



Selection of Critical Characteristics to Support Commercial Grade Item Dedication

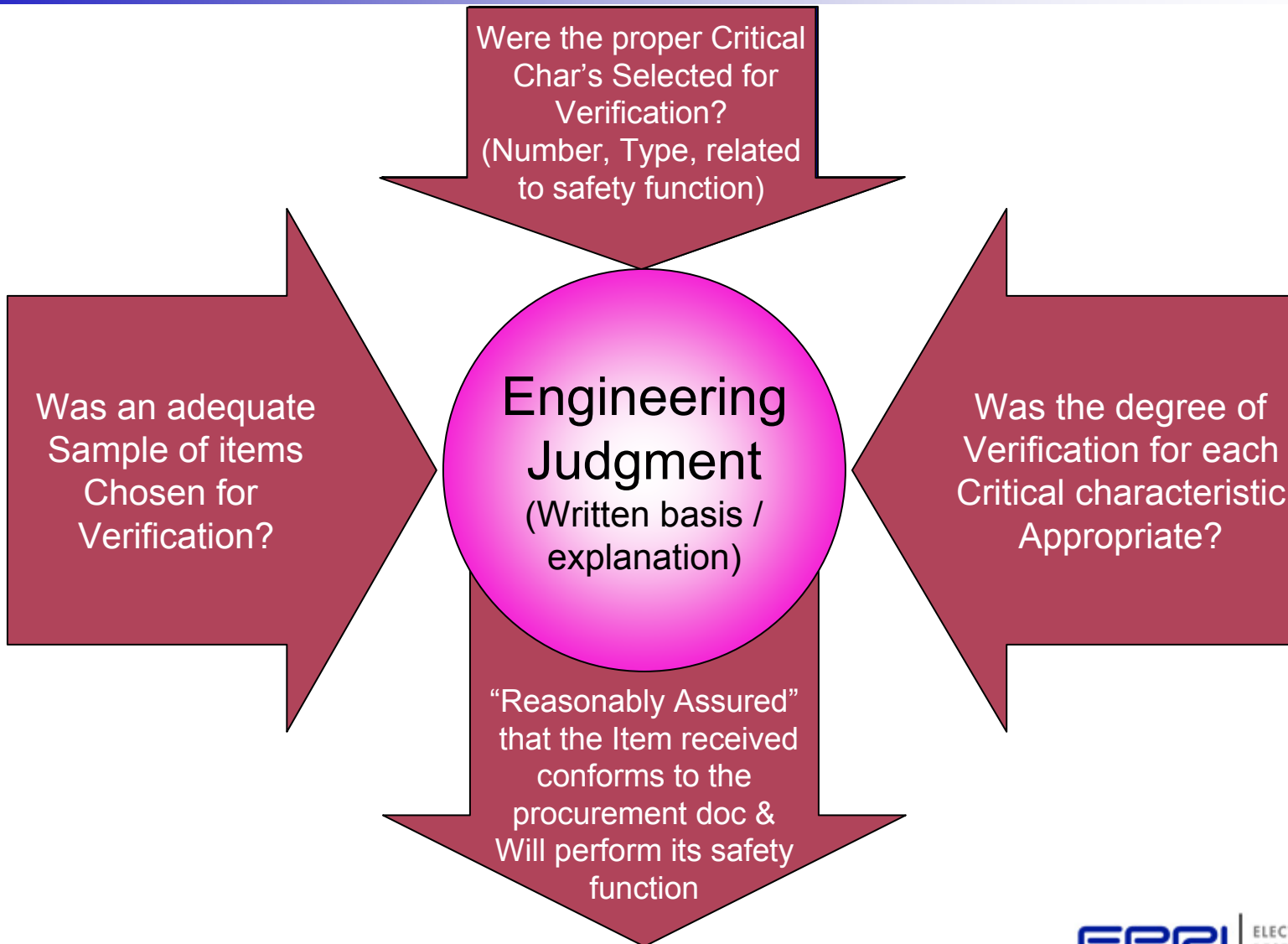
**Nuclear Regulatory Commission
Vendor Oversight Workshop**

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Factors Required to Achieve Reasonable Assurance in the Context of CGI Acceptance



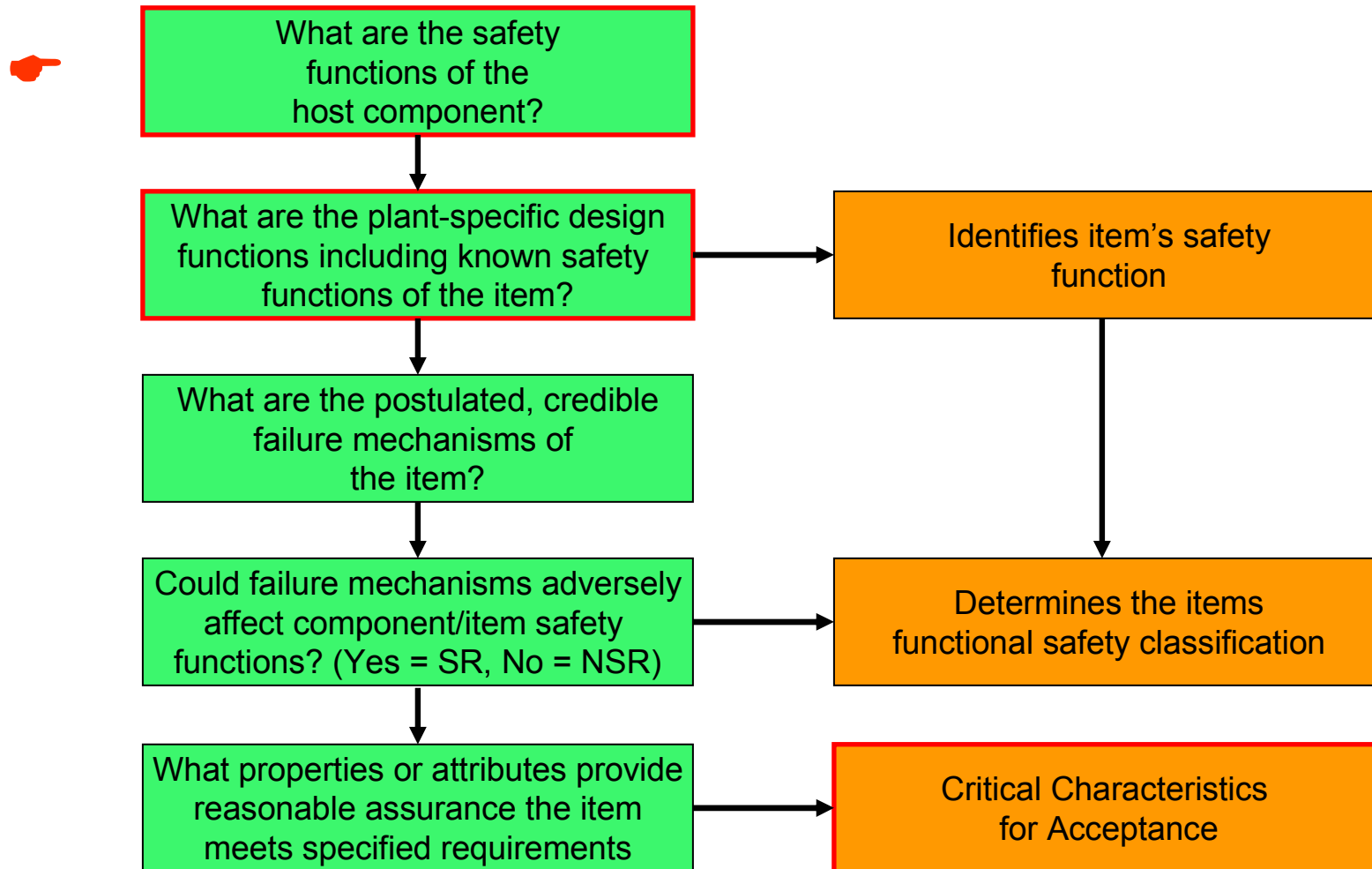
Identification of Critical Characteristics

- Critical Characteristics must envelope *all* safety functions
- If available, suppliers (particularly manufacturers) can determine critical characteristics using original design information to *envelope all of the item's possible safety functions*.
- When original design information is not available, critical characteristics are determined based upon the item's safety function and a failure modes and effects analysis (FMEA)
 - Input from the customer (licensee) may be required for each specific application and purchase order
- Using an FMEA in conjunction with original design information is also an effective way to establish critical characteristics

FMEA is the Recommended Process for Safety Classification and Selecting Critical Characteristics

Analysis Process

Conclusion/Result



Component Functions

- Suppliers can base dedication on their customer's specific safety functions, or:
- Perform dedications that envelope the item's known functions
- Functions during normal and accident conditions must be considered
 - Includes seismic & environmental conditions

Typical Component Functions*

Mechanical Component Functions

- Maintain pressure integrity
- Open
- Close
- Close/Isolate
- Provide flow
- Actuate/Modulate flow
- Control combustible gasses
- Blend or Mix

Electrical Component Functions

- Maintain circuit integrity
- Electrical Isolation
- Provide signal
- Provide power
- Filter
- Provide indication
- Change state

*Source: EPRI 1008256, Revision 1, App. A

Functional Mode

- Considering an item's functional mode is useful tool when identifying critical characteristics for the item and its parts

- Active

A component in which mechanical or electrical change of state **IS** required to occur for the component to perform its safety-related function

There **IS** a change of state



- Passive

A component in which mechanical or electrical change of state **IS NOT** required to occur for the component to perform its safety-related function

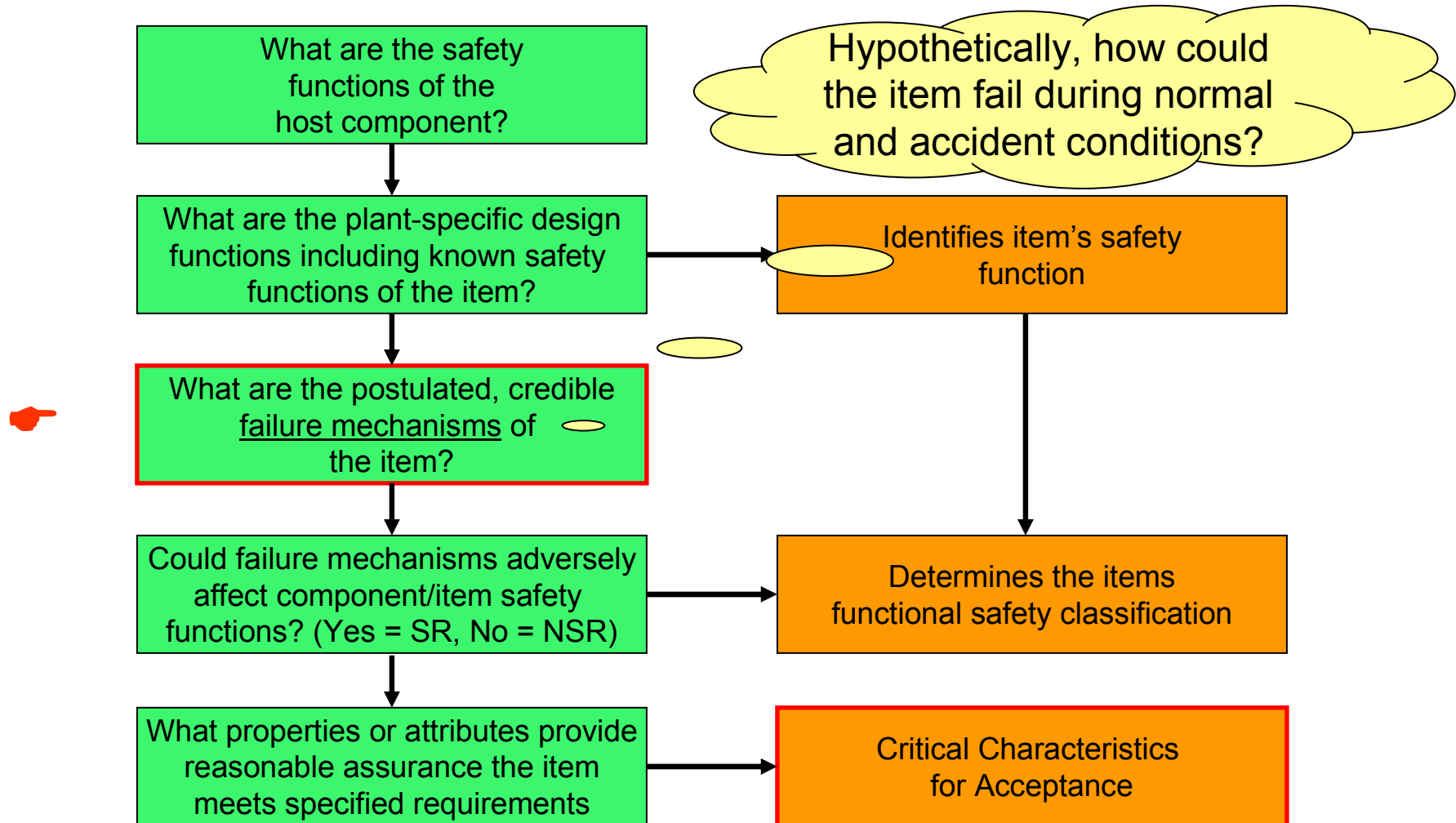
There **IS NOT** a change of state



FMEA is the Recommended Process for Safety Classification and Selecting Critical Characteristics

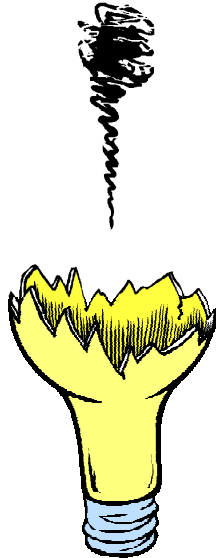
Analysis Process

Conclusion/Result



Typical Credible Failure Mechanisms / Modes*

- Fracture
- Corrosion
- Erosion
- Open Circuit
- Deformation
- Short Circuit
- Chemical Breakdown
- Blockage
- Seizure
- Unacceptable vibration
- Loss of Properties
- Excess Strain
- Mechanical Creep
- Ductile Fracture



- Failure Mechanism:
 - Failure Causes which are reasonably likely to occur. These failures include failures which have occurred before, failure causes which are addressed in the existing maintenance program, and other failure causes which are considered real possibilities.
- Failure Mode:
 - The loss of an equipment function is a functional failure or failure mode. A functional failure is defined as the inability of any equipment to meet a desired standard of performance. These failures include complete loss of function as well as failures which cause performance to fall outside of acceptable limits.

*Source: EPRI 1008256, Revision 1, App. B

FMEA is the Recommended Process for Safety Classification and Selecting Critical Characteristics

Analysis Process

What are the safety functions of the host component?

What are the plant-specific design functions including known safety functions of the item?

What are the postulated, credible failure mechanisms of the item?

Could failure mechanisms adversely affect component/item safety functions? (Yes = SR, No = NSR)

What properties or attributes provide reasonable assurance the item meets specified requirements

Conclusion/Result

If a failure can affect the safety function, what characteristics are necessary to preclude failure?

Identifies item's safety function

Determines the items functional safety classification

Critical Characteristics for Acceptance

Background / Basis

- Per EPRI NP-5652, Critical Characteristics of Acceptance are:

- “Identifiable and measurable attributes / variables of a commercial grade item, which once selected to be verified, provide reasonable assurance that the item received is the item specified”

1988

- Per EPRI NP-6406, Critical Characteristics for Design are:

- “those properties or attributes that are essential for the item’s form, fit, and functional performance. Critical characteristics for design are the identifiable and/or measurable attributes of a replacement item which provide assurance that the replacement item will perform its design function

1989

- Per 10CFR21, Rev. 2, Critical Characteristics are:

- “Those important design, material, and performance characteristics of a CGI that once verified, will provide reasonable assurance that the item will perform its intended safety function.” (licensed pursuant to 10CFR50)

1995

The Definitions are Consistent



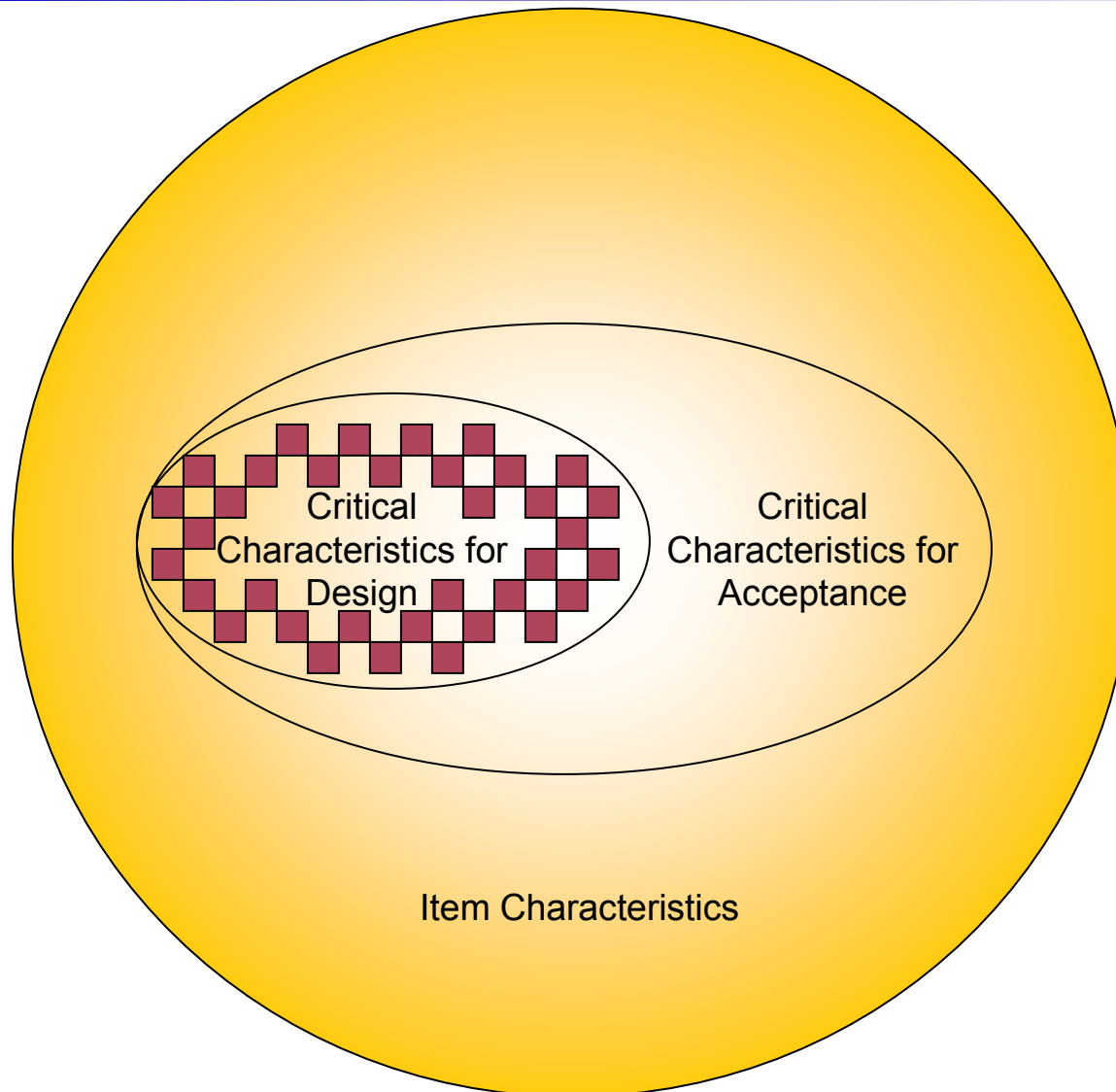
- The intent is to select and verify critical characteristics that provide reasonable assurance the item will perform its intended safety functions
- Item design function(s) are important in determining critical characteristics for design
- Item safety function(s) are important in determining critical characteristics for acceptance

Different Types of Critical Characteristics

- Physical Characteristics
 - Material Chemical Composition
 - Material Strength
 - Dimensions
 - Electrical Resistance
 - Durometer Hardness
- Performance Characteristics
 - Pick-up / Drop-out voltage
 - Open/Close time
 - Input/Output voltage
 - Leakage
- Product Identification
 - Part Number
 - Color Coding
 - Heat, Lot or Batch number
 - Nameplate Data

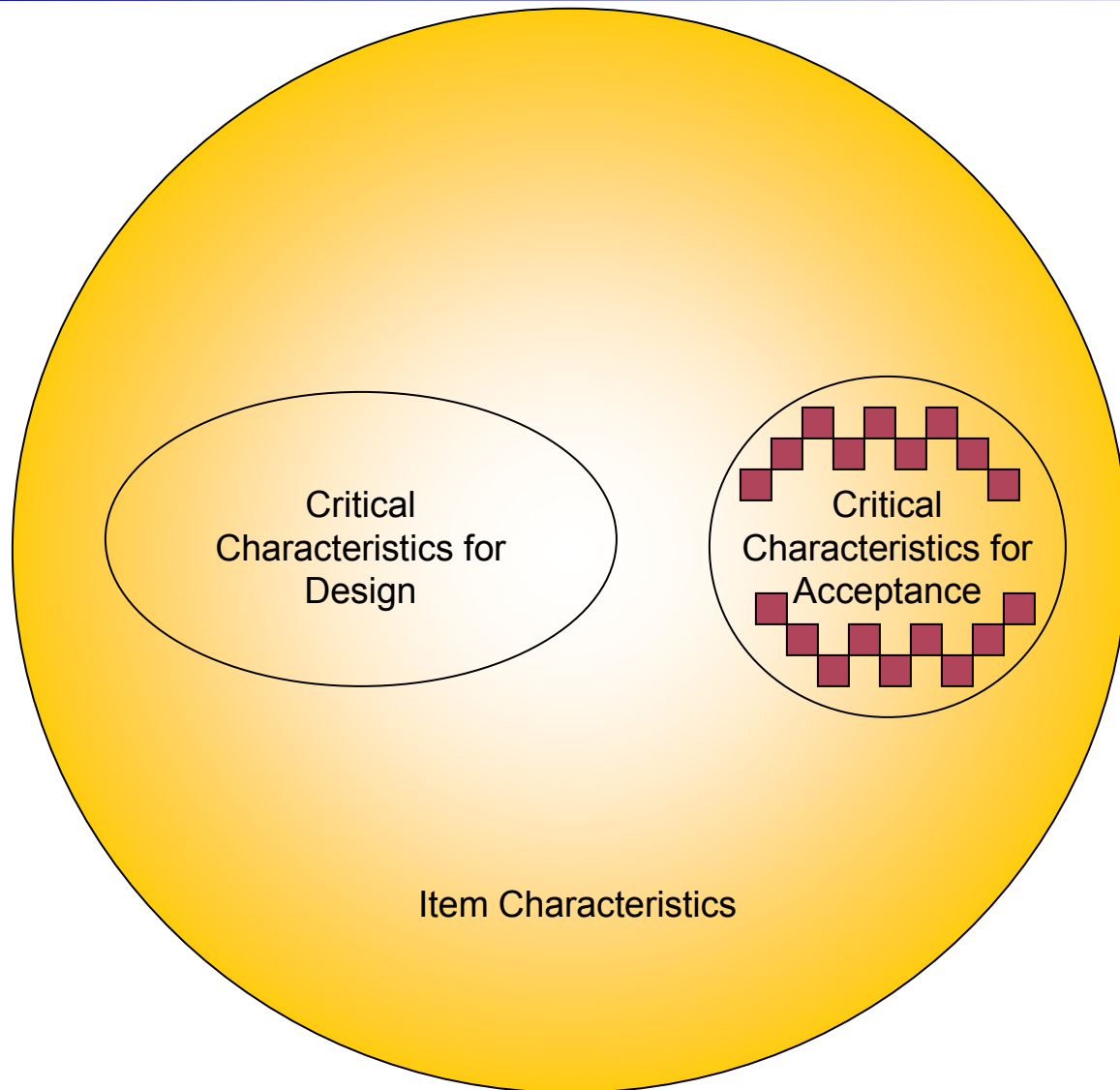


Verifying all the Critical Characteristics for Design is NOT the Intent of EPRI or NRC Guidance

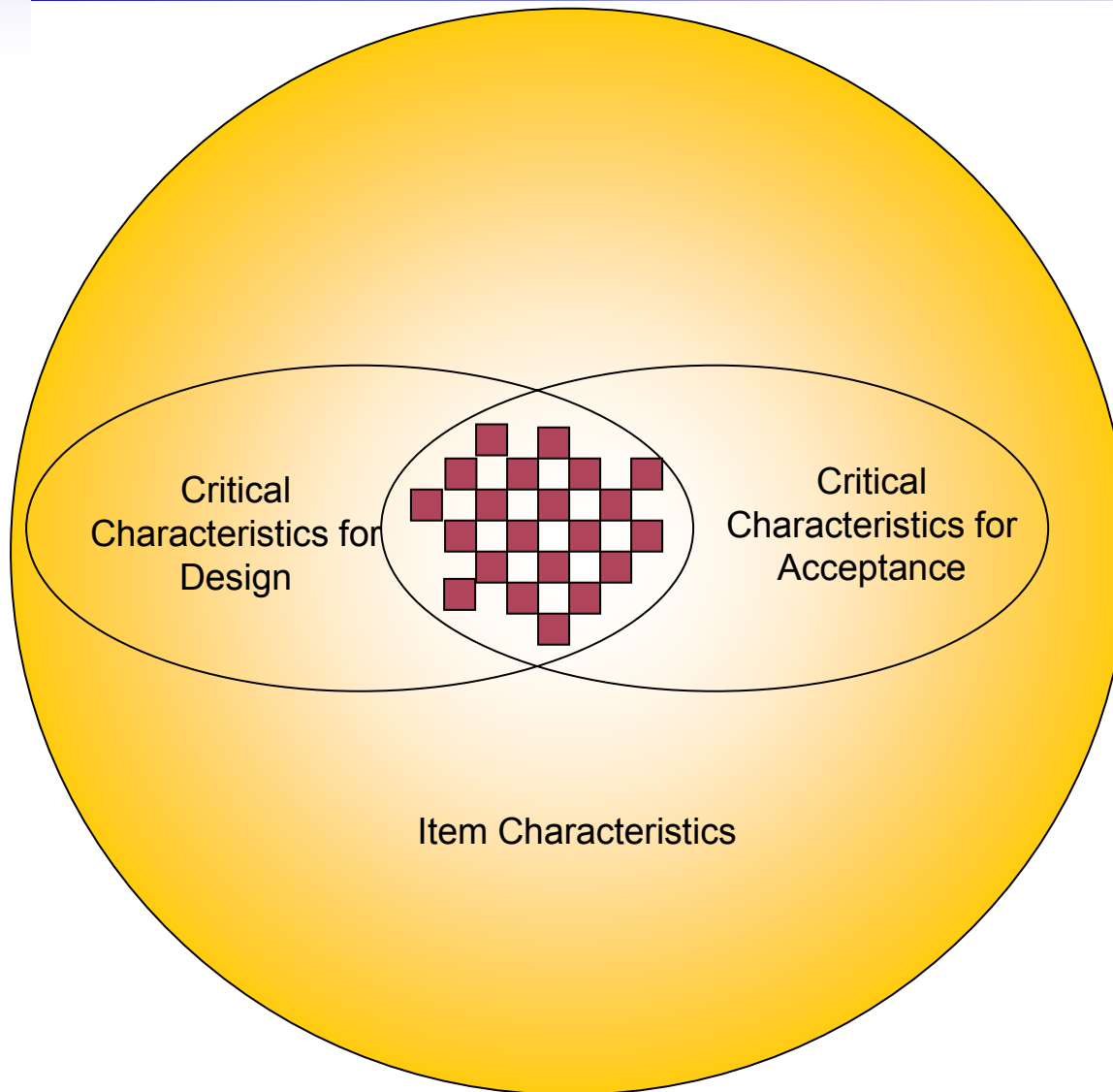


- Verification of all critical characteristics for design is not the intent
- Focus on characteristics related to the item's intended safety function(s)

Failure to verify any Critical Characteristics for Design is Inadequate



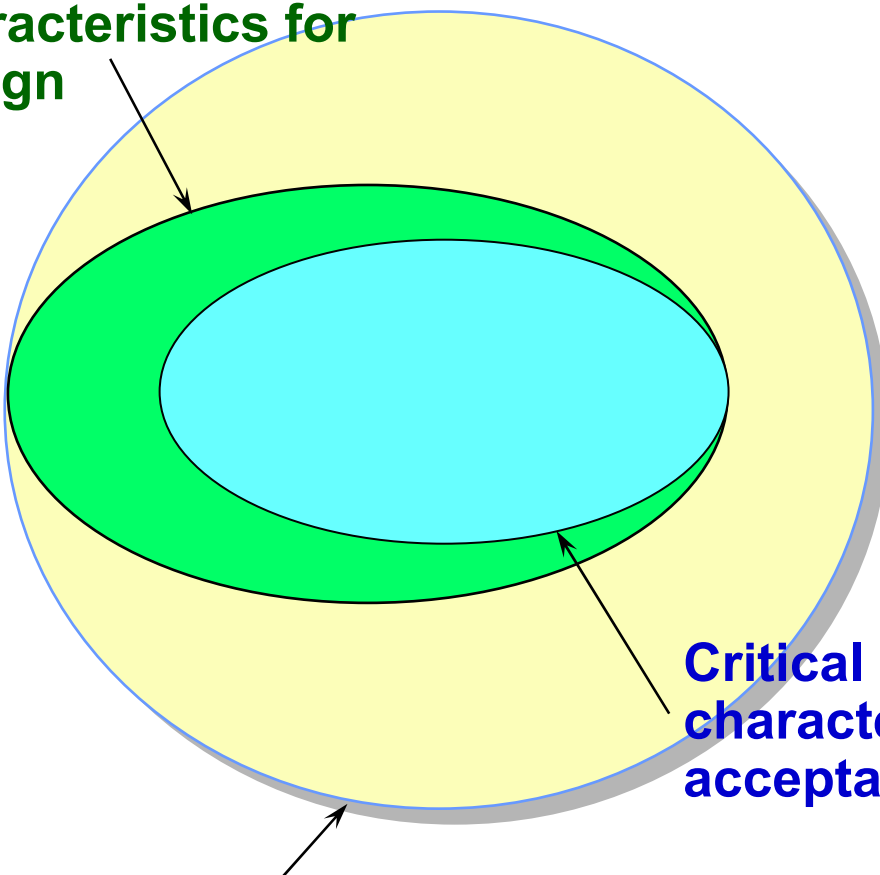
Selection of Appropriate Critical Characteristics



- Shaded area represents:
 - Those CCDs that are related to the item's safety function
 - The CCAs that are measurable (physical or performance)
- A good rule of thumb is to select at least one CCA for each safety function
- This approach is "reasonable"

Critical Characteristics for Acceptance

Critical characteristics for design



Critical characteristics for acceptance

- May be a subset of the critical characteristics for design
- Are based on the item's *safety* functions (as determined by the licensee's plant-specific application)
- Likewise are design, material and performance attributes of the item
- Are measurable and verified

Item characteristics



EPRI

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Questions?



A world map is centered on the slide, showing the continents of North America, South America, Europe, Africa, Asia, and Australia. The map is overlaid with a white grid of latitude and longitude lines. The map itself is a light blue color, contrasting with the dark blue background of the slide.

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