

**Industry Recommendations
With Regard to High Frequency
Seismic Input Motions**

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Purpose

Present recommendations on evaluation of HF effects on rock sites in CEUS, e.g.

- Guidelines for structure response modeling
- Evaluation of structural systems
- Evaluation of HF-sensitive components

CEUS Rock Sites

NSSS Standard Plant Vendors establish a Generic Rock Response Spectrum (GRRS) for which seismic adequacy is demonstrated.

Option 1: Envelop GRRS by CSDRS
(GEH Approach)

Option 2 : Evaluate high frequency sensitivity of
plant SSCs to GRRS
(Westinghouse Approach)

Definitions

SSISRS = Site-Specific In-Structure-Response-Spectra computed using FIRS Input Motion

CSDISRS = Certified Seismic Design In-Structure-Response Spectra for which Systems and Components (SC) have been qualified.

GRISRS = Generic Rock In-Structure-Response-Spectra computed using GRRS Input Motion

Comparison of Site Specific GMRS

- If GMRS (or FIRS) less than either CSDRS or GRRS, no site specific structural evaluation is required.
- If not, structural analysis using FIRS input is required to obtain site-specific-in-structure response spectra (SSISRS) for comparison with either CSDISRS or GRISRS. If less than either, no further system or component evaluation is required.
- If not, perform system and component high frequency screening evaluation as subsequently described for GRRS evaluation.

Recommendations Concerning Structure Response Modeling

- Structure Models need to be sufficiently refined so as to provide a reasonable estimate of the In-Structure-Response-Spectra (ISRS) up to a specified 'cutoff' frequency
- 'Cutoff' frequency should be specified as the lesser of:
 - Twice the frequency at which the 5% damped FIRS Spectral Acceleration (SA) has dropped below 80% of its peak value, but not less than 16 Hz
 - 25 Hz

Why 25 Hz

- Reasonably achievable goal within current structural modeling capability
- Other than for low mass, high stiffness components sensitive to very small chatter displacements, high frequency motions don't have sufficient displacement content to be damaging.

25 Hz Example

$$SA = 2.0g \rightarrow SD = 0.03 \text{ inch}$$

- Further discussed in Industry White Paper [EPRI TR-1015108 – June 2007]

Evaluation of Systems and Equipment

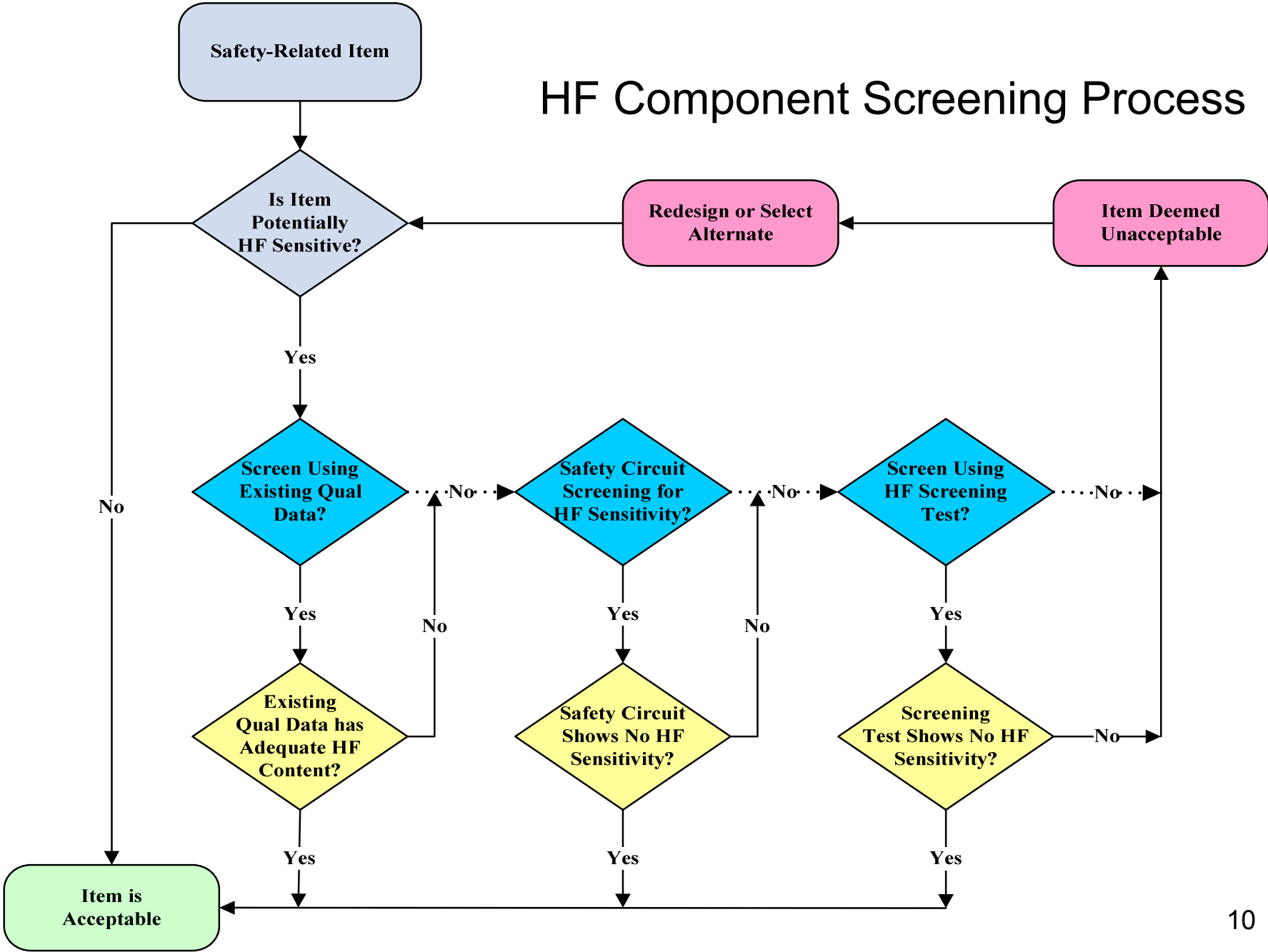
(Other than HF-sensitive components)

- $GRISRS \leq CSDISRS$ at all frequencies below 25 Hz
 - No additional evaluation needed
- $GRISRS > CSDISRS$ below 25 Hz
 - Each NSSS Vendor performs sampling scoping analyses on a limited sample of systems and equipment to demonstrate lack of damage capability from GRISRS input motions

Evaluation of High Frequency-Sensitive Components

- Components will be fully qualified to CSDISRS
- If either $GMRS < CSDRS$ or $SSRISRS \leq CSDISRS$ at all frequencies below 50 Hz, No additional evaluation needed
- If not, perform evaluations of HF-sensitive components by one of the following methods:
 - Generic Method, or
 - Location-specific Method

HF Component Screening Process



Generic Screening Method for High Frequency Chatter Sensitive Components

- Perform Screening Test Using High Frequency Input Motion with the following minimum 5% damped SA from 25 to 50 Hz
 - SA = 5 g for floor mounted components
 - SA = 15 g for enclosure/rack mounted components
- Purpose is to screen out from use components which are high frequency sensitive

Location-Specific Approach for High Frequency- Sensitive Components

- Further refine structure models so as to provide a reasonable estimate of GRISRS up to 50 Hz
- Demonstrate that high frequency-sensitive components are acceptable for GRISRS