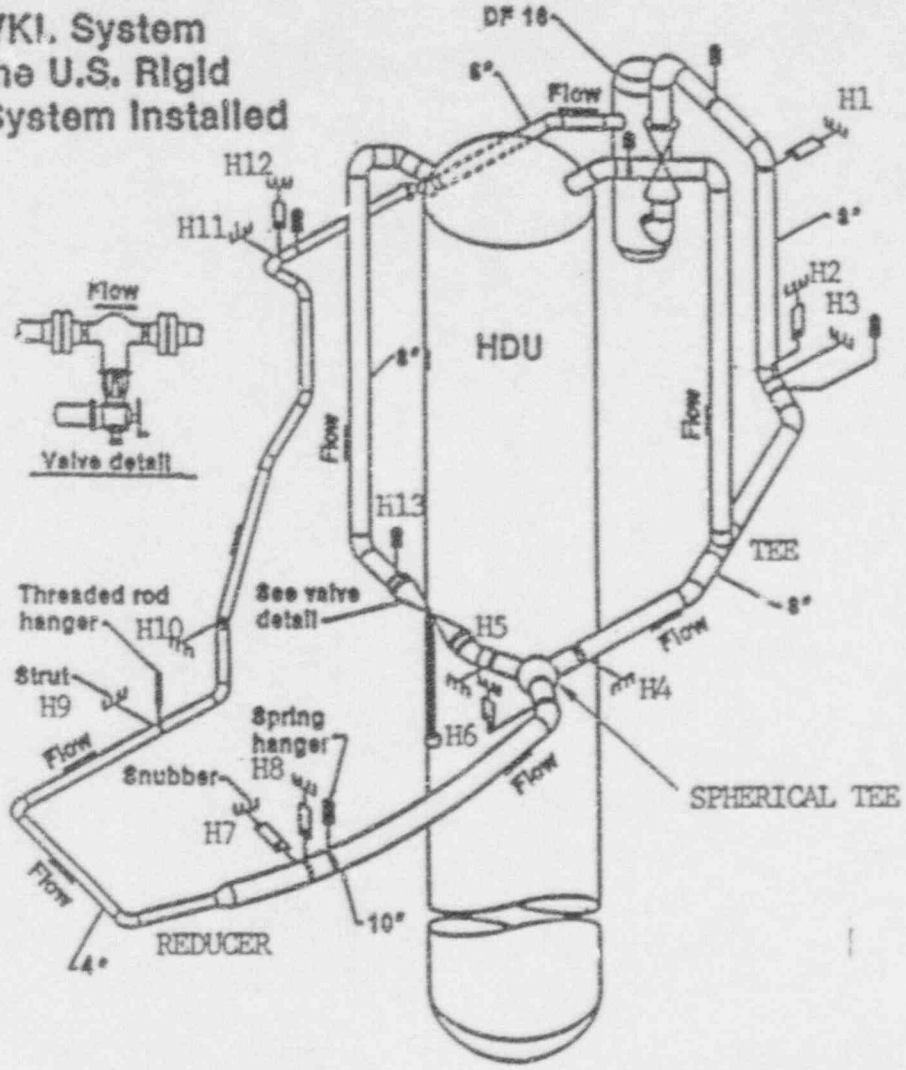
The VKI. System With the U.S. Rigid Support System Installed



SEISMIC STOP SUPPORT DESIGN

- SIX SNUBBERS (ALL REPLACED BY GAPPED SUPPORTS)
- ALL OTHERS UNCHANGED
- SYSTEM PRESSURIZED; TESTED AT COLD AND HOT CONDITIONS

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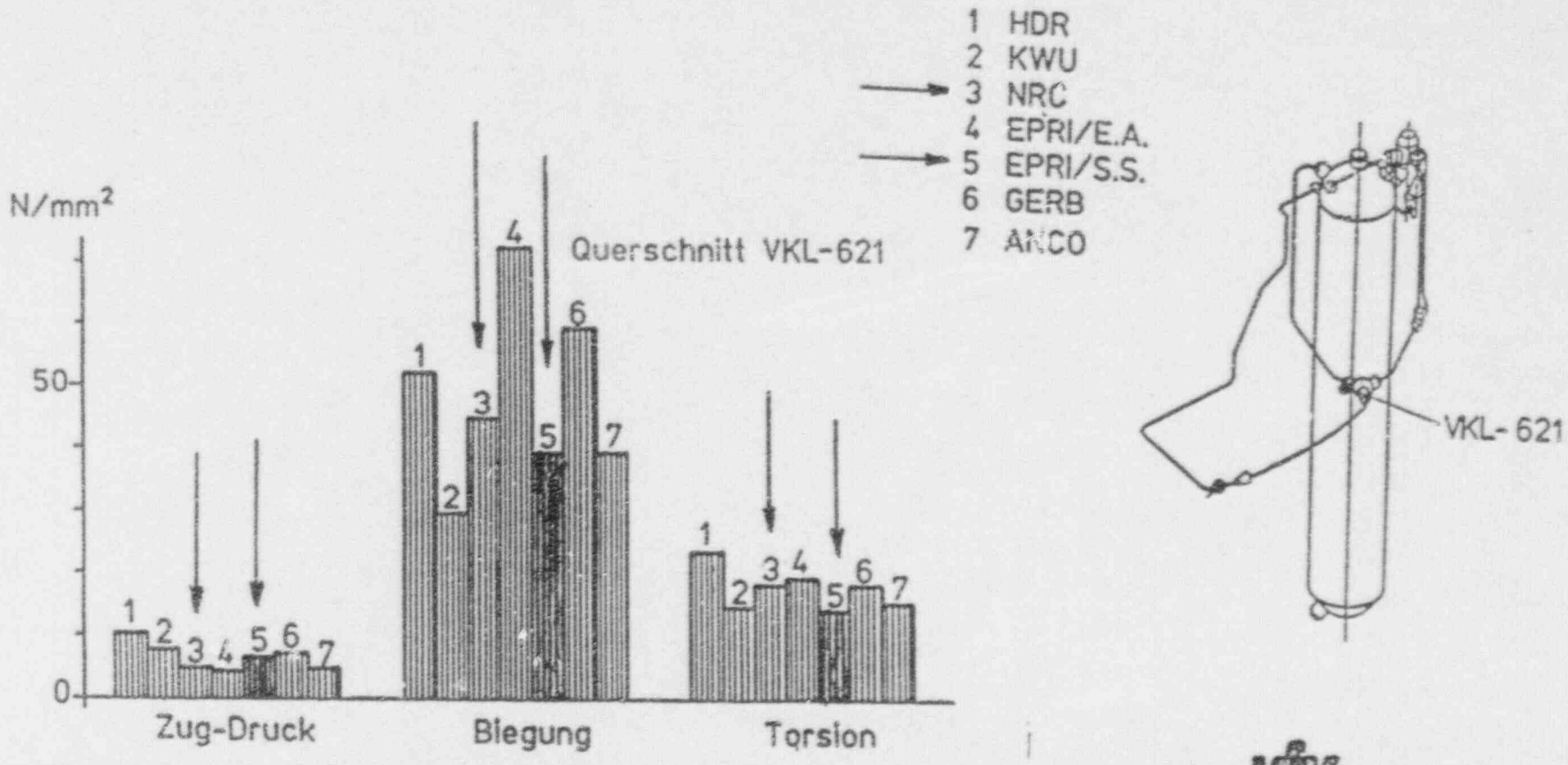
SHAG TEST RESULTS

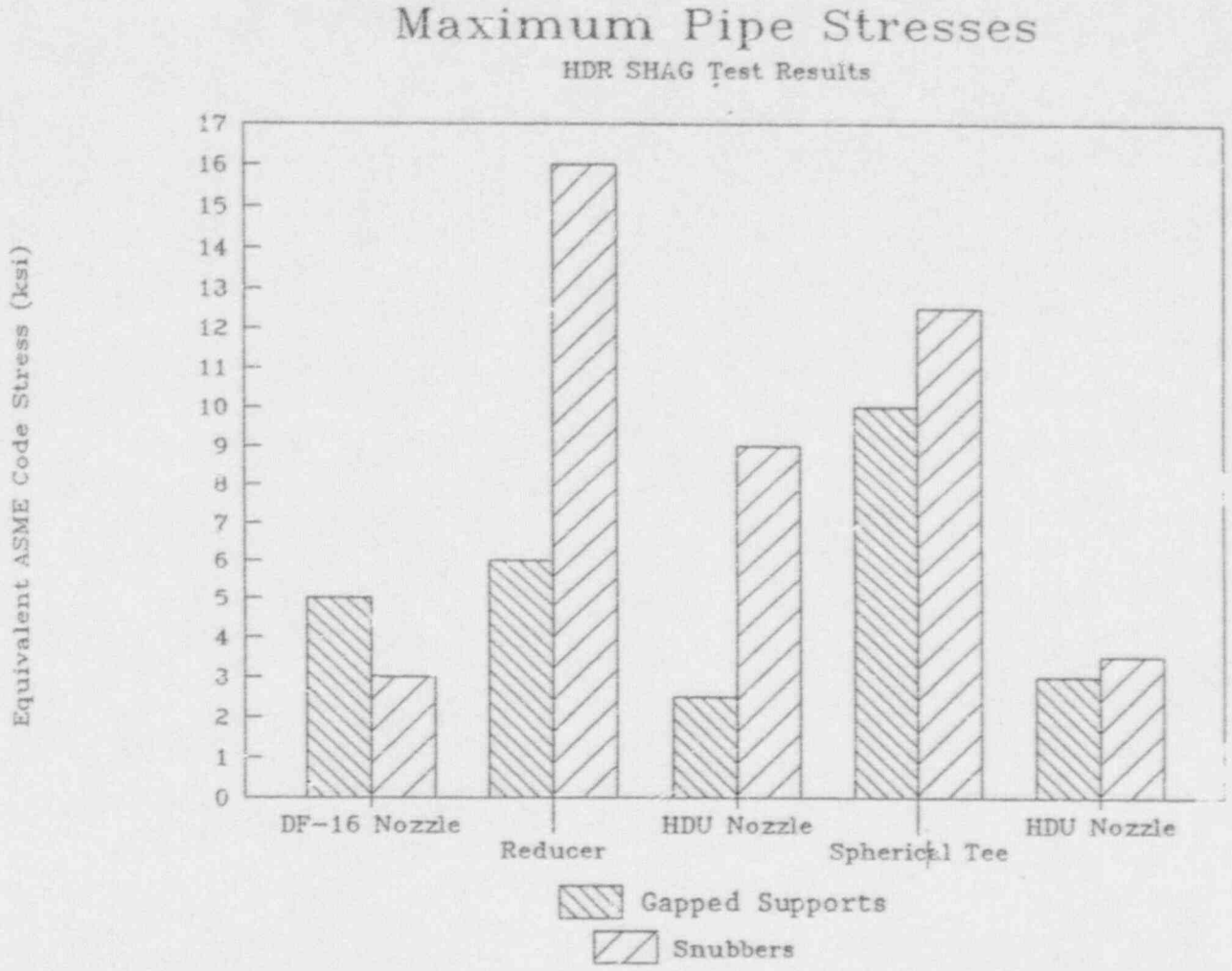
COMPARISON OF MAXIMUM PIPE STRESSES



MAXIMALWERTE DER SPANNUNGEN IN ROHRQUERSCHNITTEN

Versuche T 40. #0 (Umwucht 4700 kgm), Hängerkonfigurationen 1 bis 7

SHAG TEST RESULTS COMPARISON
GAPPED SUPPORTS / SNUBBERS



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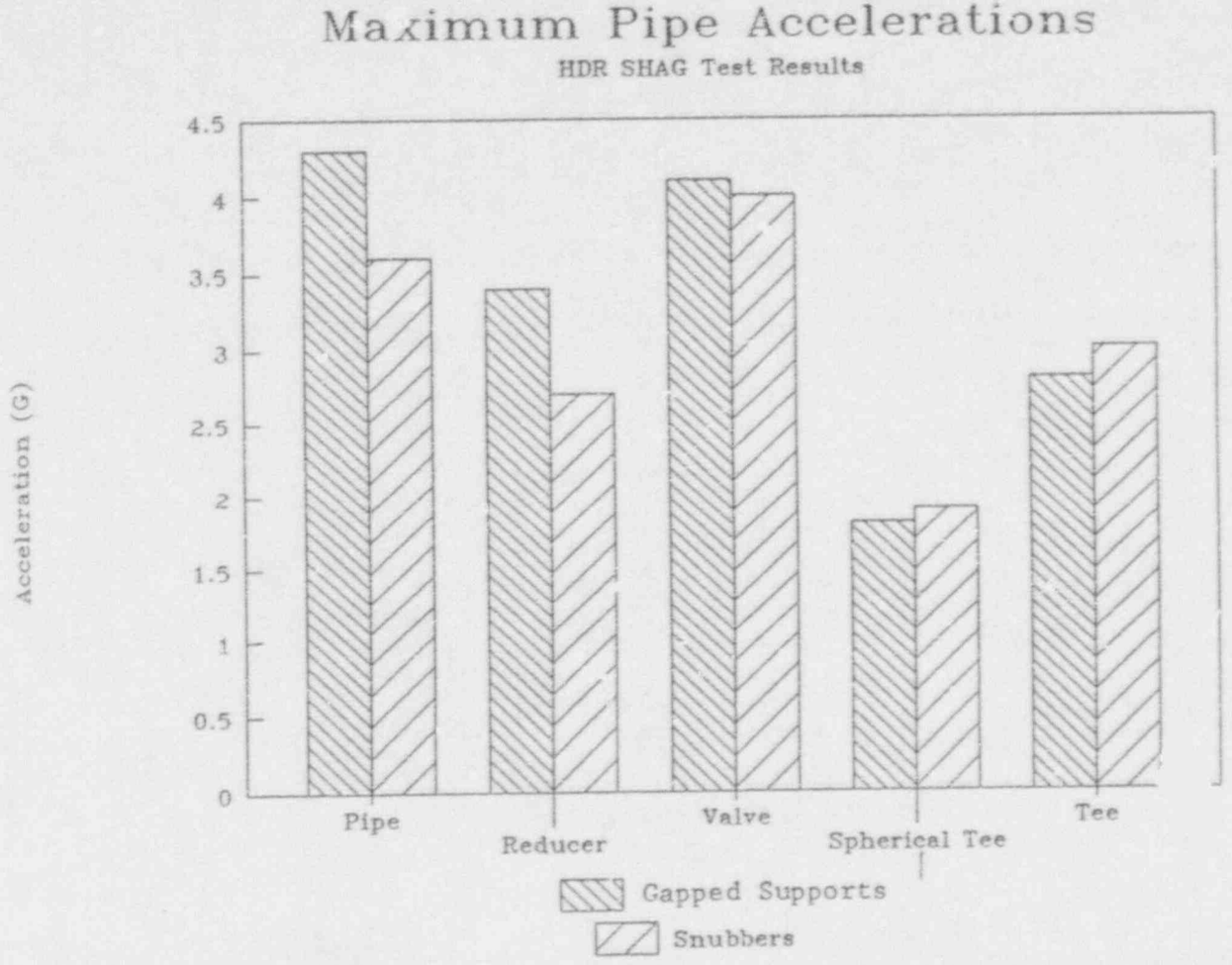
SHAG TEST RESULTS COMPARISON
GAPPED SUPPORTS / SNUBBERS



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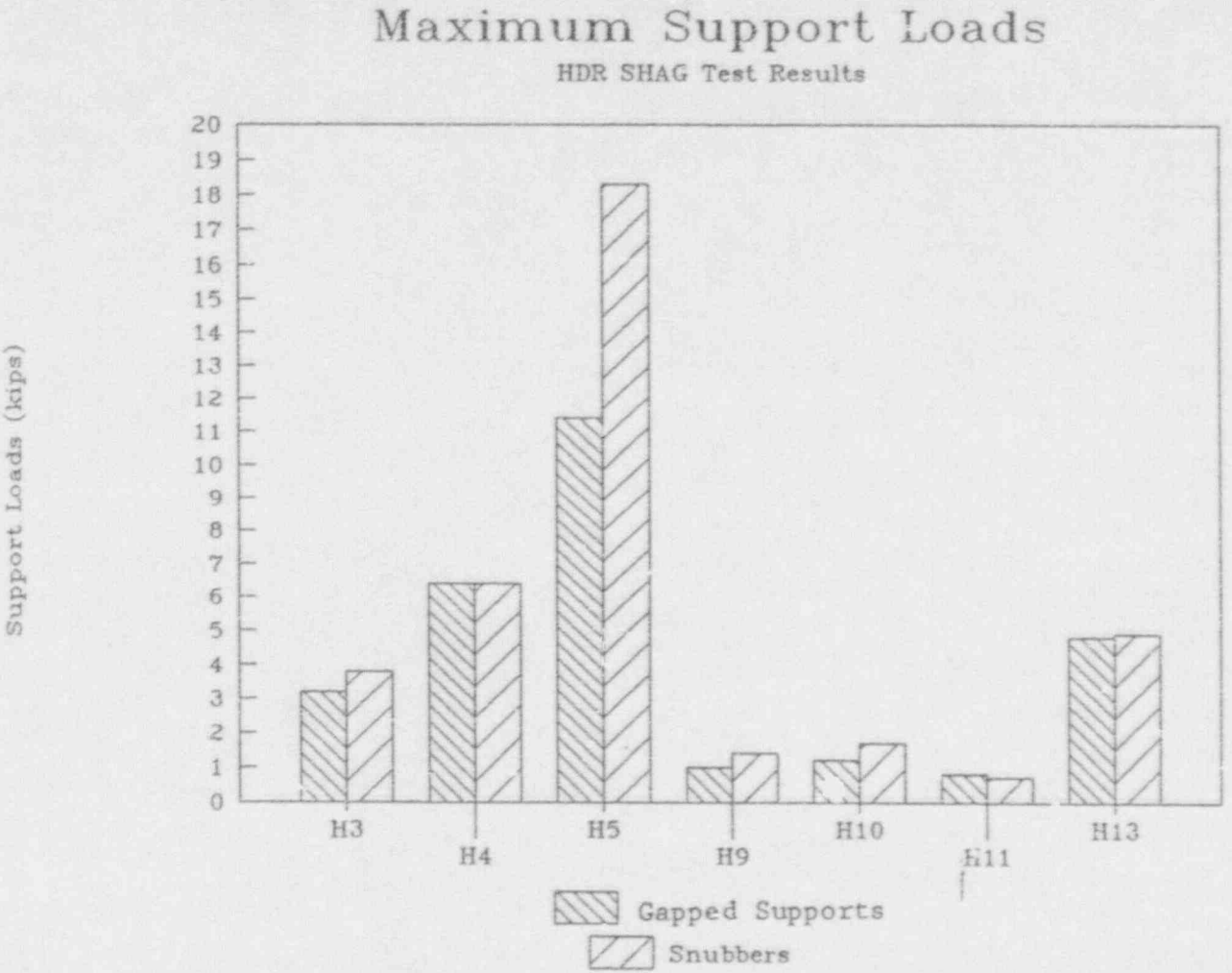
SHAG TEST RESULTS COMPARISON
GAPPED SUPPORTS / SNUBBERS



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SHAM TEST DESCRIPTION

- EXCITATION PRODUCED BY TWO LARGE HYDRAULIC ACTUATORS MOUNTED ON THE PIPING SYSTEM
- EXCITATION OF PIPING SYSTEM AND ATTACHED EQUIPMENT ONLY
- HIGH LEVEL EXCITATION RESULTING IN SOME LOCAL PLASTICITY
- INPUT MOTION TO EXCEED TYPICAL DESIGN LEVELS (AT LEAST 3 TIMES SSE)
- SEISMIC STOP HARDWARE UTILIZED WAS ESSENTIALLY A PRODUCTION DESIGN

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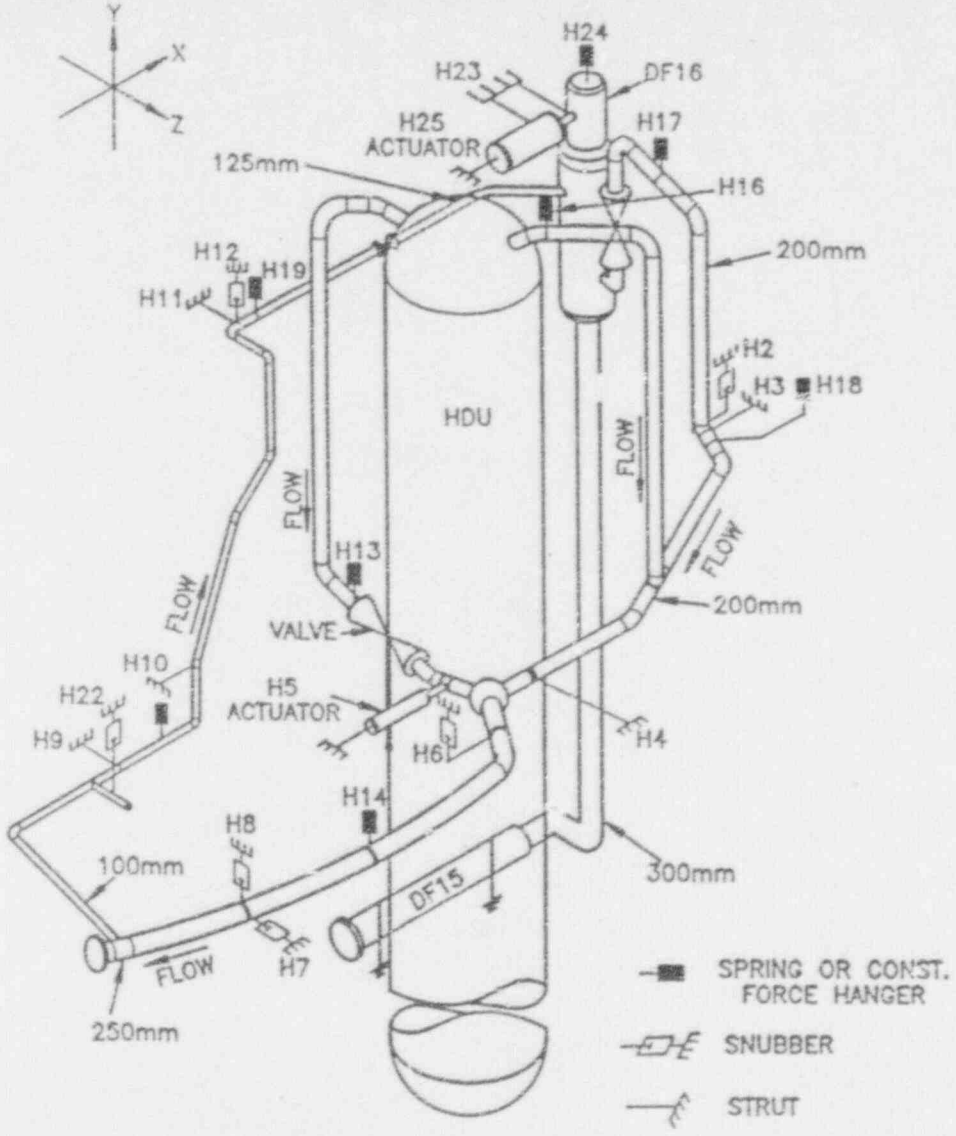


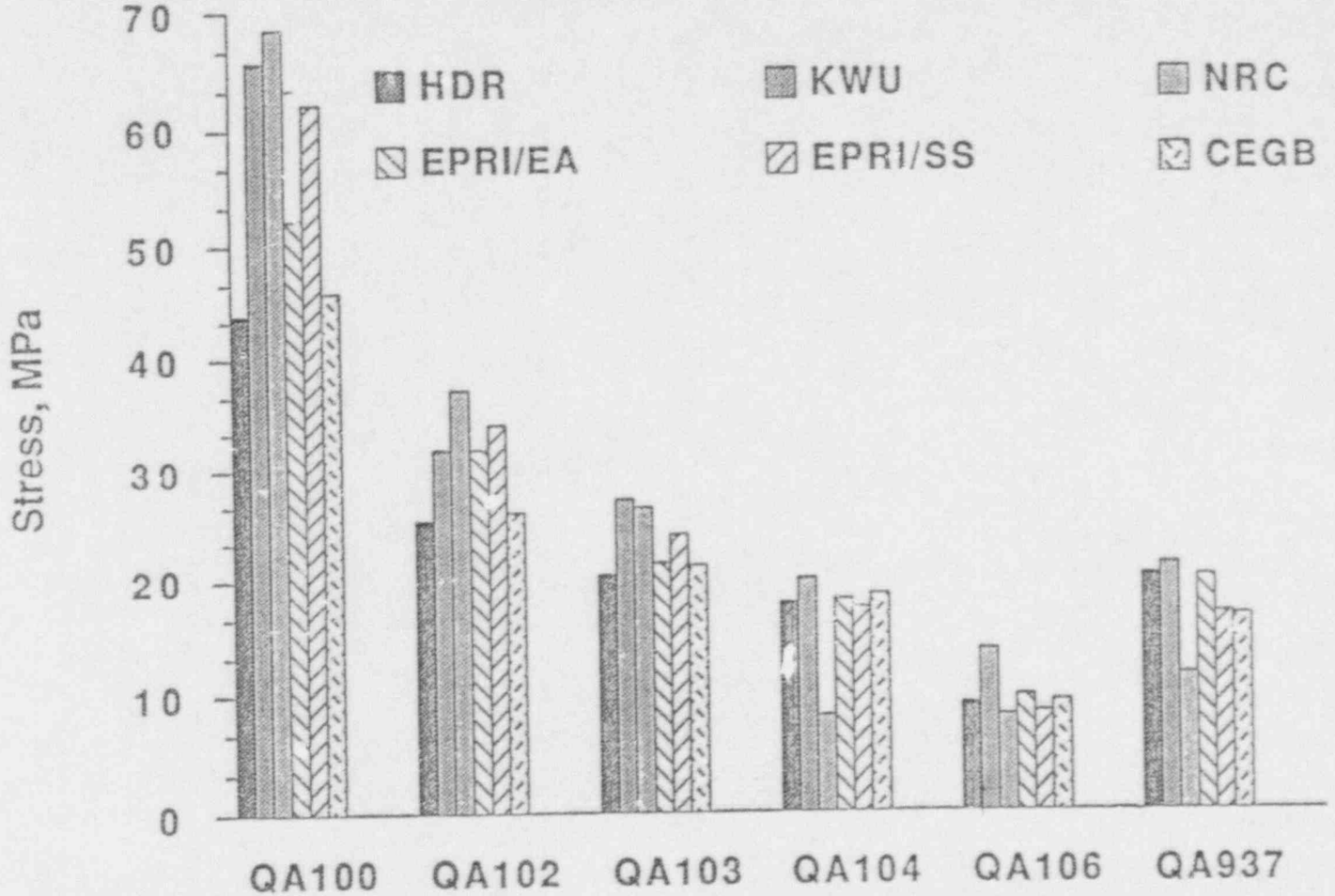
- COMPANION TO SHAG TESTS OF 1986
- HIGH SEISMIC EXCITATION LEVELS (UP TO 800% SSE)
- SEISMIC STOP SUPPORT CONFIGURATION
  - SIX ACTUAL PROTOTYPE SEISMIC STOP SUPPORTS WERE FABRICATED AND INSTALLED AS ONE-TO-ONE REPLACEMENTS FOR SNUBBERS

SHAM Test Configuration – VKL Piping with US NRC Supports

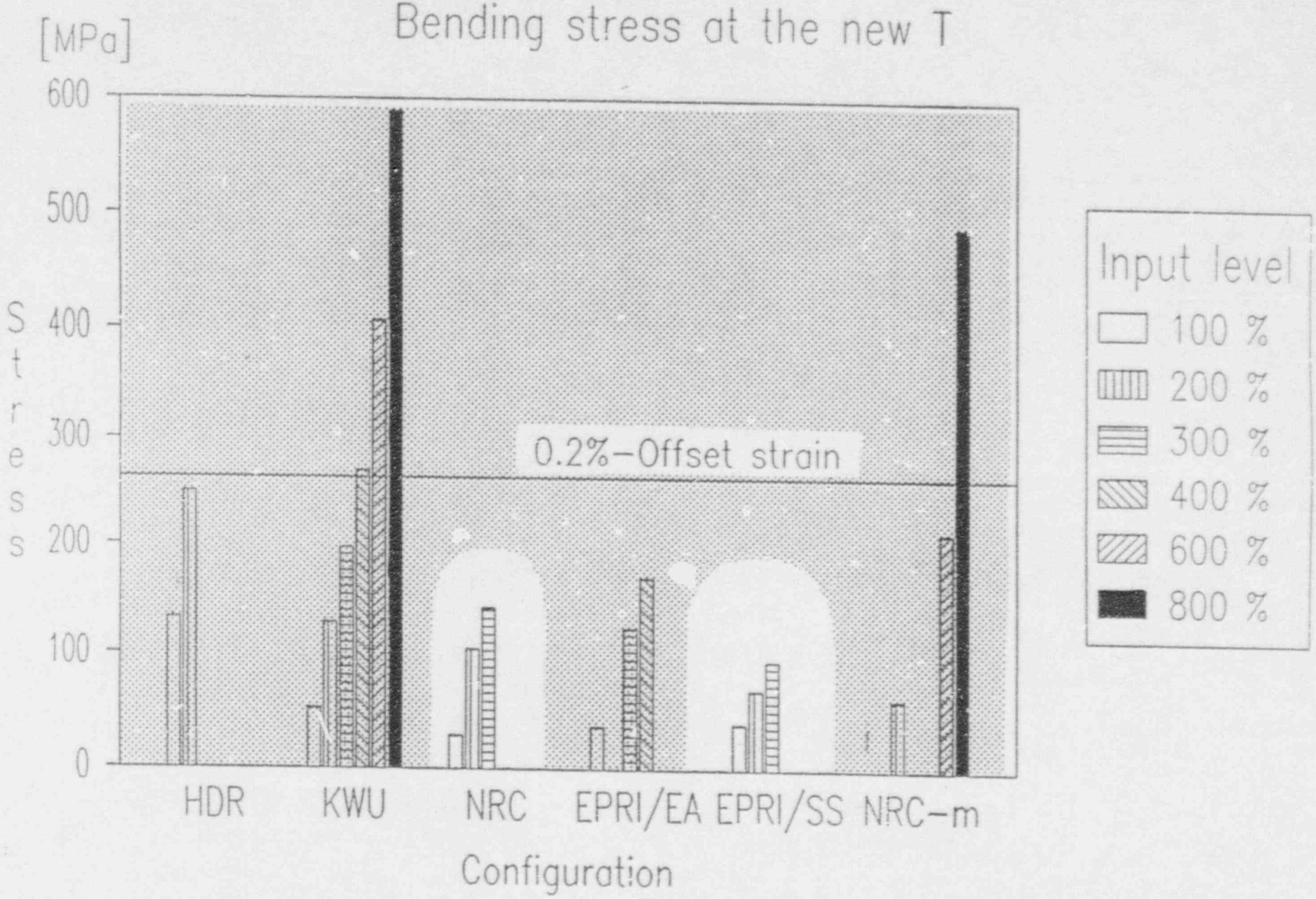
HANGER CONFIGURATIONS

Hanger No.	1 HDR	2 KWU	3 NRC	4 EPRI/EA	5 EPRI/SS	6 CEGB
2	—	—	Snubber PSA1	—	Seismic stop	—
3	—	—	Strut Size B			—
4	Strut Size 20					
6	—	—	Snubber PSA 1/2	—	Seismic stop	—
7	—	—	Snubber A/D 150	Energy Absorber	Seismic stop	Strut RS-15
8	—	—	Snubber A/D 70	Energy Absorber	Seismic stop	Strut RS-7
9	—	Strut Size B	Strut Size A			Strut RS-7
10	—	Strut Size B	Strut Size A			—
11	—	Strut Size B	Strut Size A			—
12	—	—	Snubber A/D 40	—	Seismic stop	Strut RS-15
22	—	—	Snubber PSA 1/4	Energy Absorber	Seismic stop	—
23	Two Struts 2 x Size 20					

Comparison of Support Configurations at 100% SSE
Maximum Bending Stress in 200 mm Pipe and Valve

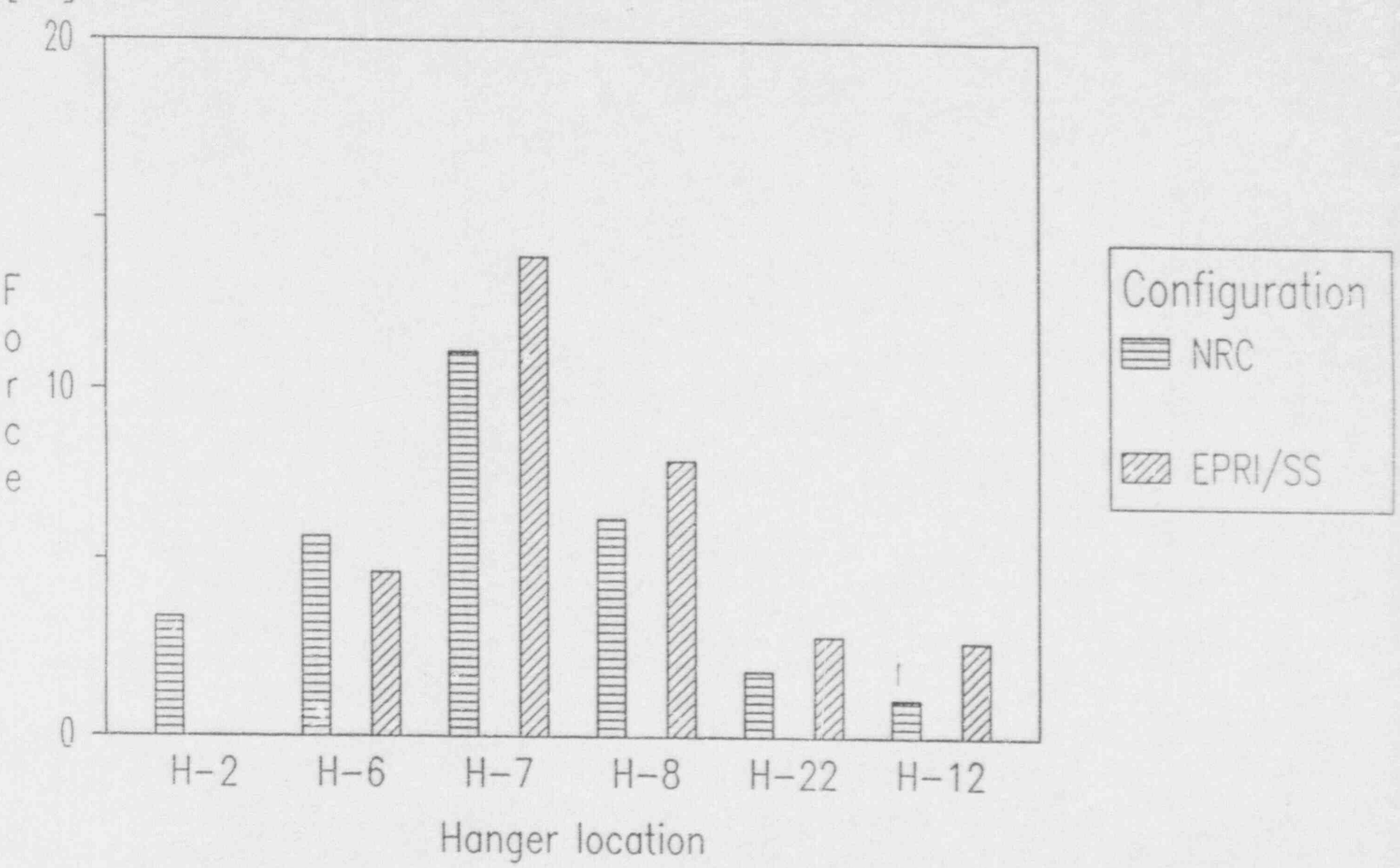


Comparison at different excitation levels

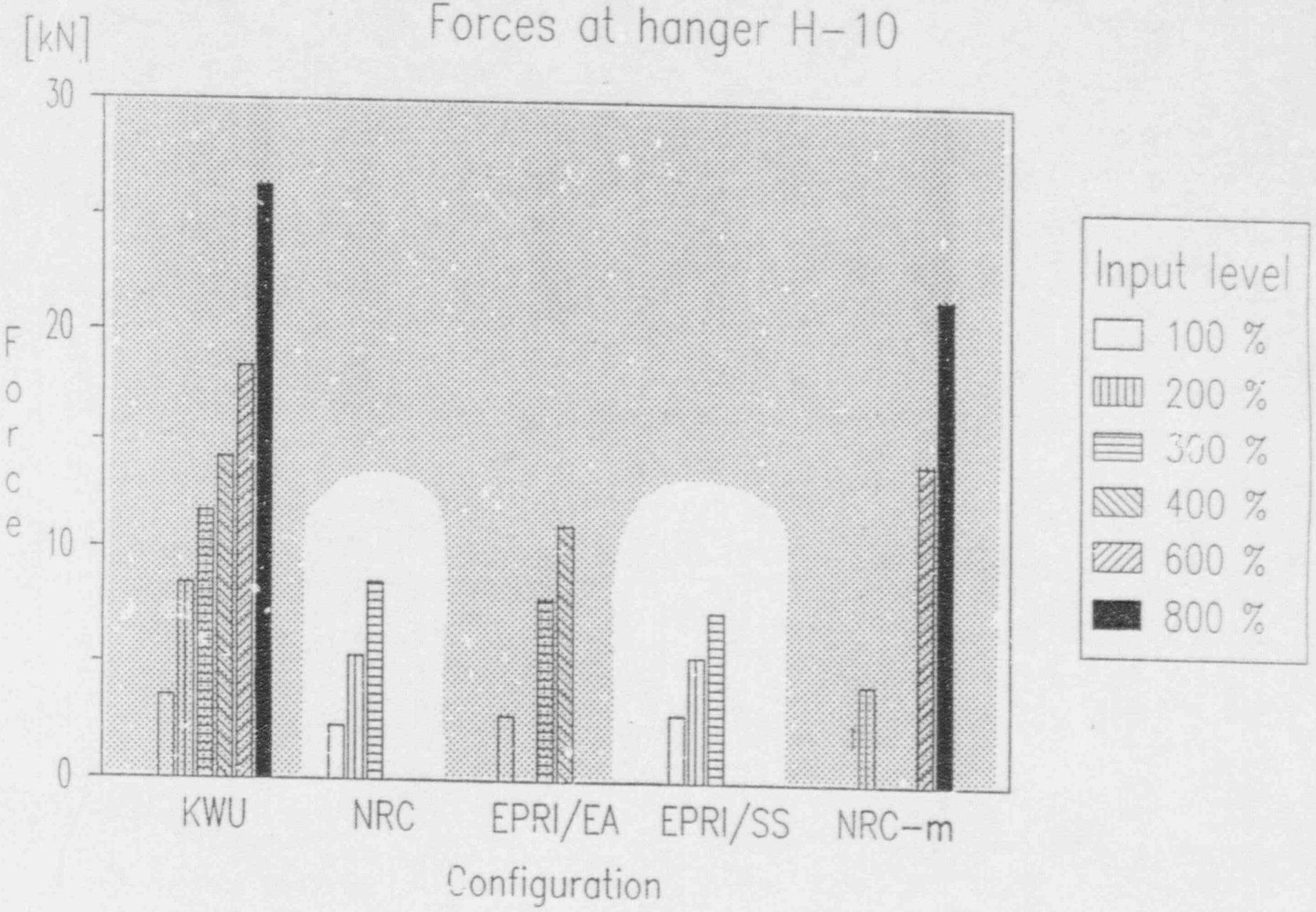


Comparison between the Configurations at 100%-SSE

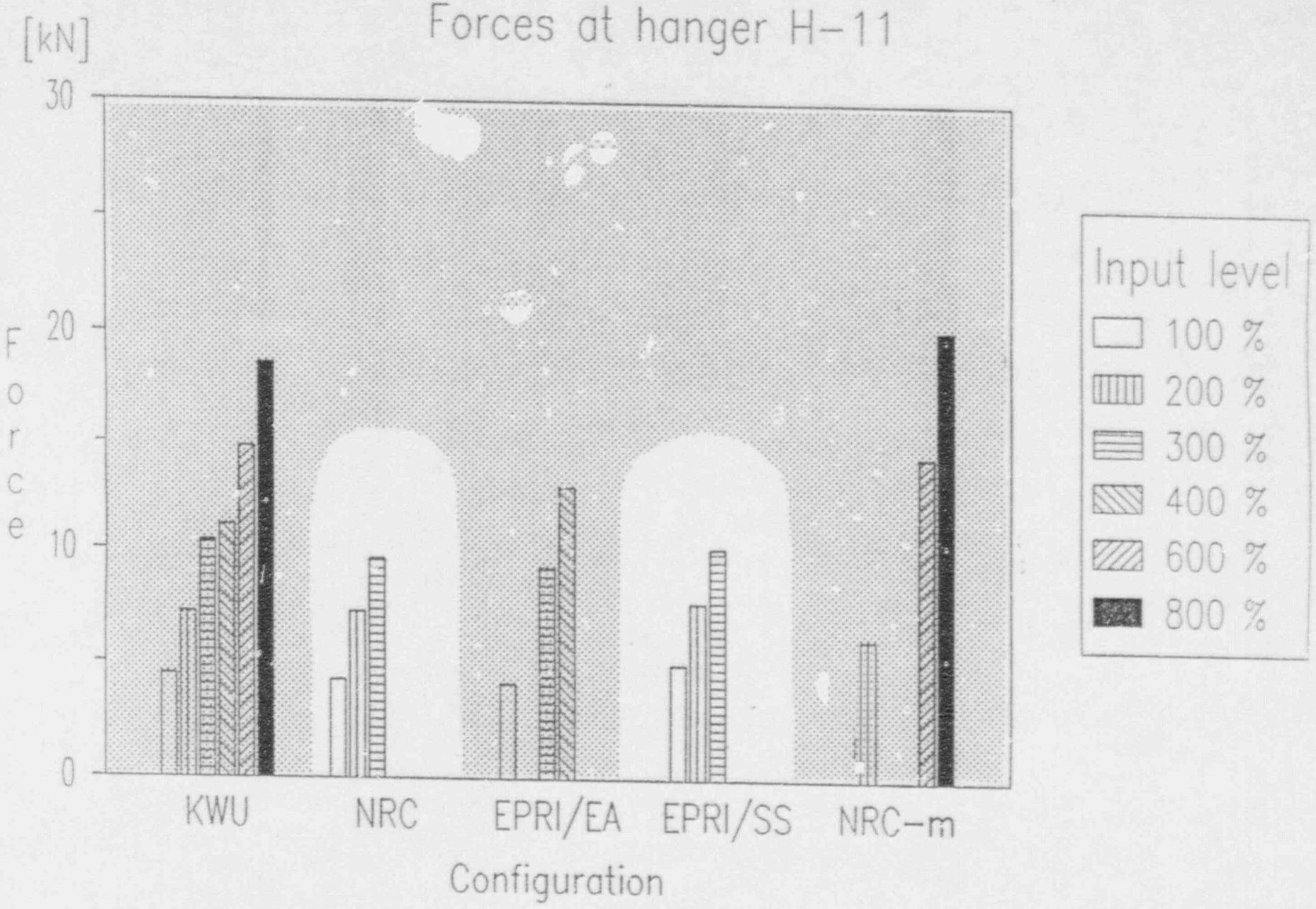
Forces at Snubbers, Energy absorbers and Seismic stops



Comparison at different excitation levels



Comparison at differeni excitation levels



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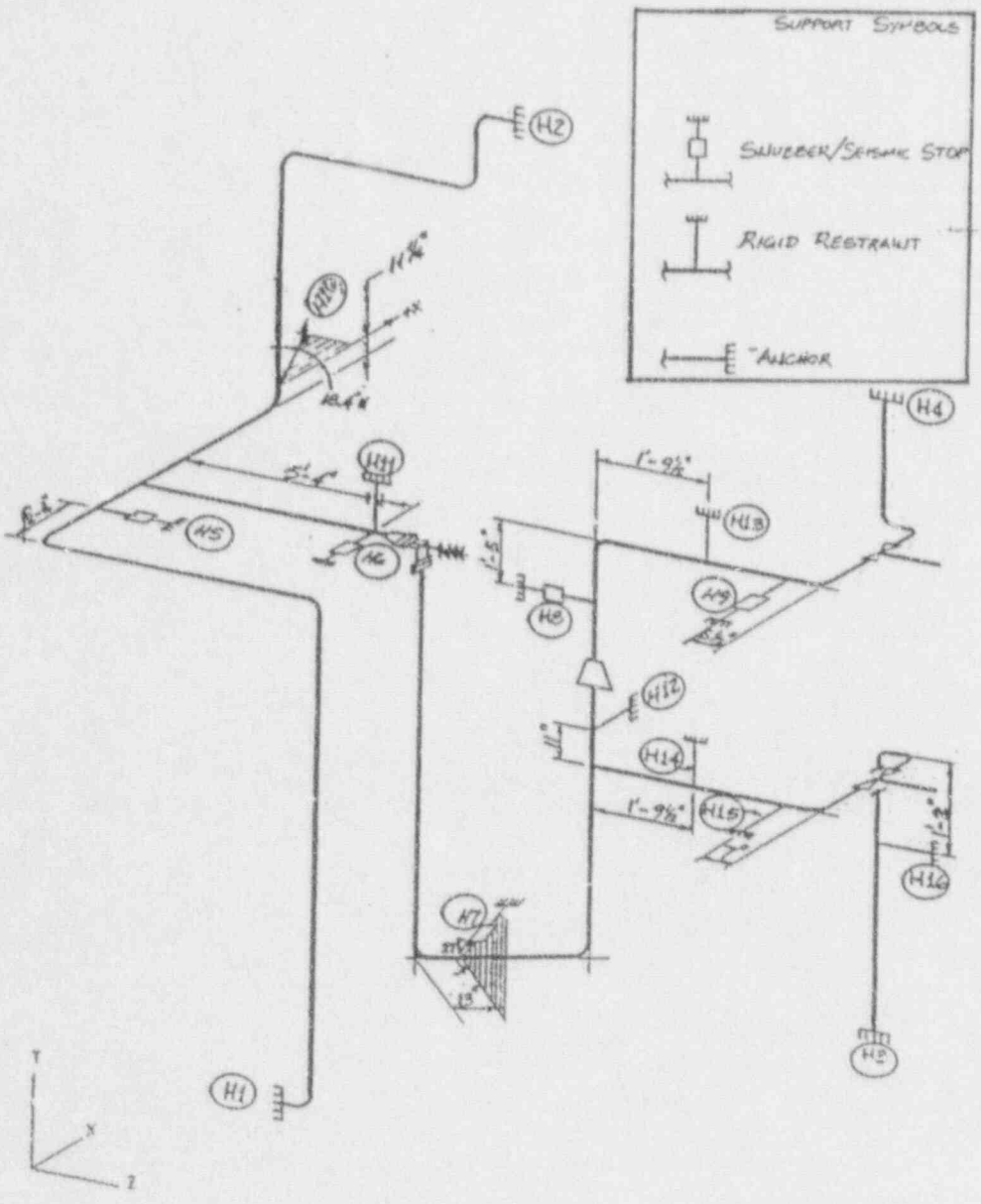
HDR SHAM TEST CONCLUSIONS

CONCLUSIONS:

- SEISMIC STOP SUPPORTED CONFIGURATIONS PERFORMS AS WELL AS OR BETTER THAN THE SNUBBER SUPPORTED CONFIGURATIONS
- PEAK PIPE STRESSES ARE GENERALLY LOWER FOR THE SEISMIC STOP SUPPORTED CONFIGURATION
- SEISMIC STOP SUPPORT LOADS ARE GENERALLY HIGHER THAN SNUBBER LOADS, BUT ARE MUCH SHORTER IN DURATION
- THE ANALYSIS METHOD FOR THE SEISMIC STOP CONFIGURATION PROVIDES THE SAME DEGREE OF CONSERVATISM AS THE PRESENT INDUSTRY ANALYSIS METHOD EMPLOYED FOR SNUBBER SUPPORTED CONFIGURATIONS

UCB EARTHQUAKE ENGIN. RESEARCH CENTER
1988 SHAKE TABLE TEST CONFIGURATION



SHAKE TABLE TEST CONCLUSIONS

- TEST DESCRIPTIONS
  - Piping Configuration Based on Actual Plant Design
  - Supported to Two Independently Excited Building Structures
  - Seismic Inputs Include Generic Reg. Guide Spectra and Recorded EQ Signals
  - 13 Pipe Supports (5 are Snubbers or Seismic Stops)

- KEY PARAMETERS MONITORED & COMPARED
  - Pipe Strain (Stress)
  - Pipe and Valve Accelerations
  - Pipe and Support Displacements
  - Support Loads

- CONCLUSIONS
  - Overall Seismic Stop Supported Piping Responses were Comparable to Snubber Supported Piping
  - Seismic Stop Hardware Functioned Flawlessly During and After Over 100 Tests of SSE and Higher EQ Simulations

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FW-350 ANALYSIS

- Description of Piping System
  - Composed of Refueling Water, Containment Spray, and Heat Removal Systems
  - 6 Pipe Sizes (6 to 24 Inches)
  - 20 Snubbers (4 in Tandem)
  - 4 Thermal Conditions (110-350°F)
  - First Mode Frequency is 3.4 Hz
- Analysis Effort
  - Benchmark GAPPIPE Model
  - Perform Analysis of Direct Changeout of Snubbers with Seismic Stops
  - Optimize Seismic Stop Support Configuration
- Analysis Objectives
  - Demonstrate Revised Analysis Has Better Design Margins
  - Provide Results for Development of Plant-Wide Implementation Rules

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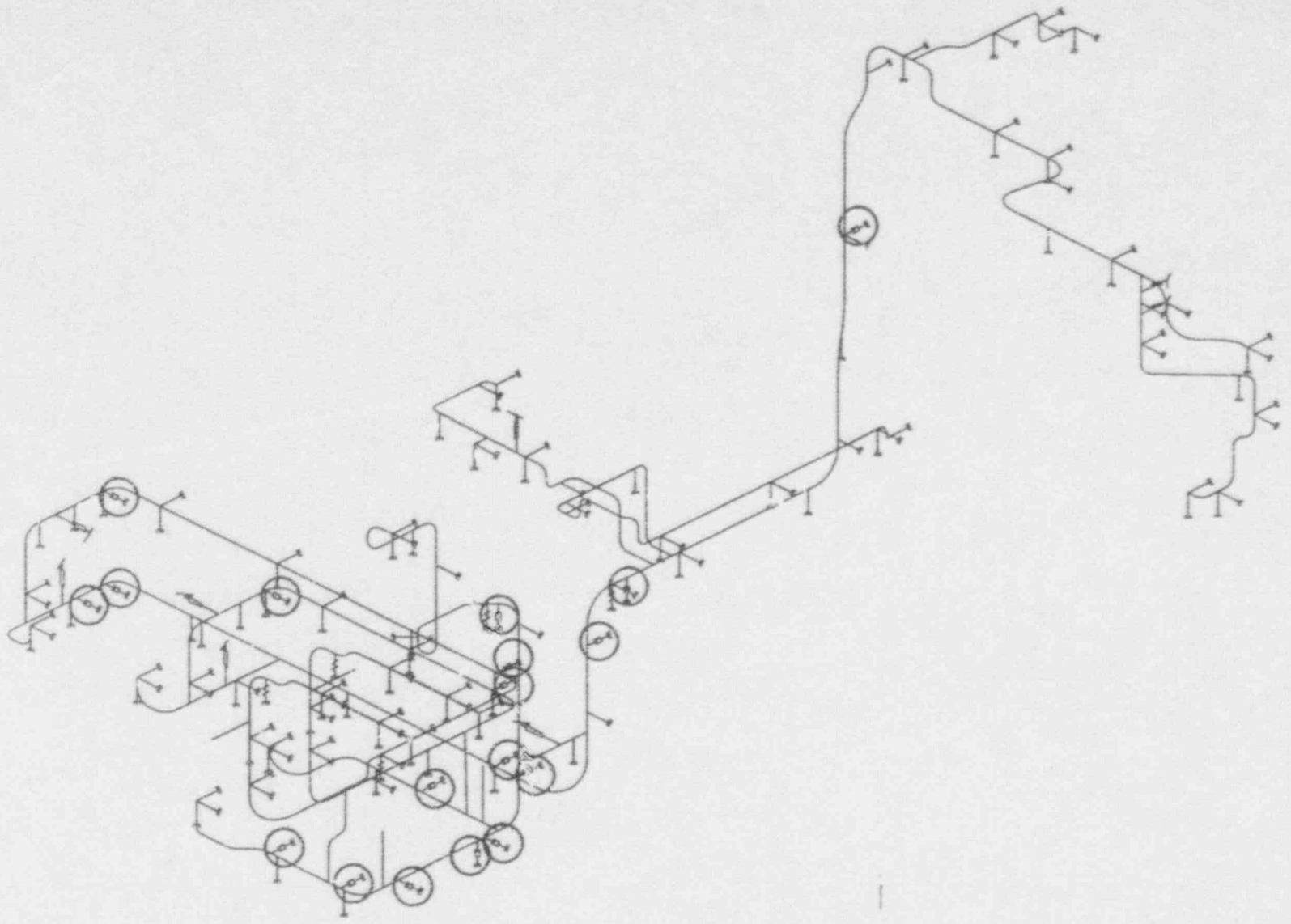

Y
Z
X

MCGUIRE UNIT 2 - FW ?50

Duke Power Co.

Project: Seismic Stops Pilot Study | Project #: P226-01-02

Engineer: date: | Checker: date:

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GAPPLOT 2.3

AVAILABLE, ADDITIONAL DESIGN MARGIN

- o McGuire Original Design Based on R.G. 1.61 Damping

- o Majority of Piping Designs Based on the Lower, Allowed Value of 1%

- o Benefits of N-411 Damping Increases at Lower Frequencies

- o Seismic Stop Configurations Trend Towards Lower Frequencies

AVAILABLE MARGIN IS GREATER THAN EXPECTED RESPONSE VARIATION DUE TO SNUBBER SUBSTITUTION

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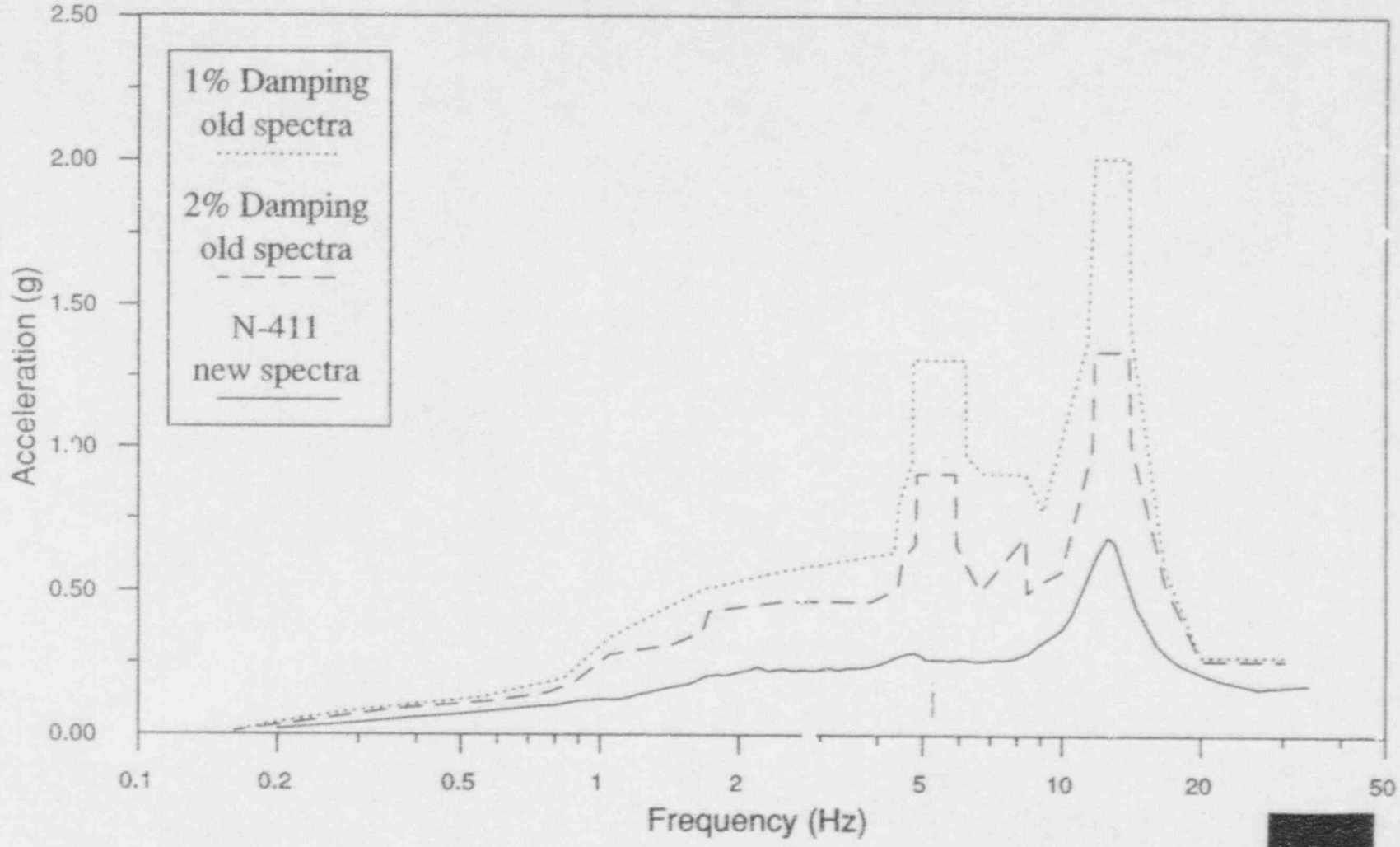
McGuire-2 Input Spectra

North-South



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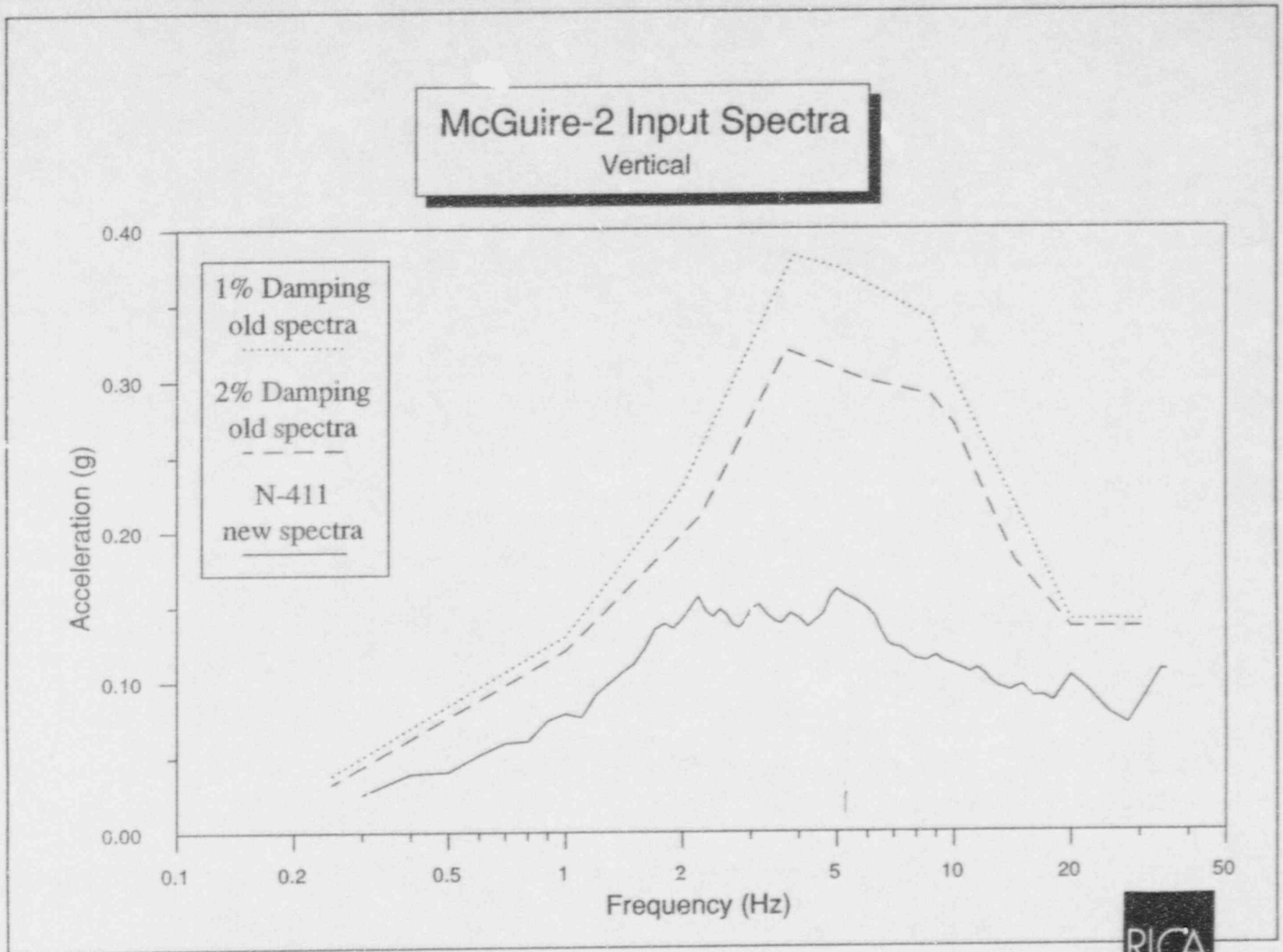
McGuire-2 Input Spectra
Vertical
1% Damping
old spectra
2% Damping
old spectra
N-411
new spectra
Acceleration (g)
0.40
0.30
0.20
0.10
0.00
0.1
0.2
0.5
1
2
5
10
20
50
Frequency (Hz)
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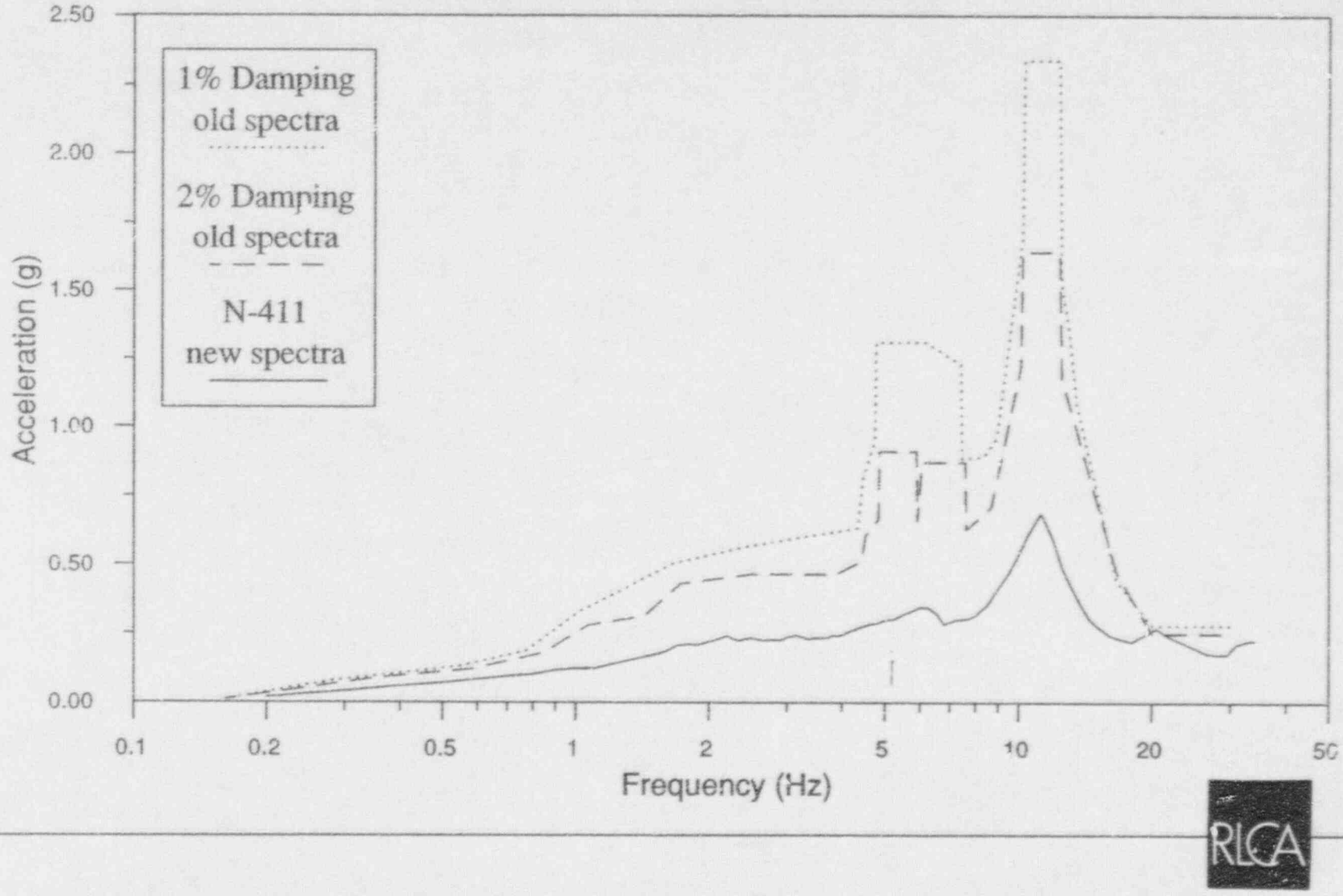
McGuire-2 Input Spectra

East-West



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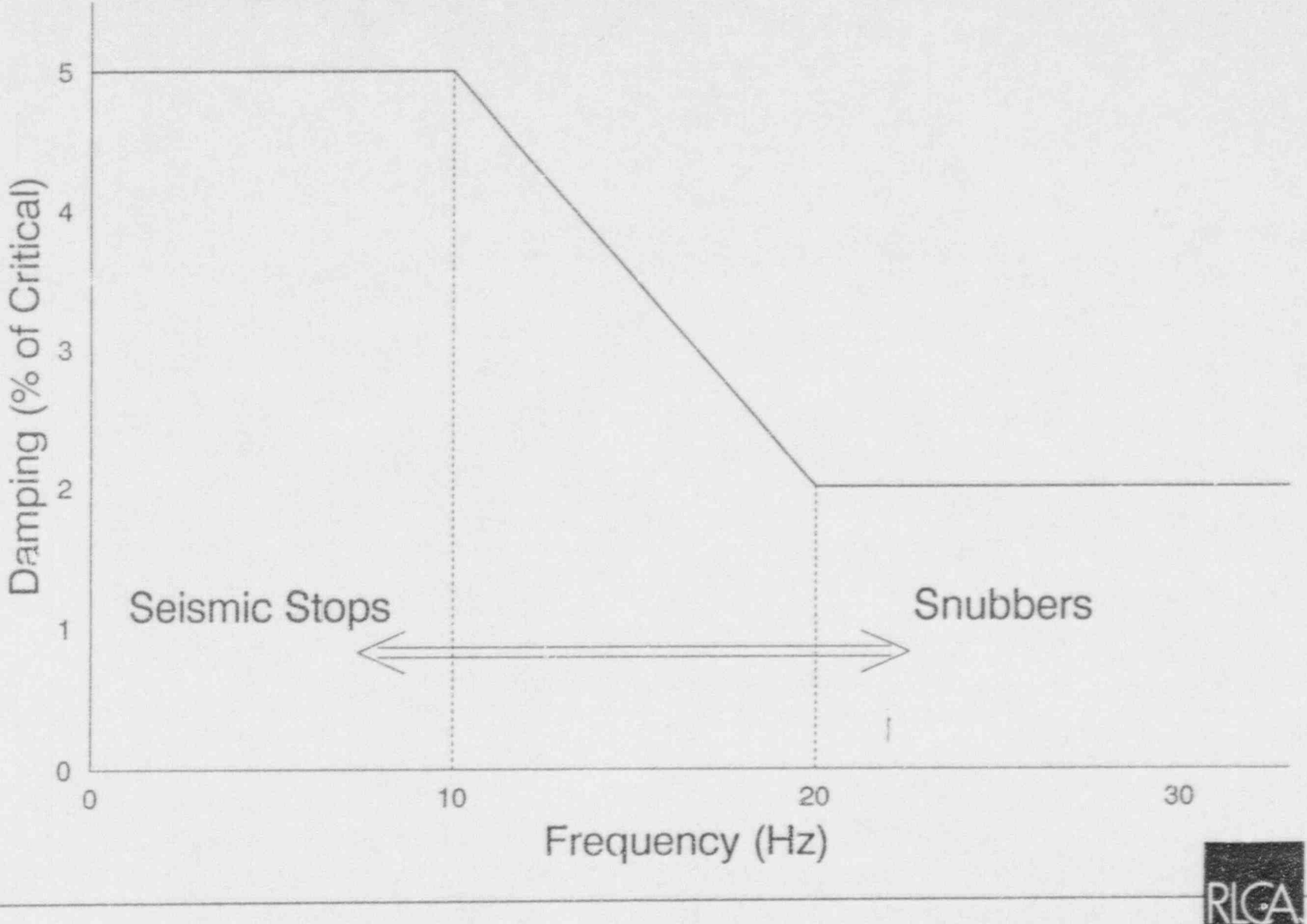
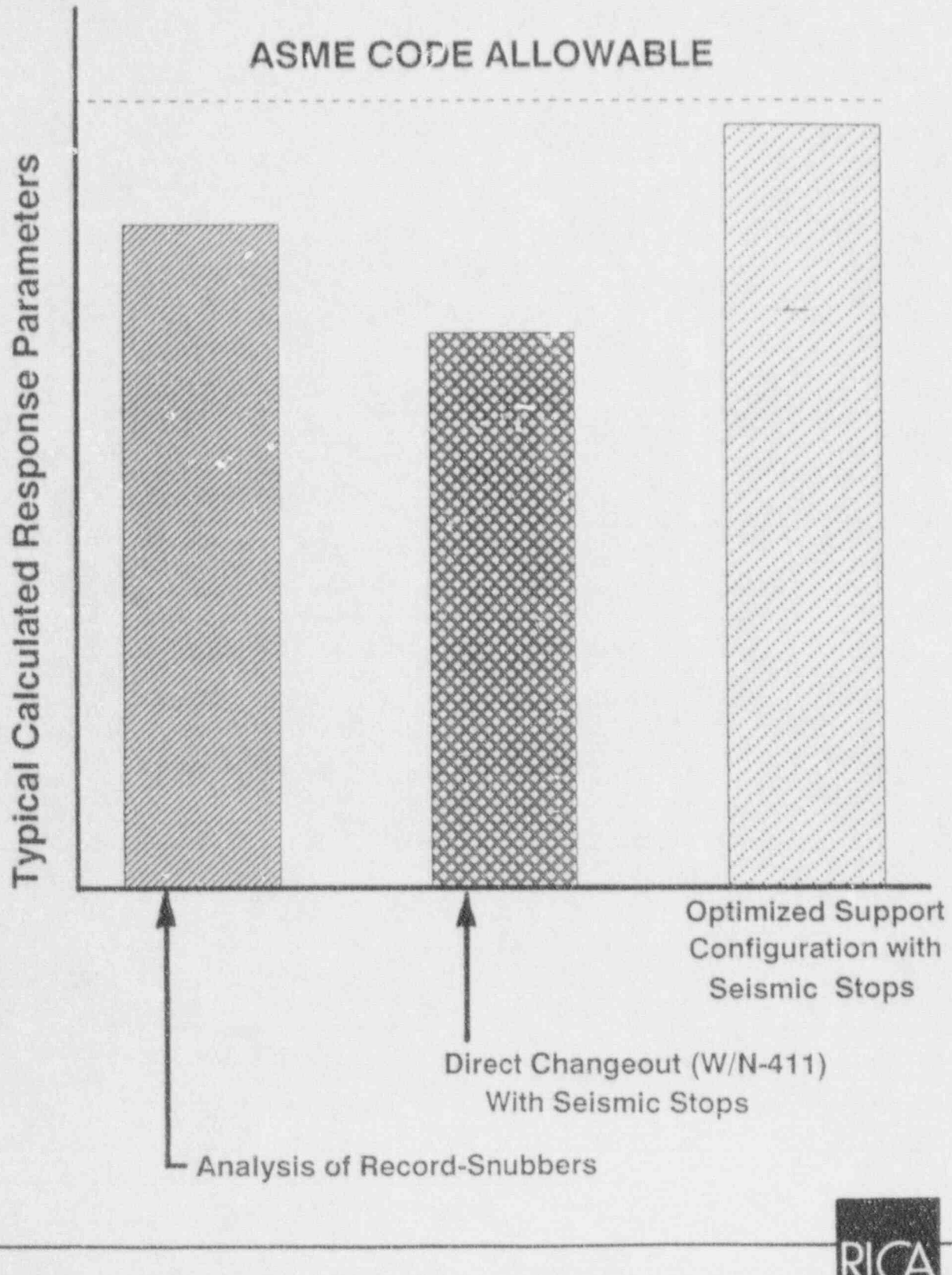
Damping Values of ASME Code Case N-411



PERFORMANCE PREDICTION



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APPLICATION AT OTHER PLANTS

The Application of Seismic Stops in Conjunction with N-411 Damping Can Eliminate All Snubbers, Reduce the Total Number of Existing Supports, and Meet the Original Design Criteria:

- Commonwealth Edison - Byron 2 (Class 1)
- Northeast Utilities - Millstone 3 (Class 2)
- EPRI Studies (PWR & BWR Sample Systems)
- Other Unpublished Applications
  - Diablo Canyon
  - Beaver Valley - 2
  - Catawba
  - KWU

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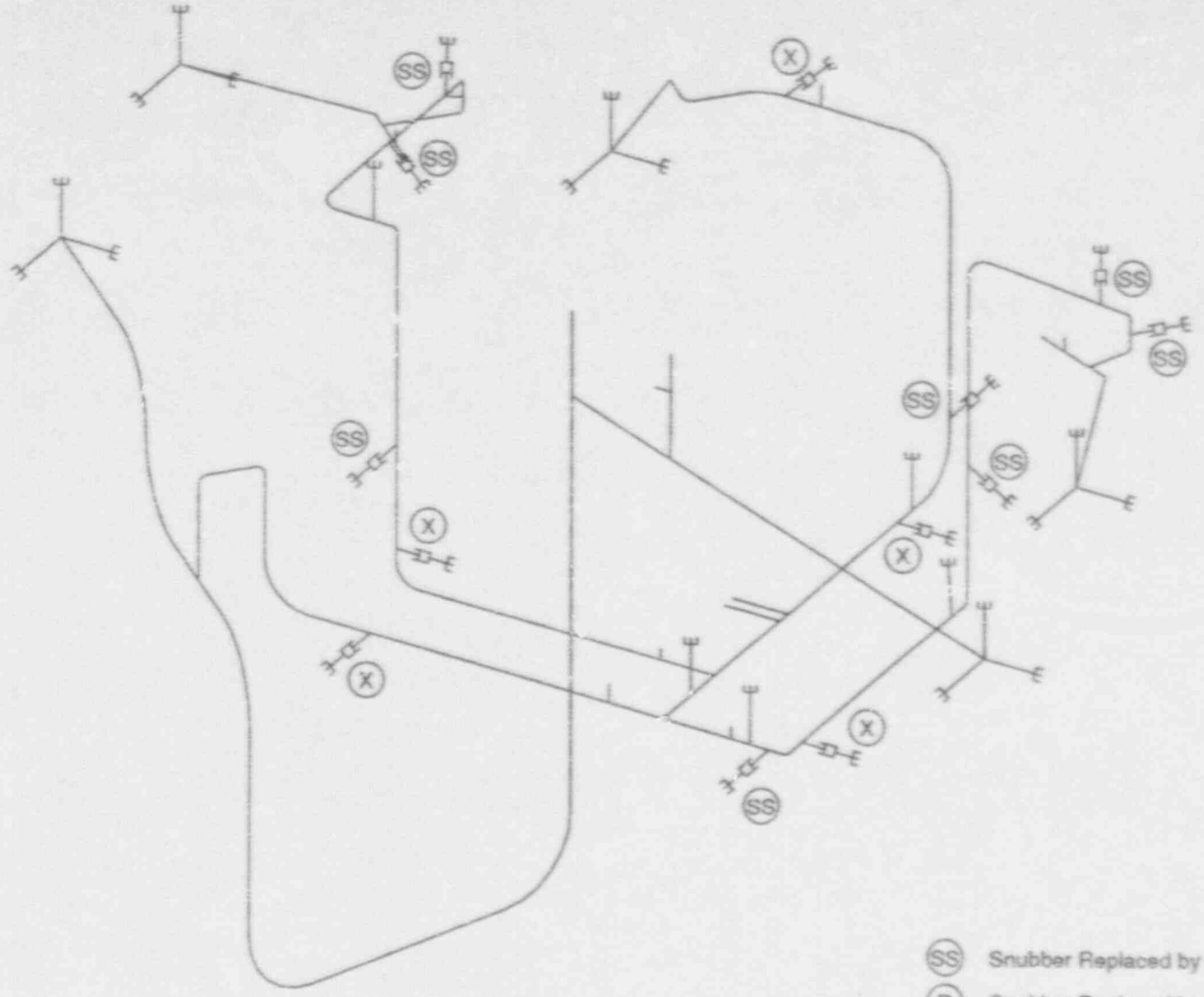

SS Snubber Replaced by Seismic Stop

R Snubber Replaced by Rigid Support

X Snubber Deleted

Y
Z
X

BYRON 2 - REACTOR COOLANT BYPASS LINE 2RC19/04

Commonwealth Edison

Project: Seismic Stops Pilot Study		Project #: P182.01	
Engineer:	date:	Checker:	date:

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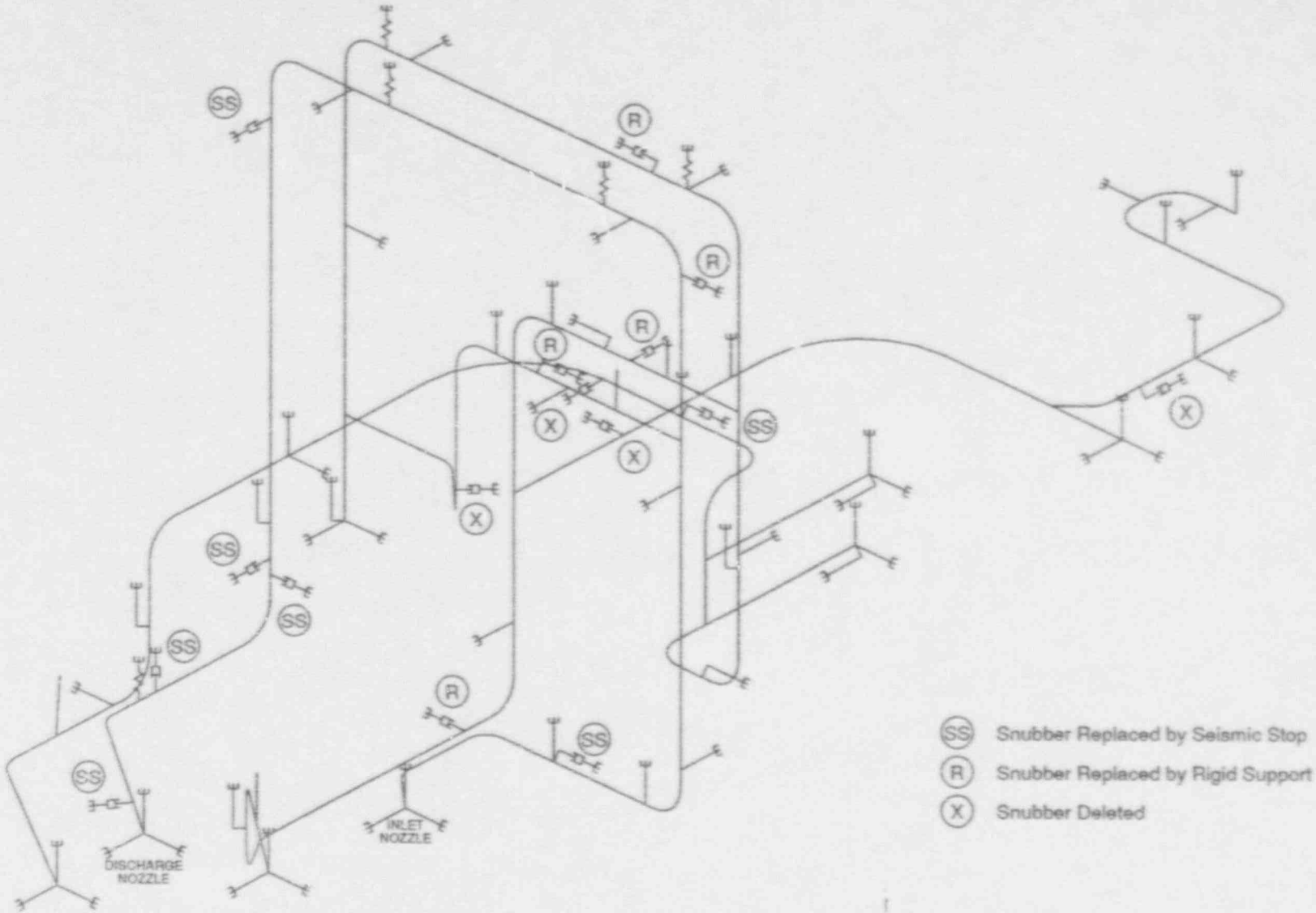
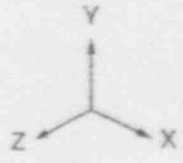
GAPPLOT 2.3





MILLSTONE UNIT 3 - RESIDUAL HEAT REMOVAL

Northeast Utilities

Project: Seismic Stops Pilot Study		Project #: P161-01	
Engineer:	date:	Checker:	date:

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GAPPLOT 2.3

BENEFITS

USE OF SEISMIC STOPS IN PLACE OF SNUBBERS WILL:

- o Improve System Performance
- o Reduce O & M Costs
  - – Eliminate ISI & Testing of Snubbers
  - – Minimize Outage Uncertainties
- o Reduce Radiation Exposure to Personnel
- o Maintain Existing Margins
- o Maintain Commodity Clearances
- o Provide Hardware Reliability

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HARDWARE RELIABILITY

- o Simplicity in Design
- o Passive Component
- o Thoroughly Tested
- o Manufactured by Major US Supplier of Nuclear Pipe Support Hardware
- o Reduced ISI Requirements
- o No In-Service Tests Required

SEISMIC STOP HARDWARE COMPONENTS
SUPERIOR TO SNUBBER HARDWARE

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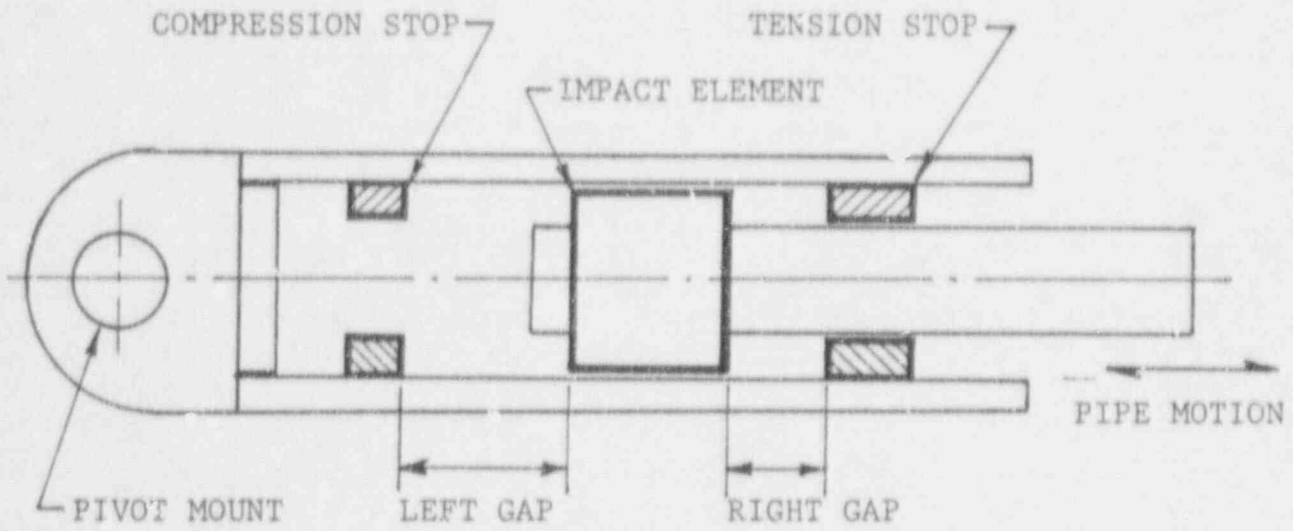
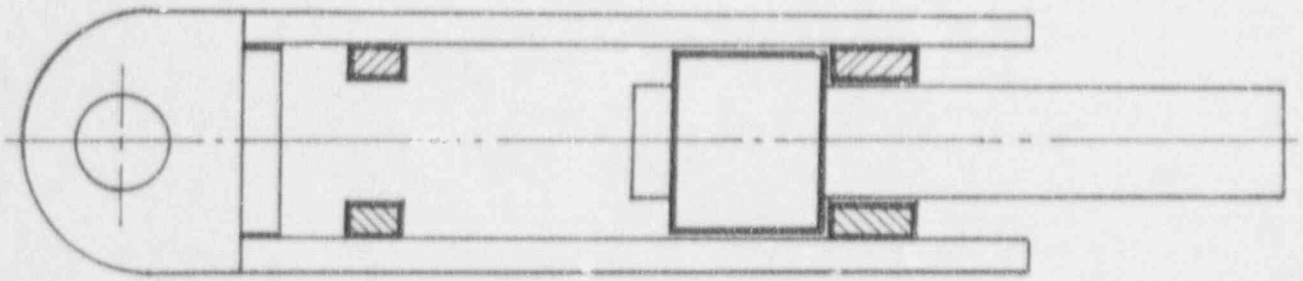
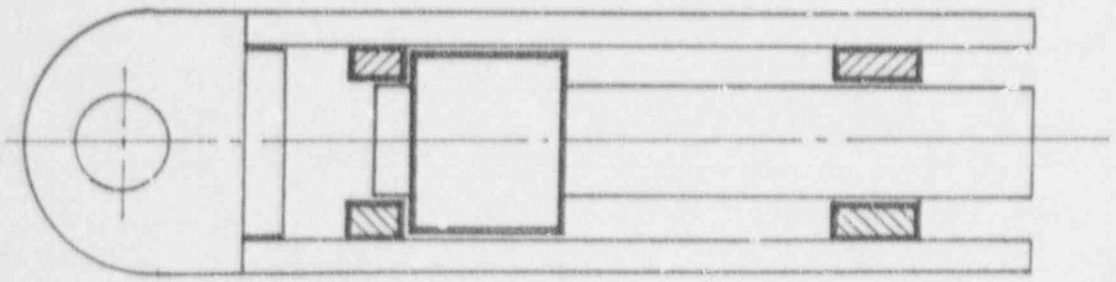
SEISMIC STOP DESIGN





FULLY EXTENDED



FULLY COMPRESSED

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IMPLEMENTATION RULES

- o Consistency With Plant Licensing Basis and Design Basis Criteria
- o Consistency With Findings From FW-350 Analysis and Implementation
- o Exclusion of Local Configurations Unsuitable for Seismic Stops Applications (If Any)

TIGHTLY CONTROLLED IMPLEMENTATION RULES AND APPLICABILITY EXCLUSIONS WILL ENSURE IMPROVED SYSTEM PERFORMANCE AND RELIABILITY

RLCA

SCHEDULE

o Project Planning	April 92
o Introductory NRC Presentation	June 92
o Complete Analysis of Demonstration Piping System at McGuire	July 92
o Presentation of Results and Future Program	Sept 92
o Initiate Change Out Of Snubbers with Seismic Stops	April 93
o Field Verification of Installed Seismic Stops	May-Oct 93

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