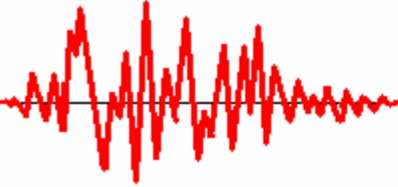


New Plant Seismic Issues Update to IEEE SC2

John Richards, Duke Energy

April 18, 2007

New Plant Seismic Issues

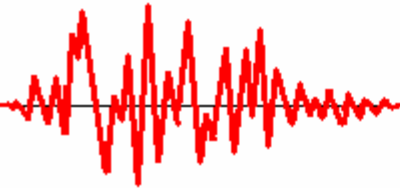


*New Plant
Seismic*

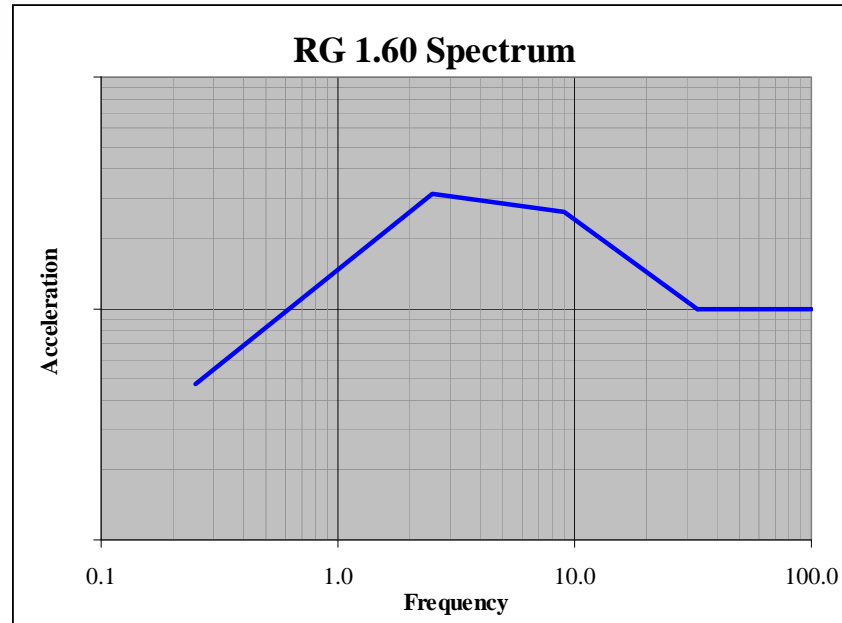
- Background
- Existing Plants
- New Plant Issues
- Example Analysis
- High Frequency Sensitive Items

Seismic Ground Motions

New Plant
Seismic

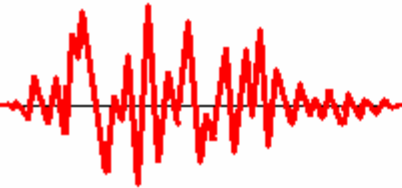


RG 1.60
Response
Spectrum



Seismic Ground Motions

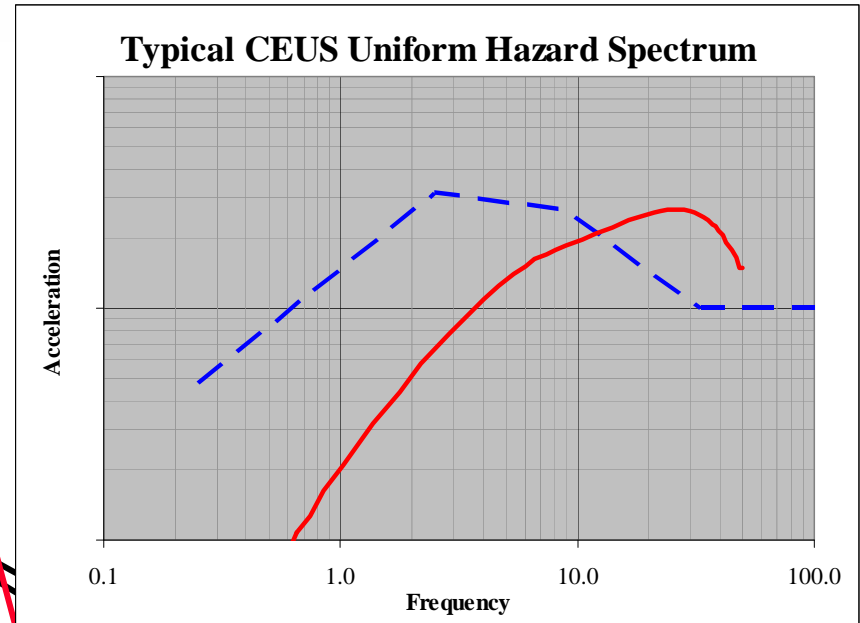
New Plant
Seismic



RG 1.60
Response
Spectrum

LLNL
Hazard
Studies

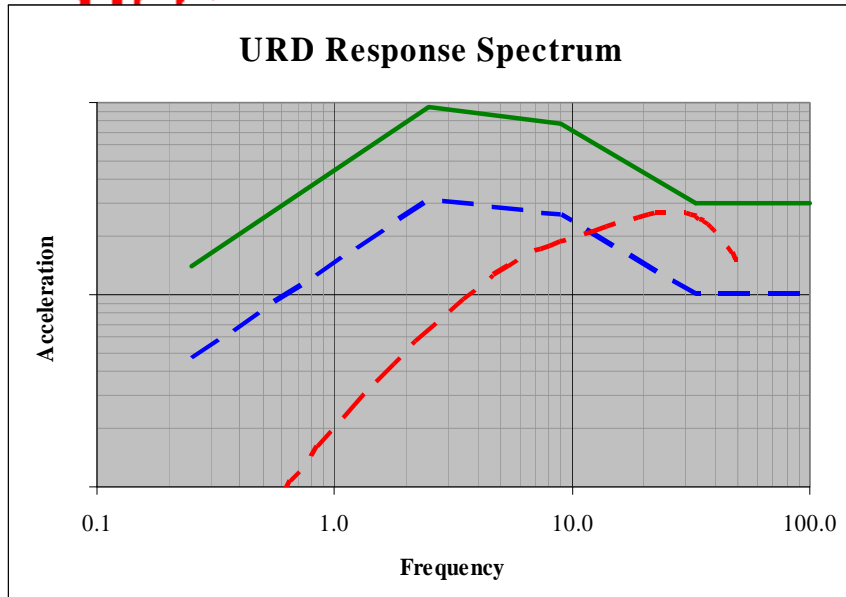
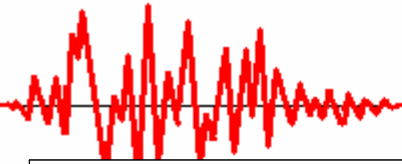
EPRI
Hazard
Studies



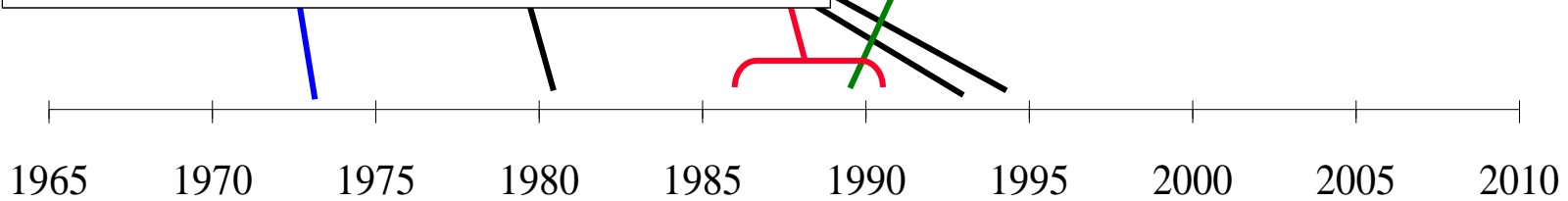
1965 1970 1975 1980 1985 1990 1995 2000 2005 2010

Seismic Ground Motions

New Plant
Seismic

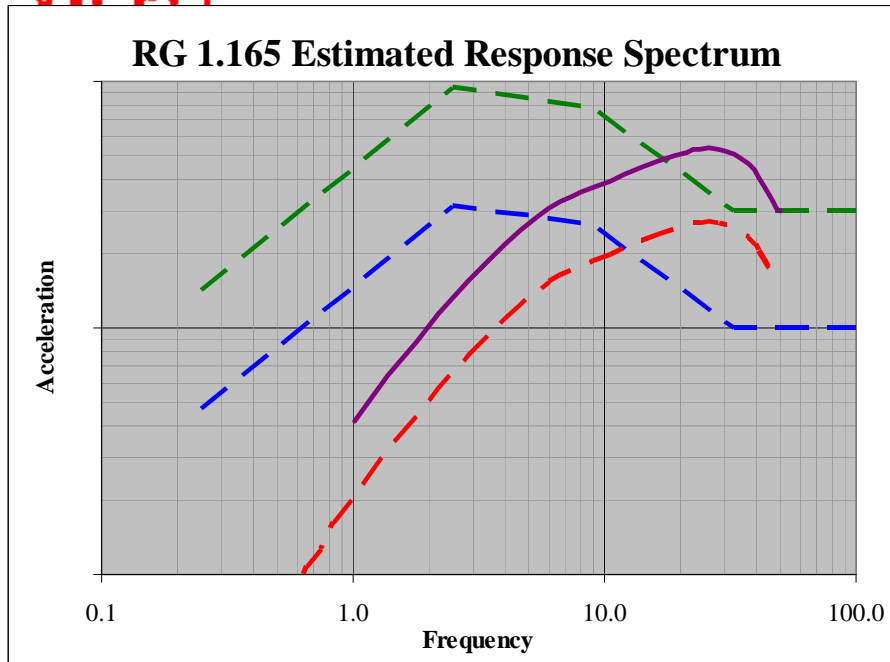
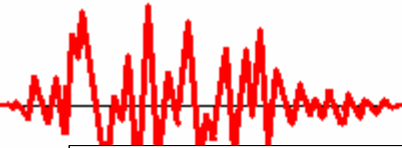


Utilities
Requirement
Document



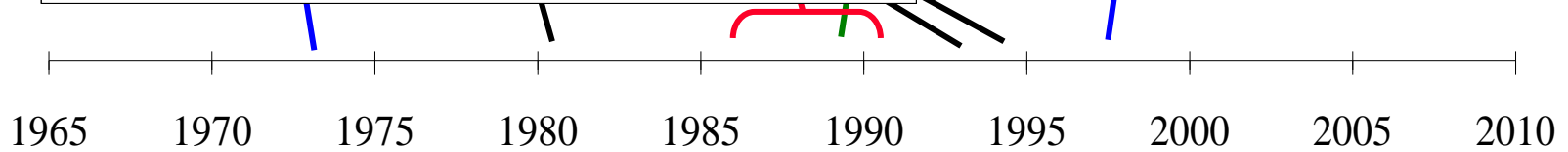
Seismic Ground Motions

New Plant
Seismic

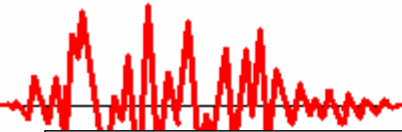


RG 1.165
Seismic
Sources
and SSE

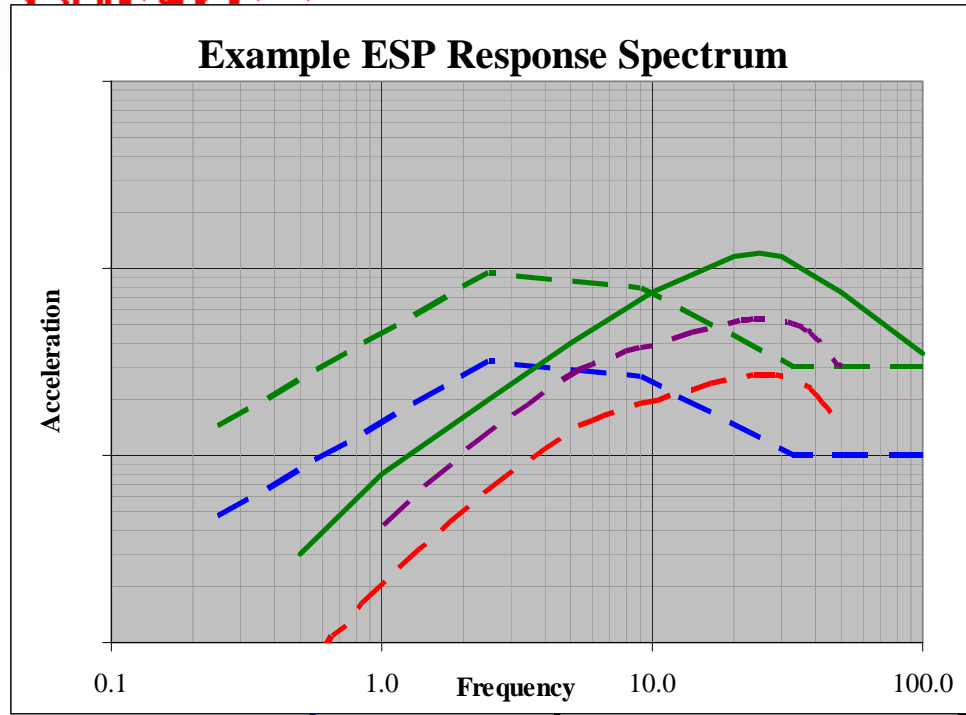
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Seismic Ground Motions



New Plant
Seismic

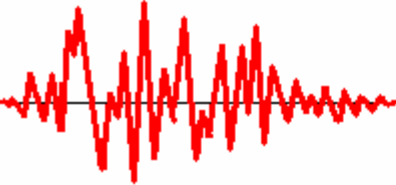


RG 1.165
Seismic
Sources
and SSE

Utility ESP
and COLA



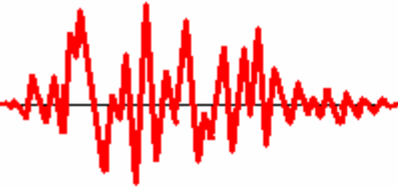
Evaluations for Existing Plants



*New Plant
Seismic*

- Individual Plant Examination of External Events (IPEEE) For Severe Accident Vulnerabilities – GL 88-20, Supplement 4
 - ◆ Procedural and Submittal Guidance for IPEEE – NUREG 1407, 1991
 - Acknowledged the new hazard estimates and “... relatively higher ground motions at frequencies greater than 10 Hz...”
 - No plant specific response necessary for high frequency motion provided special margin evaluations were performed for non-ductile components such as relays

Evaluations for Existing Plants

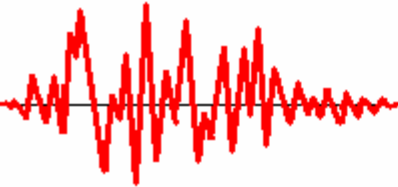


*New Plant
Seismic*

➤ NUREG-1407 Relay Evaluations

- ◆ Attempts to address by analysis likely to entail extensive efforts
- ◆ More suitable approach
 - Determine relays with high frequency sensitivity (SQUG low ruggedness relay list)
 - Screen relays with high seismic capacities (HCLPF)
 - Screen relays using circuit analyses or operator actions
 - Replace or retest remaining relays

Evaluations for Existing Plants

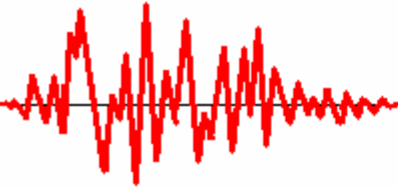


*New Plant
Seismic*

➤ USI A-46 Resolution

- ◆ SQUG developed a low ruggedness (bad actor) relay list based on test and operating experience
- ◆ Performed detailed relay reviews
- ◆ Coordinated walkdowns and evaluations with IPEEE reviews

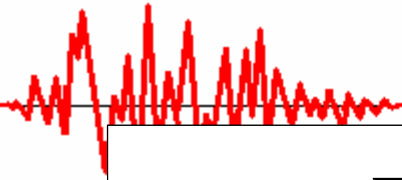
Generic Issue 199



*New Plant
Seismic*

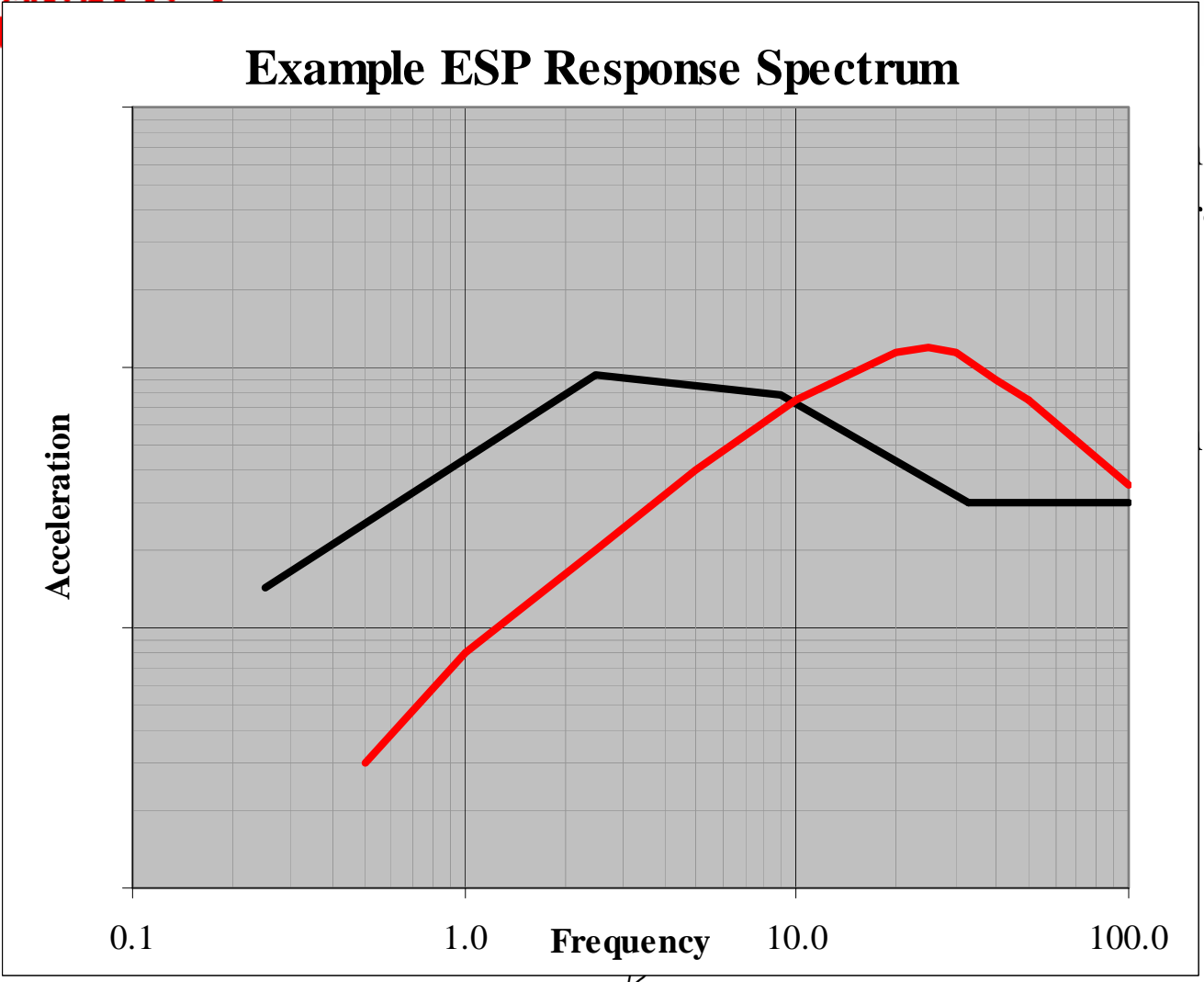
- GI 199 - Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States
 - ◆ Initiated in May 2005
 - ◆ RG 1.165 specifies a reference probability for exceedance of a safe shutdown earthquake ground motion based on 29 CEUS sites
 - ◆ Preliminary results from a 2004 USGS report indicated that the reference probability has increased
 - ◆ Contractor work has been delayed pending reviews of EPRI information

Seismic Issue - New Plants



New Plant
Seismic

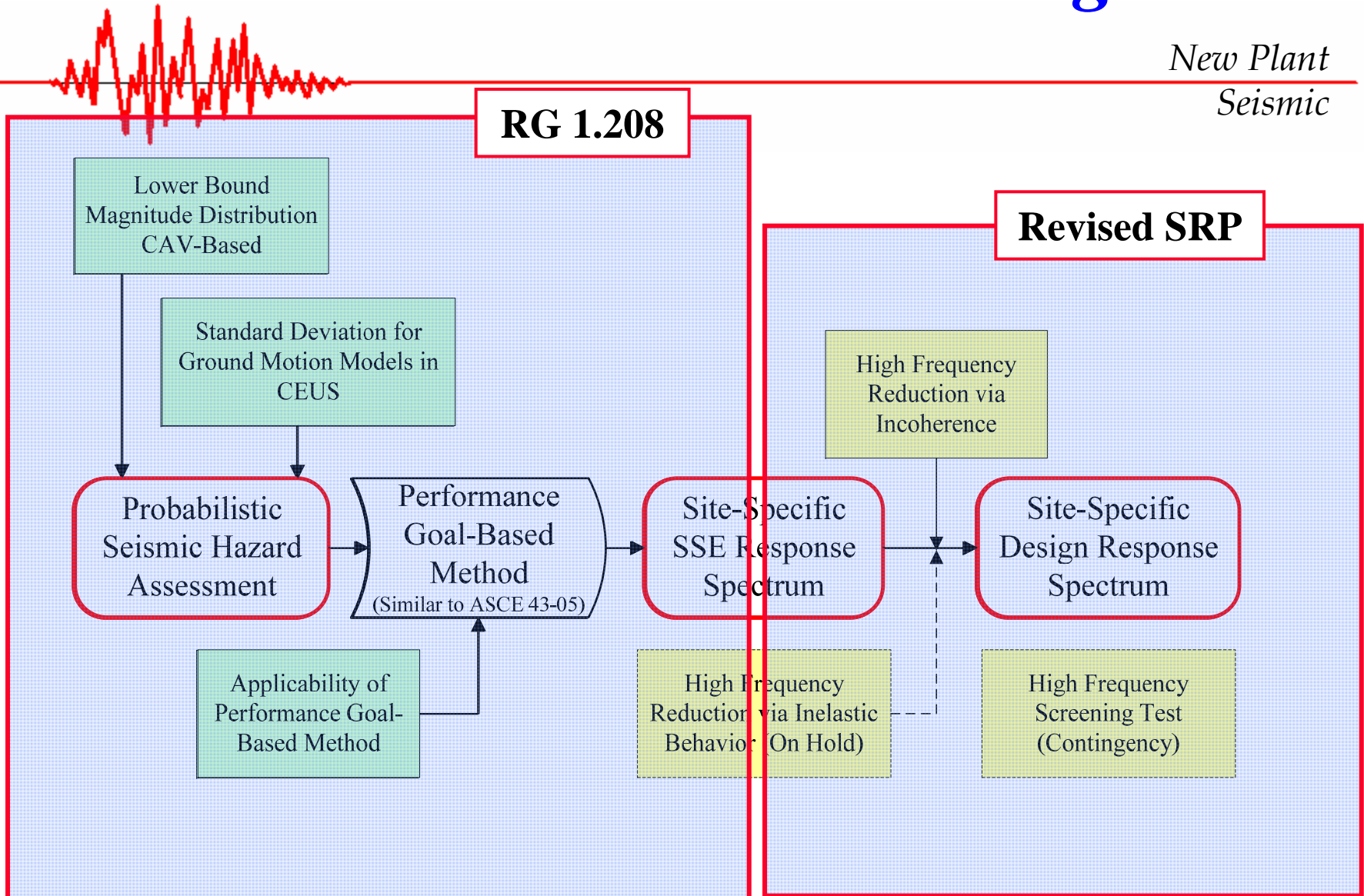
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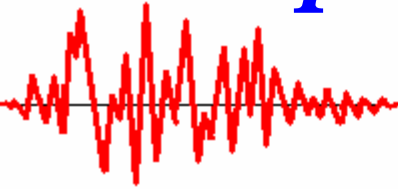
)
rock sites
e target

NEI/EPRI Seismic Issues Program

New Plant
Seismic



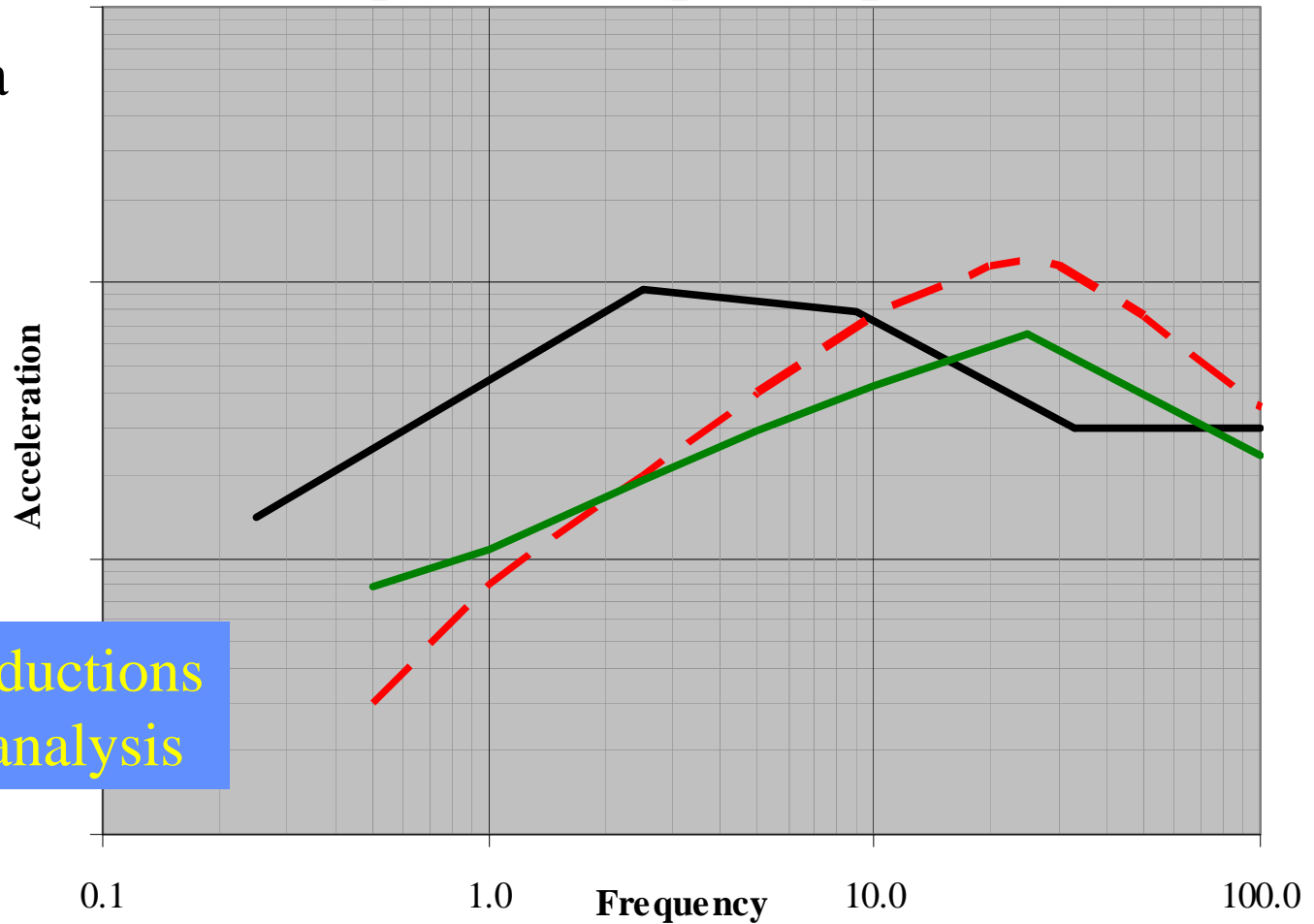
Example Analysis



New Plant
Seismic

Example ESP Response Spectrum

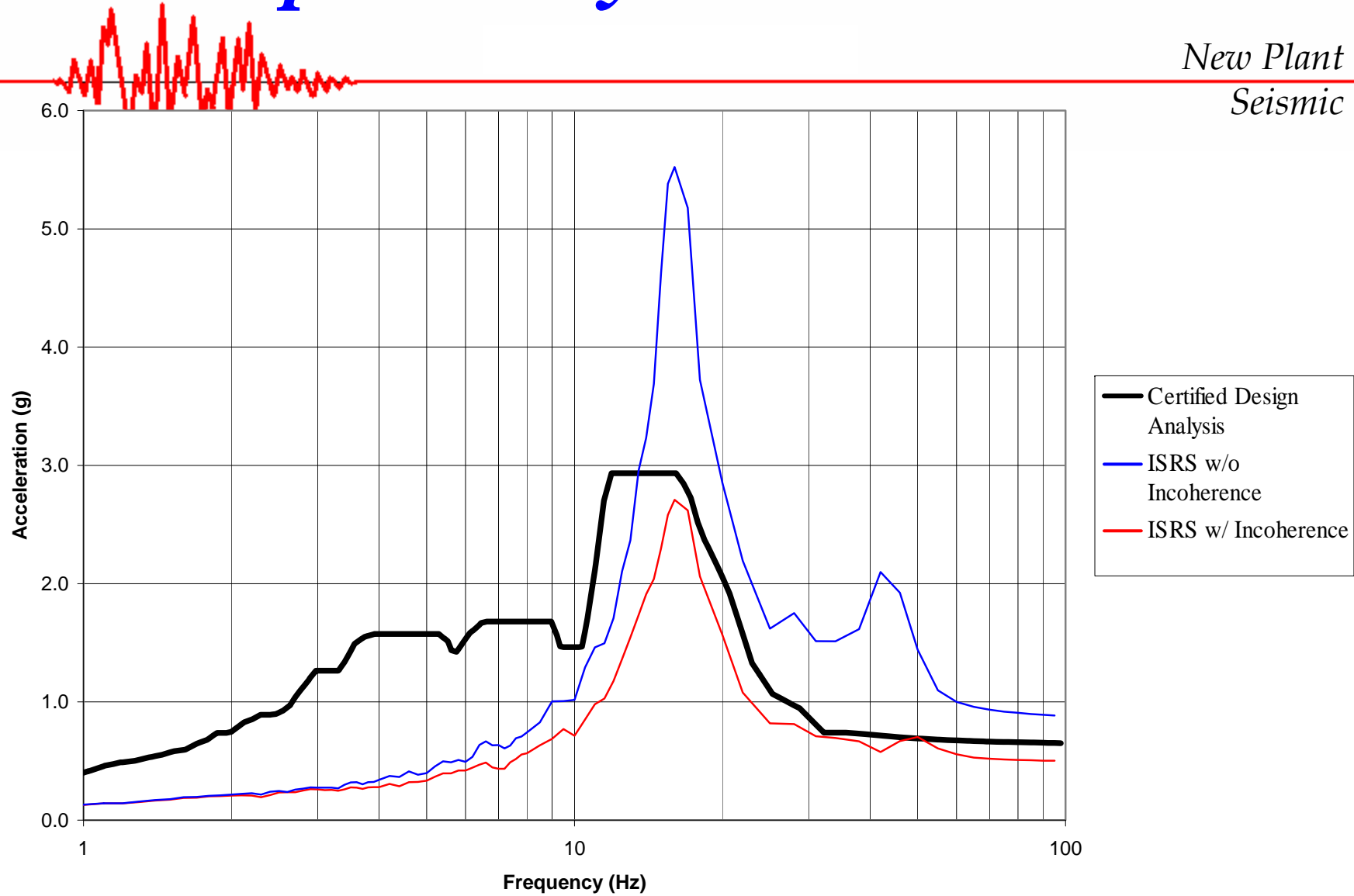
Reduced spectra
using hazard
improvements
and alternate
performance-
based process



Incoherence reductions
require ISRS analysis

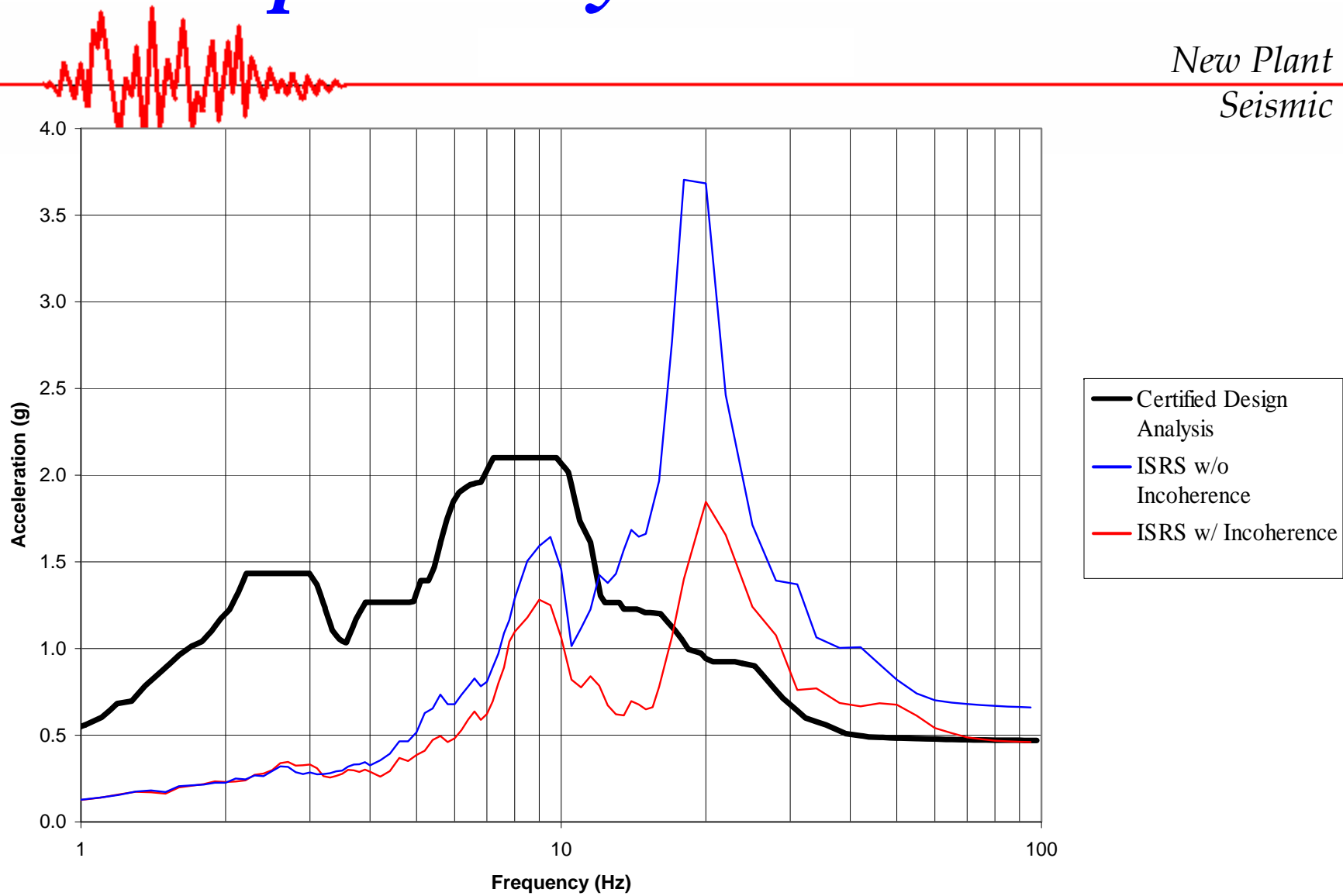
Example Analysis

New Plant
Seismic



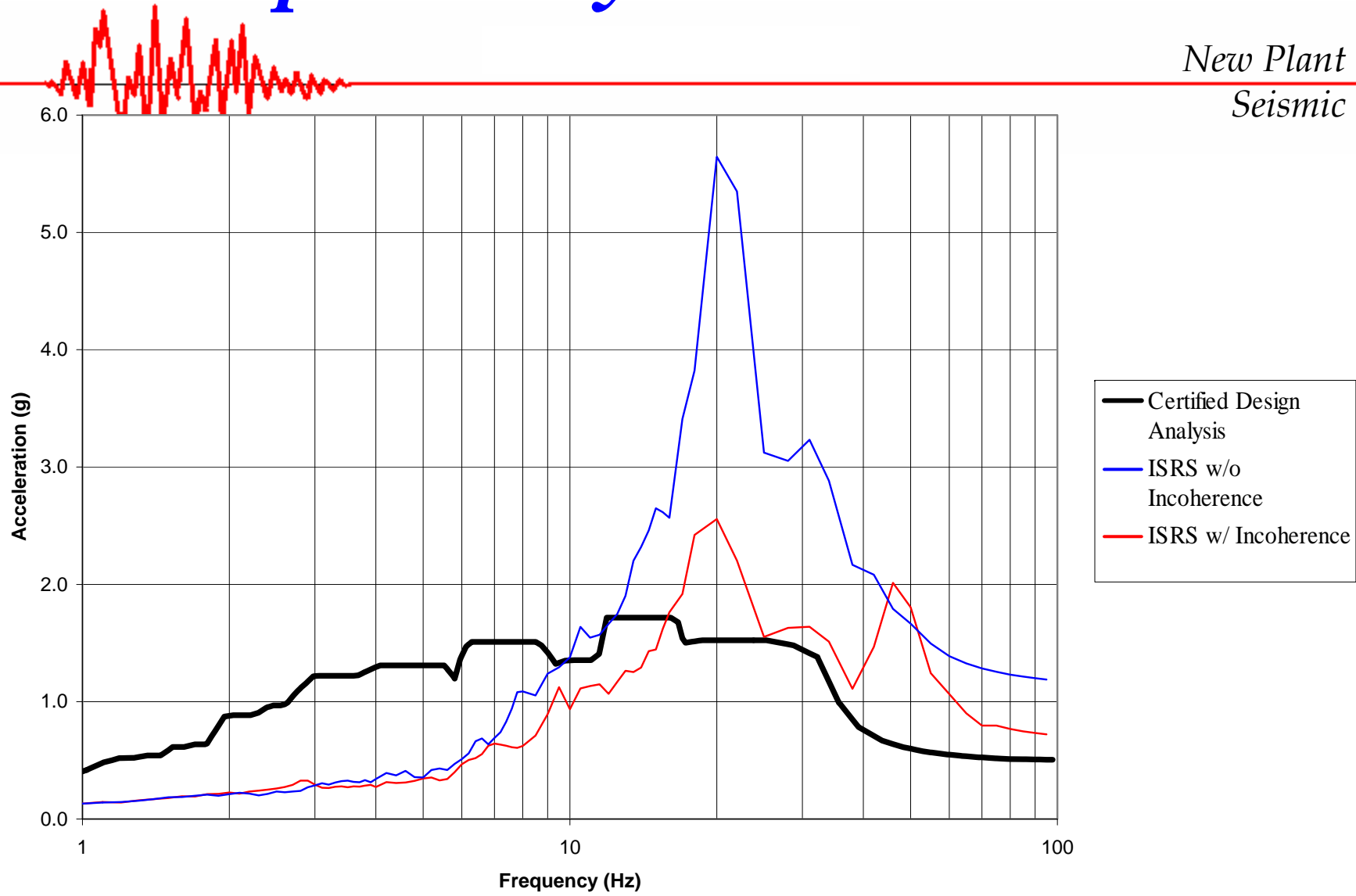
Example Analysis

New Plant
Seismic

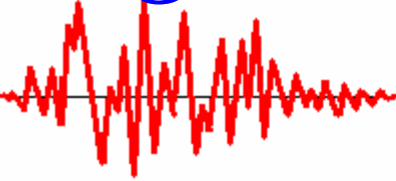


Example Analysis

New Plant
Seismic



High Frequency Resolution

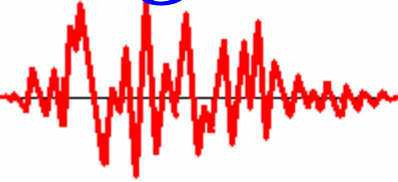


*New Plant
Seismic*

- Use new methods to reduce high frequency motions as much as possible
 - ◆ Hazard improvements and alternate Performance-based method
 - ◆ Incoherence reductions

- Qualitative evaluation for structural items
 - ◆ White Paper EPRI Report
 - ◆ Limited stress comparisons

High Frequency Resolution



*New Plant
Seismic*

- Screening for potentially high frequency sensitive items
 - ◆ Selection criteria for items
 - ◆ Determination of high frequency requirement
 - ◆ Evaluation methods