

EPRI
*Challenges with Commercial
Grade Dedication, Equipment
Qualification, and Reverse
Engineering*



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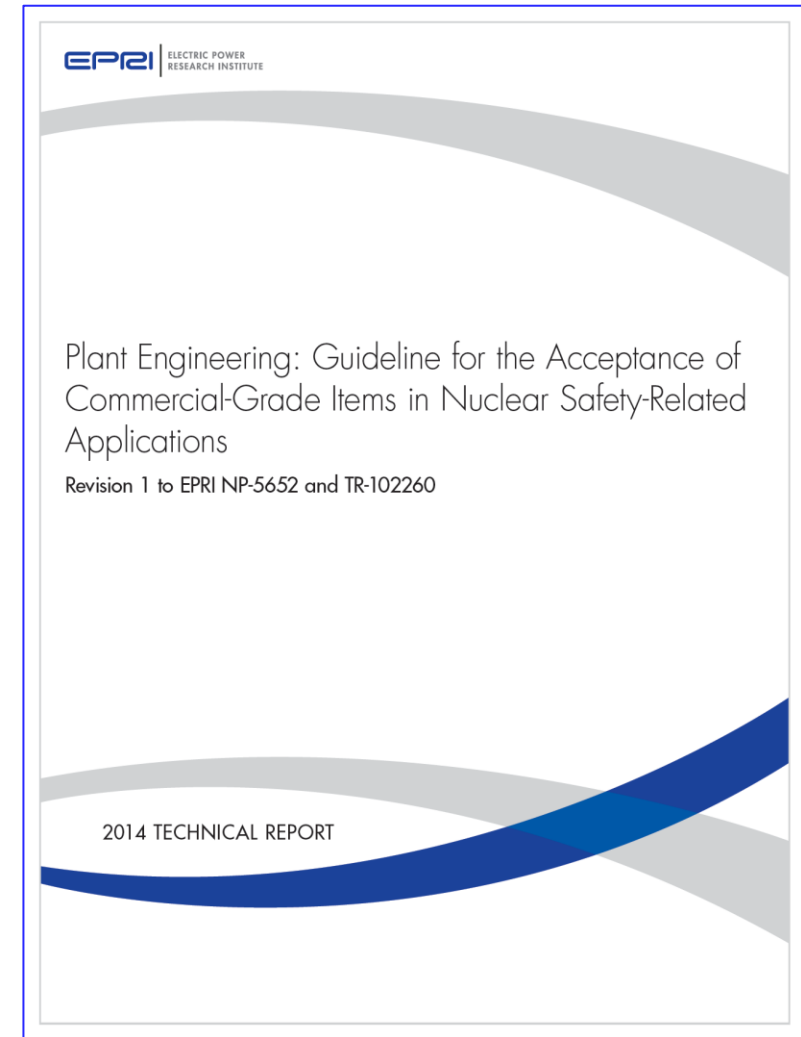
Terminology is an important foundation



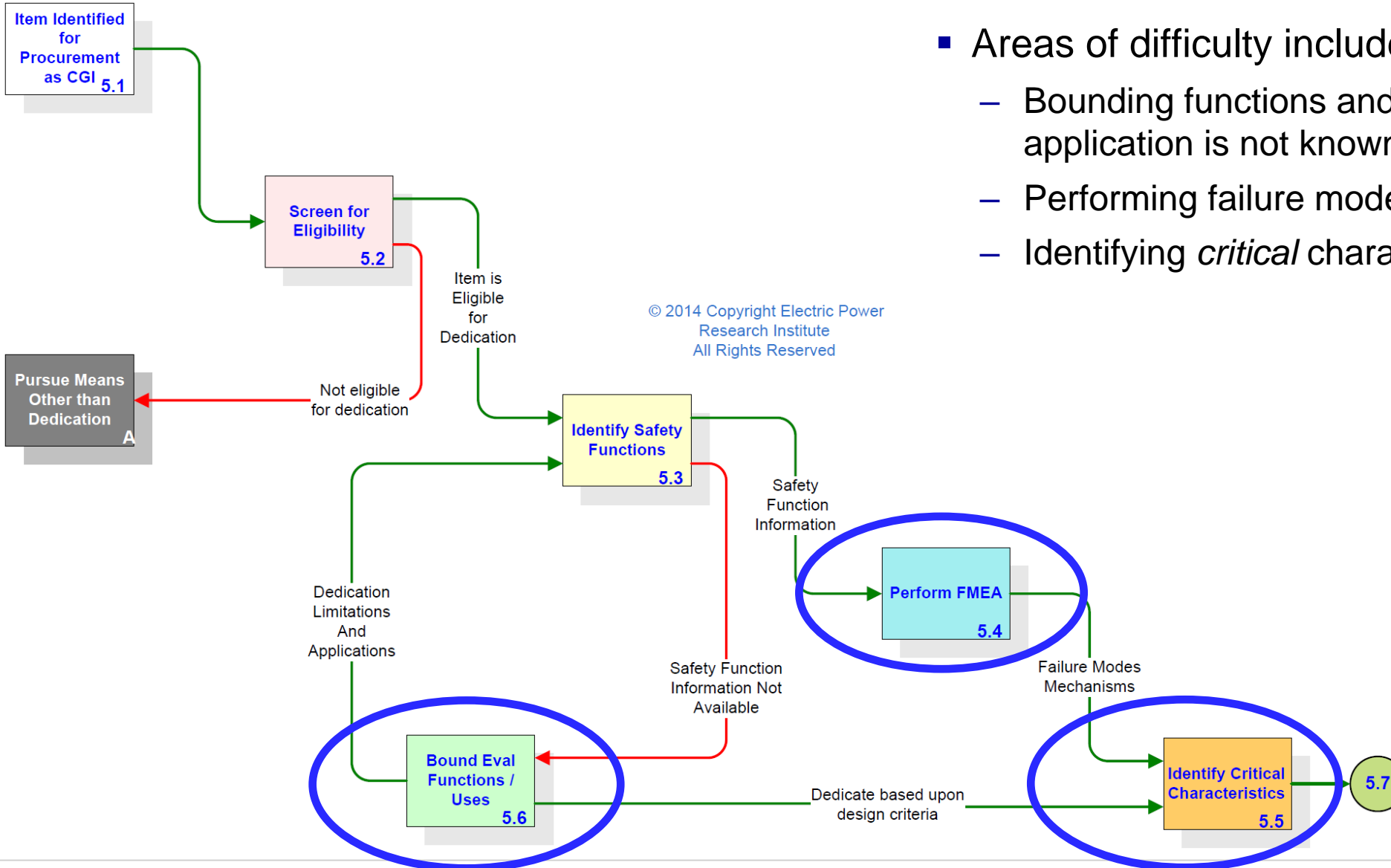
- (1) Design – Establish suitability of design including equipment *qualification* (seismic, radiation, EMI/RFI, chemical spray, etc.)
- (2) Supplier's quality controls – Determine the supplier's capabilities and role in ensuring items meet design requirements
- (3) Technical evaluation – Translate design and quality requirements into contract or purchase order requirements and ensure control of design.
- (4) Acceptance – Establish acceptance criteria and verify that items meet design requirements
- (5) Post acceptance / installation controls provide continued assurance the item can perform its intended function(s)
- (6) *Dedication* is an acceptance process – originally intended to address situations where acceptance criteria is unavailable (and is therefore determined based on function) Design & qualification must be complete prior to dedication.

Commercial Grade Dedication

- Methodology with origins linked to
 - Establishing when licensees became responsible for reporting defects and noncompliance
 - Counterfeit and fraudulent items
- Evolved into a method of accepting items not controlled under a “nuclear” QA program for use in safety-related applications
- [EPRI 3002002982](#) provides detailed guidance
 - Conditionally endorsed by [NRC RG 1.164](#)
- Recent increase in inquiries related to:
 - How to produce a basic component without dedication
 - How to implement quality controls (described in 10CFR50, Appendix B) without use of dedication
 - “Reasonable assurance” versus “absolute assurance”

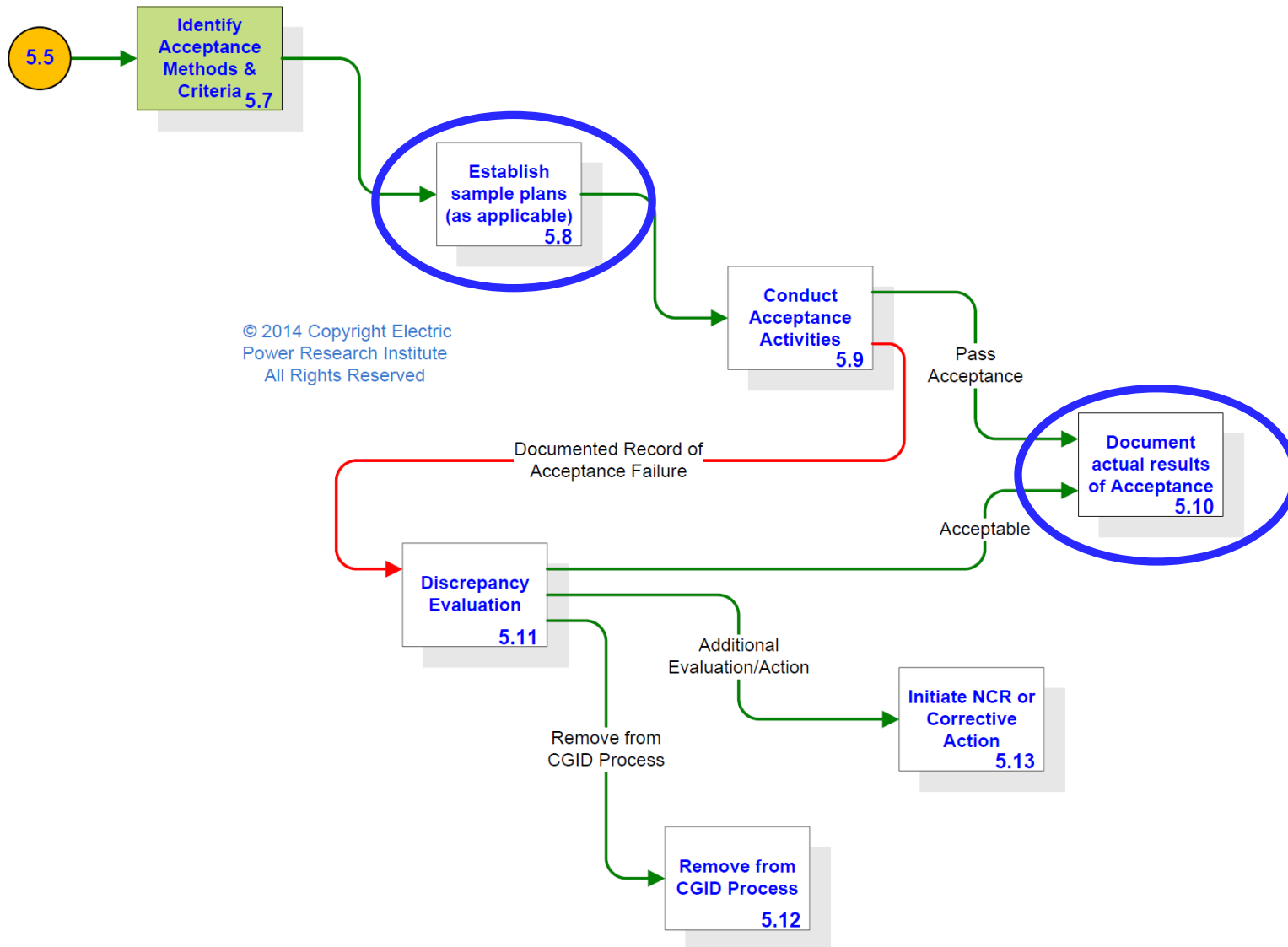


Commercial Grade Dedication



■ Areas of difficulty include:

- Bounding functions and uses when end-use application is not known
- Performing failure modes and effects analysis
- Identifying *critical* characteristics



- Areas of difficulty include:
 - Bounding functions and uses when end-use application is not known
 - Performing failure modes and effects analysis
 - Identifying *critical* characteristics
- EPRI has developed step-by-step course
 - Rolling out in 2019

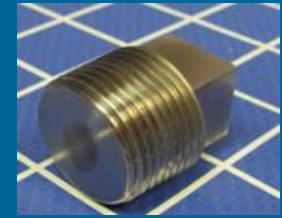
Reverse Engineering

- Important tool for addressing obsolescence
- Examine an existing specimen, review and analysis of information available about the item's design and its design functions to enable manufacturing or otherwise facilitate acquisition of the item
- Typically applied in situations where complete original design information is not available



Typical applications of reverse-engineering techniques

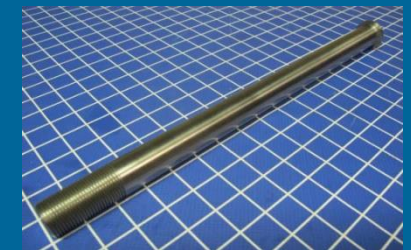
Purchasing an item with known attributes or design from a different supplier



Recover characteristic information for commercial grade dedication



Produce a functionally equivalent “part” (simple item)

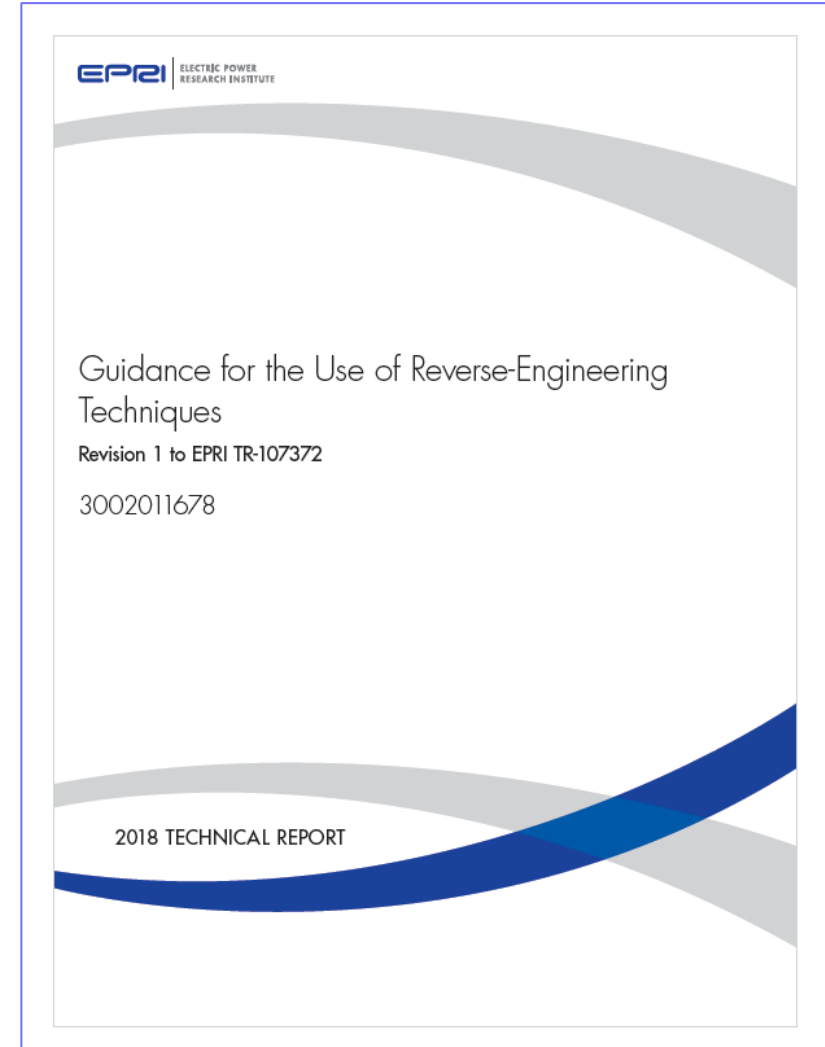


Produce a functionally equivalent “component” (complex item)

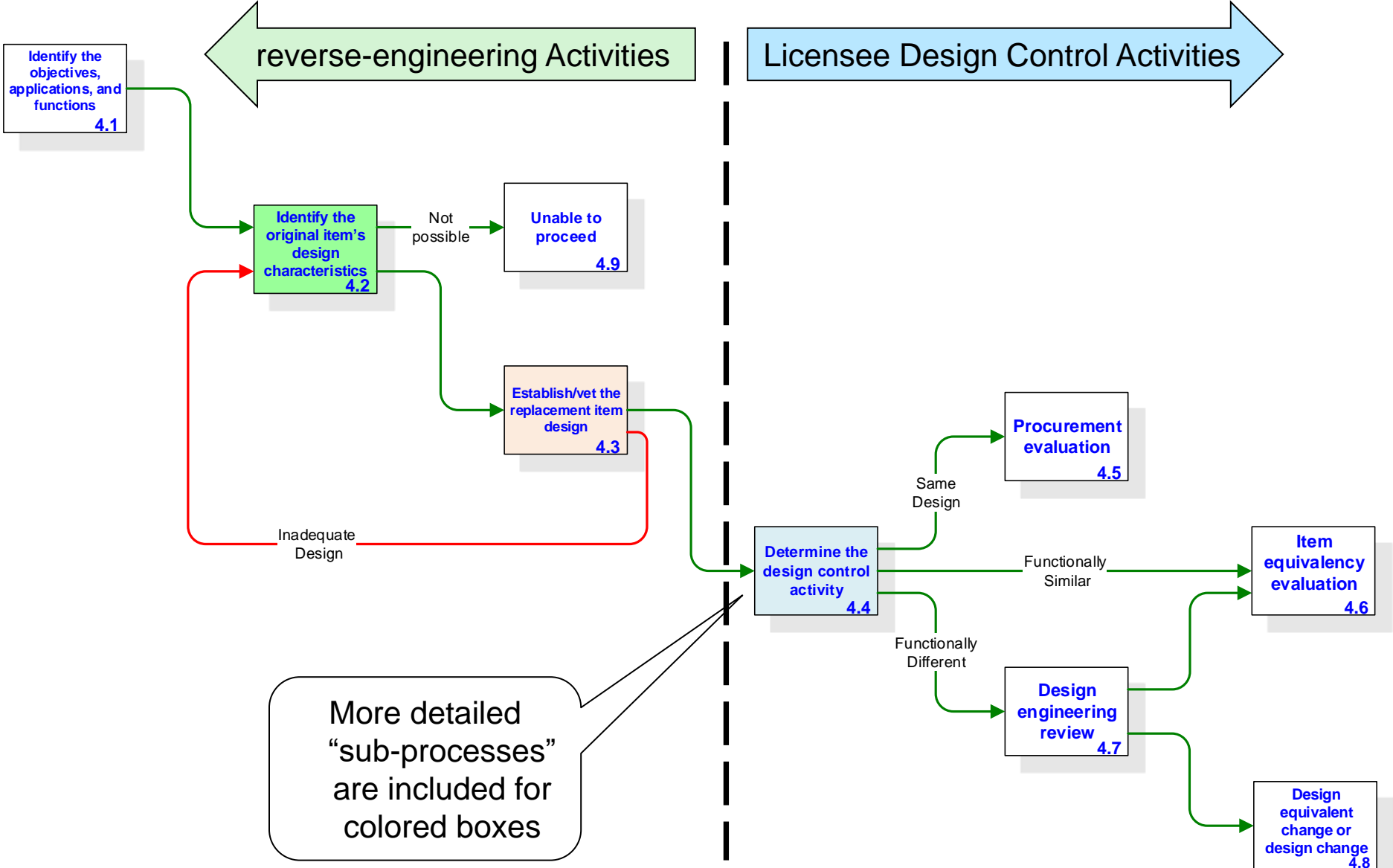


Significant Reverse Engineering Concepts

- Inherent risk
- Design control cannot be assumed
- Reverse-engineering involves:
 - Understanding of design functions
 - Understanding in situ conditions
 - Understanding interface requirements
 - Measures to ensure design is controlled
- Communication is critical
 - Licensee must provide appropriate information

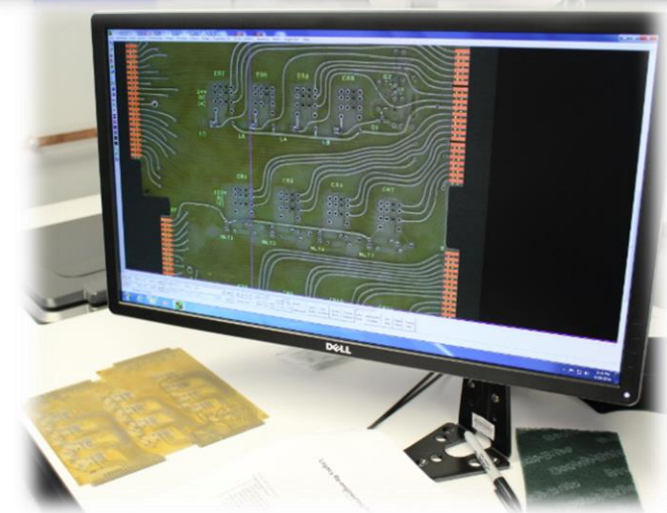


Basic process for applying of reverse-engineering techniques



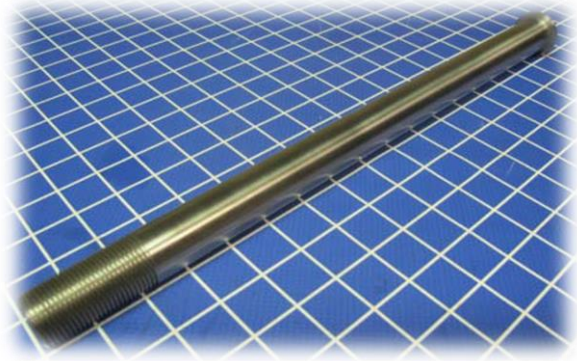
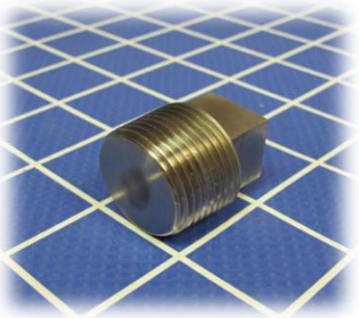
Advanced technologies

- Laser and structured light computer scanning
- X-ray computed tomography (CT) scanning
- X-Ray Fluorescence Spectrometer
- Electronic contact computer scanning
- Additive manufacturing (three-dimensional/3D printing)



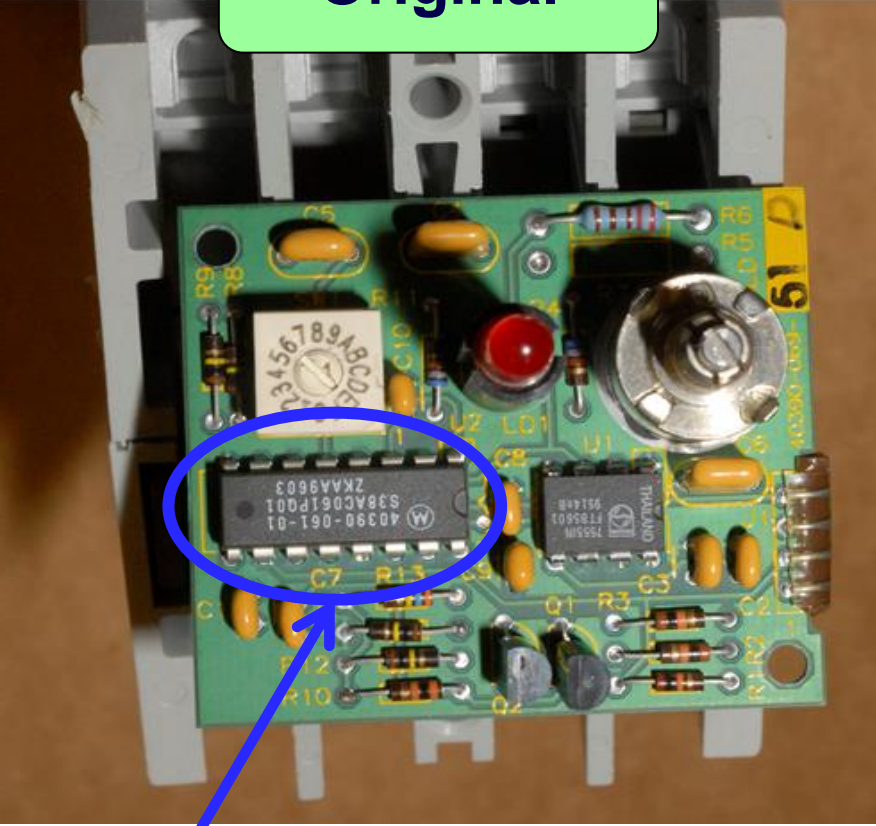
Examples

- Describe how each process step was addressed



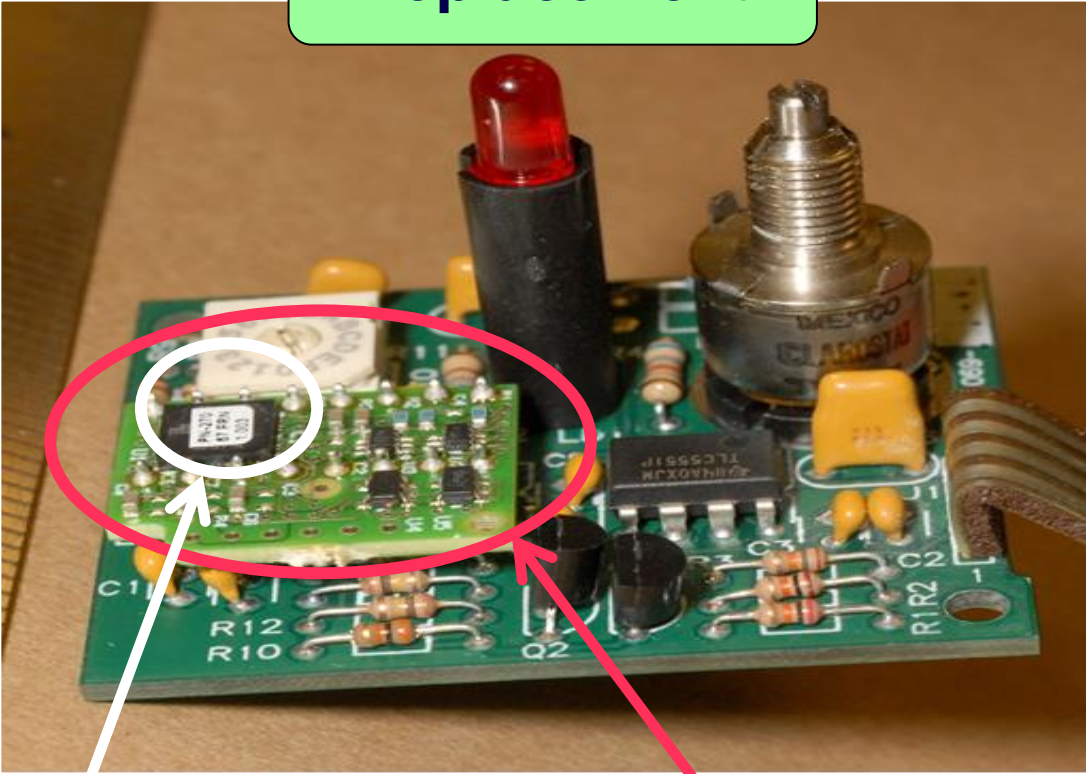
Emerging Issue - Undeclared Digital Content

Original



Non-programmable integrated circuit (i.e., no digital content)

Replacement



Complex Programmable Logic Device (CPLD), indicating *digital content*

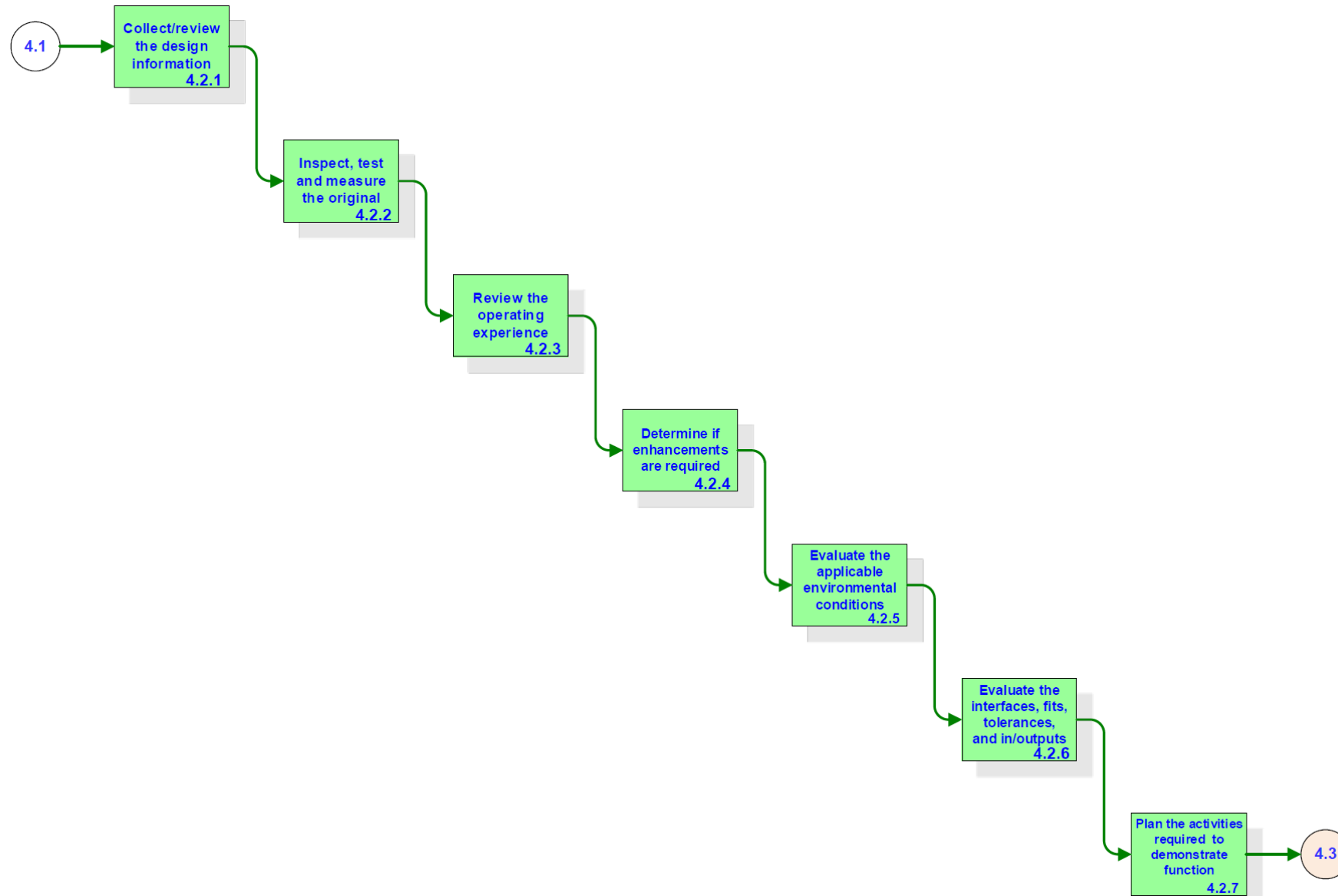
Mezzanine board in place of original integrated circuit



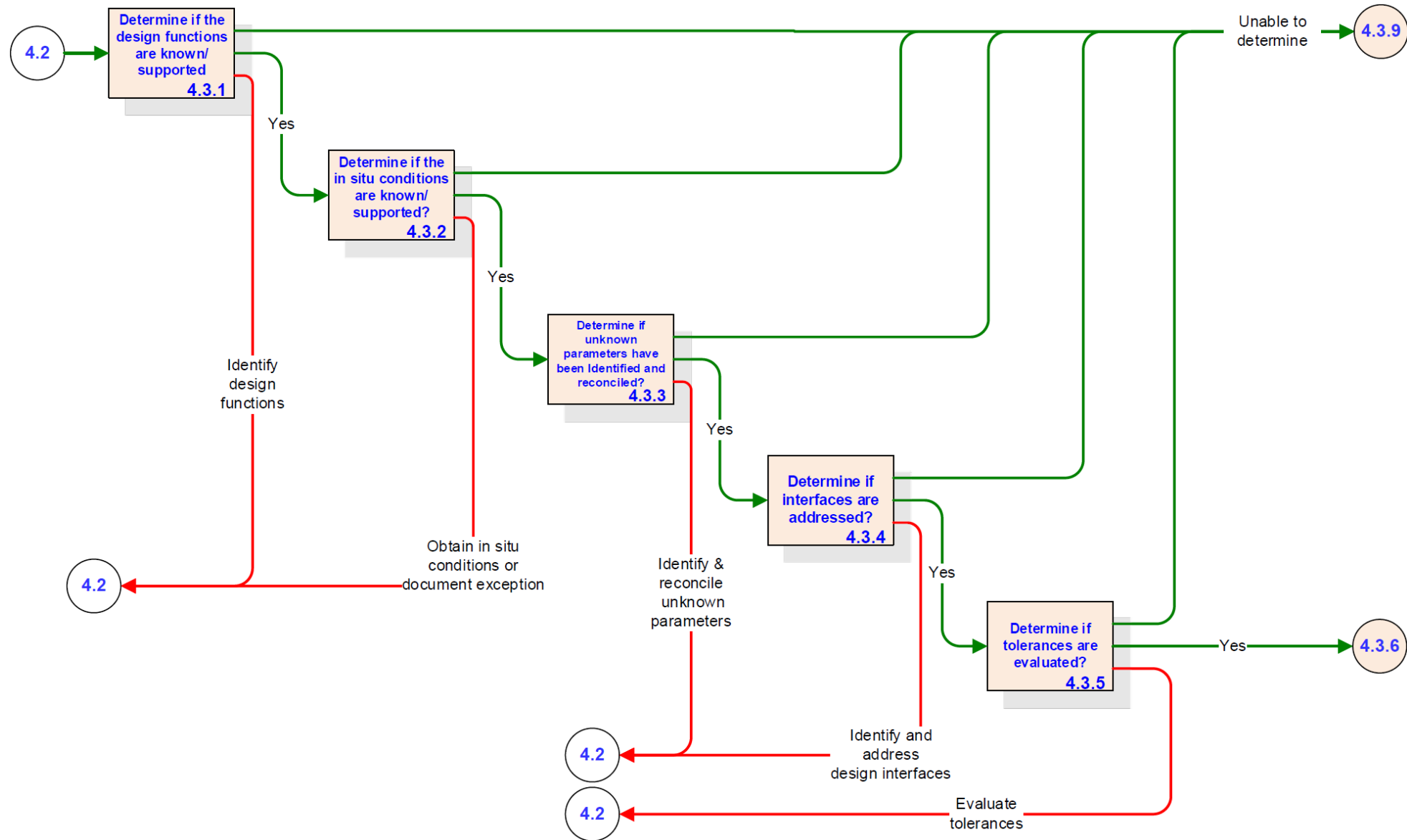
Together...Shaping the Future of Electricity

Information Slides

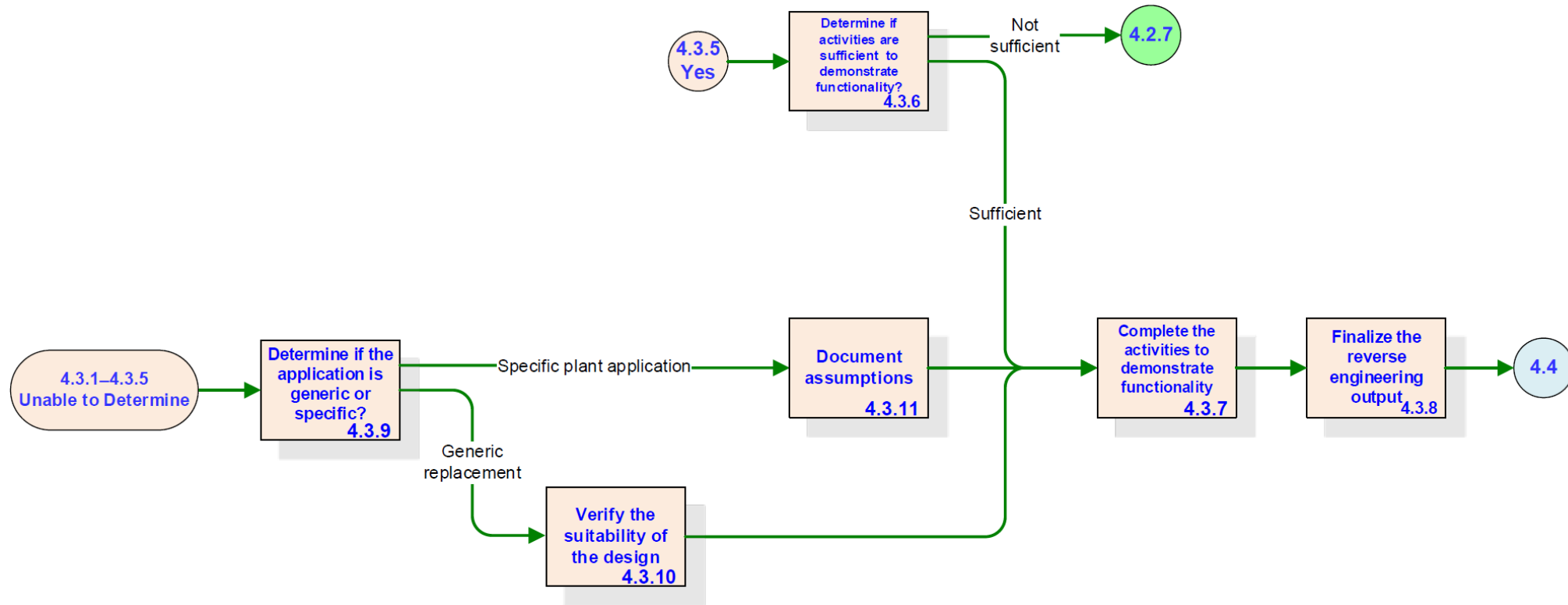
Sub-Process to Identify Item's Design Characteristics



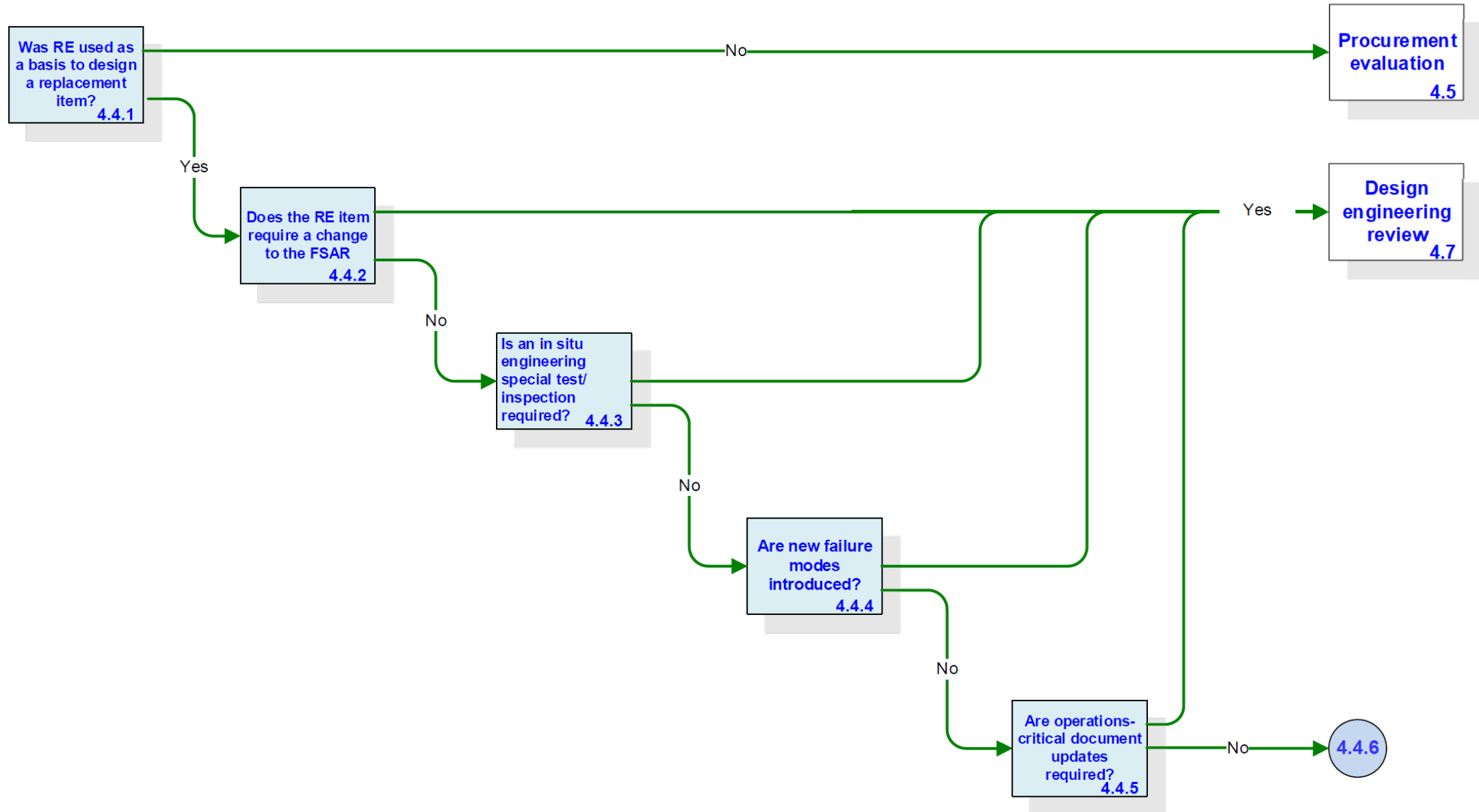
Sub-Process to Establish/Vet Replacement Item Design



Sub-Process to Establish/Vet Replacement Item Design



Sub-Process to Determine Design Control Activity



Sub-Process to Determine Design Control Activity

