EPRI Update

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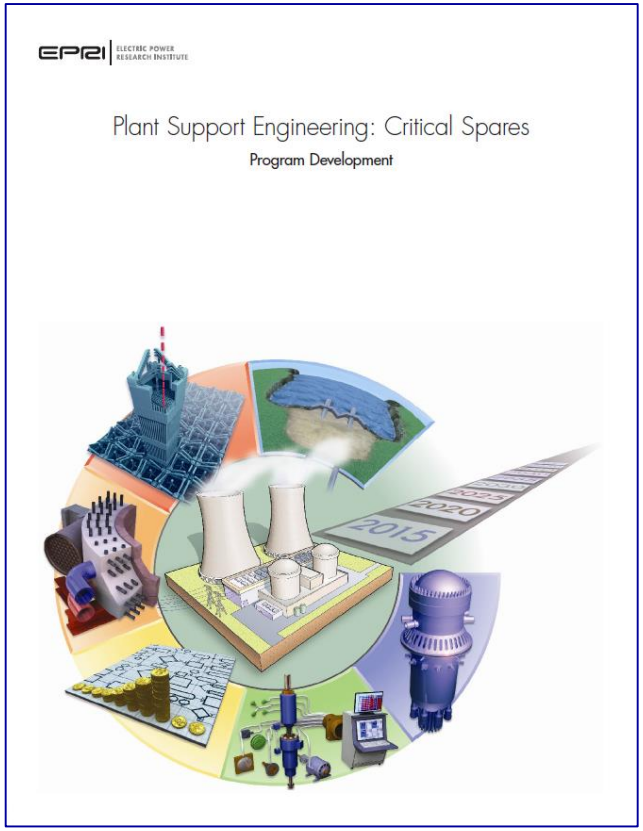
Critical Spares Project is building on 1019162

- Some sites have implemented critical spares programs
  - A few efforts are mature
- A 2015 survey showed the number of critical spares for 1 unit varied from 29 to almost 19,000
- Benchmarking to identify
  - Lessons learned
  - Challenges encountered during implementation
  - How scope of the program was established
  - How the process can be improved
- Guidance is being coordinated with INPOs Parts Quality and Availability work



Participants

- Dave Burdick, AEP
- Anne Edgely, APS
- Dave Metcalf, APS
- Franklin Fite, Duke Energy
- Greg Sponholtz, Energy Northwest
- Laura Farrell, Exelon
- Doug Kinsman, INPO
- Bob Leone, NextEra Energy
- George Shampy, Rolls-Royce
- Nick Zwiryk, Rolls-Royce
- Scott Stewart, Southern Nuclear

EPRI Critical Spares Implementation and Lessons Learned – Early Results

- Critical spares may be thought of as “insurance”
  - The amount of risk that is acceptable should be determined and accepted by the organization
  - Flexibility is required
    - EPRI 1019162 provided flexibility by adopting an early industry definition of critical spare that was subjective
  - Updated guidance *may* adopt the AP-913 definitions – *but, AP-913 definitions are being revised based on Nuclear Promise Component Cluster Team work*
    - Facilitates consistent “screening criteria” to identify critical spares
    - Flexibility will be found in how the critical spares program is applied
      - Review all identified critical spares
      - Determine which will be readily available (and the method for doing so)
      - Determine what activities will be implemented to assure the available critical spare will function as intended

EPRI Critical Spares Implementation and Lessons Learned – Early Results

- "Tiers"(priorities) for critical spares programs can be based on AP-913 definitions:
  - Single Point Vulnerability
  - Critical
  - Non-critical / Run to failure
- Two key aspects to the critical spares program
  - Ensuring availability of critical spares
  - Ensuring reliability of critical spares
- Boundaries and extent of program implementation is decided by executive / senior-level management
  - Tiers included
  - Measures to ensure availability and reliability

EPRI Critical Spares Implementation and Lessons Learned – Early Results

- Process enhancements
- Availability Options
  - Maintain items in inventory
  - Available within 24 hours
  - Pooled/shared inventory
  - - Vendor stocking
  - - Supplier managed inventory
- Reliability Options (Ensure the spare will function)
  - Enhanced testing prior to acceptance
  - Source verification / oversight
  - Enhanced purchase specifications
  - - Enhanced design/purchase spec's
  - - Trending failures / causal analysis
- Regular Activities
  - Storage
  - In-storage maintenance
  - Bench-testing prior to installation
  - Control Issue and use (only critical applications)

EPRI Critical Spares Implementation and Lessons Learned – Early Results

- Critical spares may include
  - Component-level items
  - Part-level items
  - Consumables
- There are instances where a “screened-in” critical spare might not be considered a critical spare . . .
  - When it is a part and the component is stocked as a critical spare
    - Basis should be documented
- Once selected as a critical spare:
  - Decide if making it available is the right thing to do
  - Document the decision, and if applicable,
  - Put a plan in place for making the spare readily available
    - Track implementation of the plan

What is a critical spare?

Critical spare – A spare large asset, component, or piece part that when installed supports an important function and failure would result in a critical component failure as defined in AP-913. See Appendix A for AP-913 excerpts and critical component criteria.

or

A spare large asset, component, or piece part needed to return critical components, as defined in AP-913, to service following anticipated wear or aging. See Appendix A for AP-913 excerpts and critical component criteria.

Three-tiered approach to Critical Spares (Draft)

Tier 1 - Single Point Vulnerability Spares

- Spares are considered Tier 1 – Single Point Vulnerabilities if an in-service failure of the asset, component, or piece part directly results in a reactor or turbine trip.

Tier 2 – Critical Spares

- Unplanned power reduction
  - reactor or turbine trip/scram
  - unplanned manual shutdown
  - unplanned power reduction > 5%
  - significant power transient > 10%,
- Unplanned shutdown LCO < 72 hours
- Loss of a critical safety function:
  - core, RCS, or SFP heat removal
  - RCS inventory or pressure control
  - containment isolation, temperature, pressure
  - reactivity control
  - vital AC electrical power
- ESFAS actuation:
  - Equipment failure that directly results in an unplanned actuation of the engineered safety features actuation system (that results in or should have resulted in flow into RCS or a containment isolation signal).
- Maintenance Rule functional failure (high-safety-significant or risk-significant ONLY)
- Reactor/turbine half scram (BWR) or partial trip (PWR) [partial trip/half scram coincidence made up]
- MSPI monitored component failure

Three-tiered approach to Critical Spares (Draft)

Tier 3 - Noncritical Component

- Unplanned power reductions > 2% and up to 5% OR power transients > 2% up to 10%
- Maintenance Rule functional failure of a non-risk-significant function
- unplanned shutdown LCO > 72 hours
- loss of a 100% redundant feature which increases nuclear safety or generation risk
- regulatory (for example, license renewal, insurance noncompliance, NERC,
- FERC, fire protection)
- determined to be more cost effective to maintain than to allow failure
- emergency preparedness equipment
- emergency response equipment
- refueling equipment

Tier 3 - Run-to-Maintenance Component

- Those components that do not fall into one of categories above. A run-to-maintenance component is one for which the risks and consequences of failure are acceptable without any predictive or repetitive maintenance being performed and there is not a simple, cost effective method to extend the useful life of the component. The component should be run until corrective maintenance is required

Very preliminary "Best Practices" from a work in process

Tier 1 - Single Point Vulnerability Spares

- Develop purchasing specifications with adequate detail to describe important performance characteristics and associated design/operating margins availability
- Enhanced procurement/ refurbishment process including oversight of manufacturing activities when appropriate.
- Perform enhanced receipt inspections that provide assurance the spare can perform it's critical function.
- Ensure age-related degradation is managed through controls such as shelf life program or PM's
- Ensure storage and handling requirements are in accordance with applicable standards and guidance (ANSI, NQA-1, EPRI, etc.)
- Perform detailed part failure cause investigations following failures
- Stocking strategy – In stock or readily available

Tier 2 – Critical Spares

- Develop purchasing specifications with adequate detail to describe important performance characteristics.
- **Consider** enhanced procurement/ refurbishment process including source inspections.
- **Consider** pre-receipt test – prove critical function/ indication of service life.
- Perform enhanced receipt inspections that are more thorough than commercial procurements.
- Ensure age related degradation is managed through either a shelf life program or PM's
- Ensure storage and handling requirements are in accordance with ANSI/EPRI standards
- Perform detailed part failure cause investigations following failures
- Stocking strategy – In stock or readily available
- Included in availability performance indicators

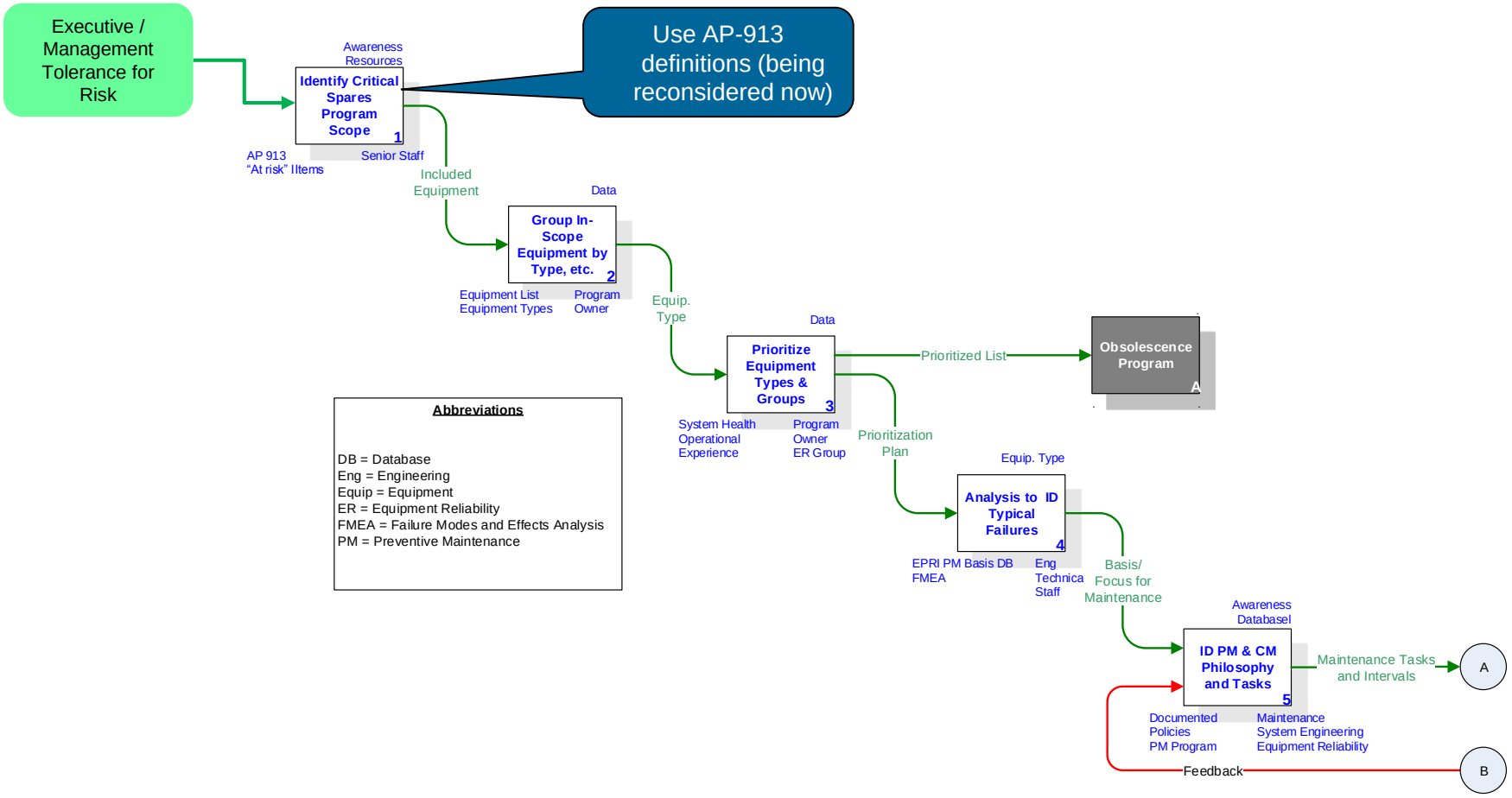
Very Preliminary “Best Practices”

Tier 3 - Noncritical Spares and Run-to-Maintenance Spares

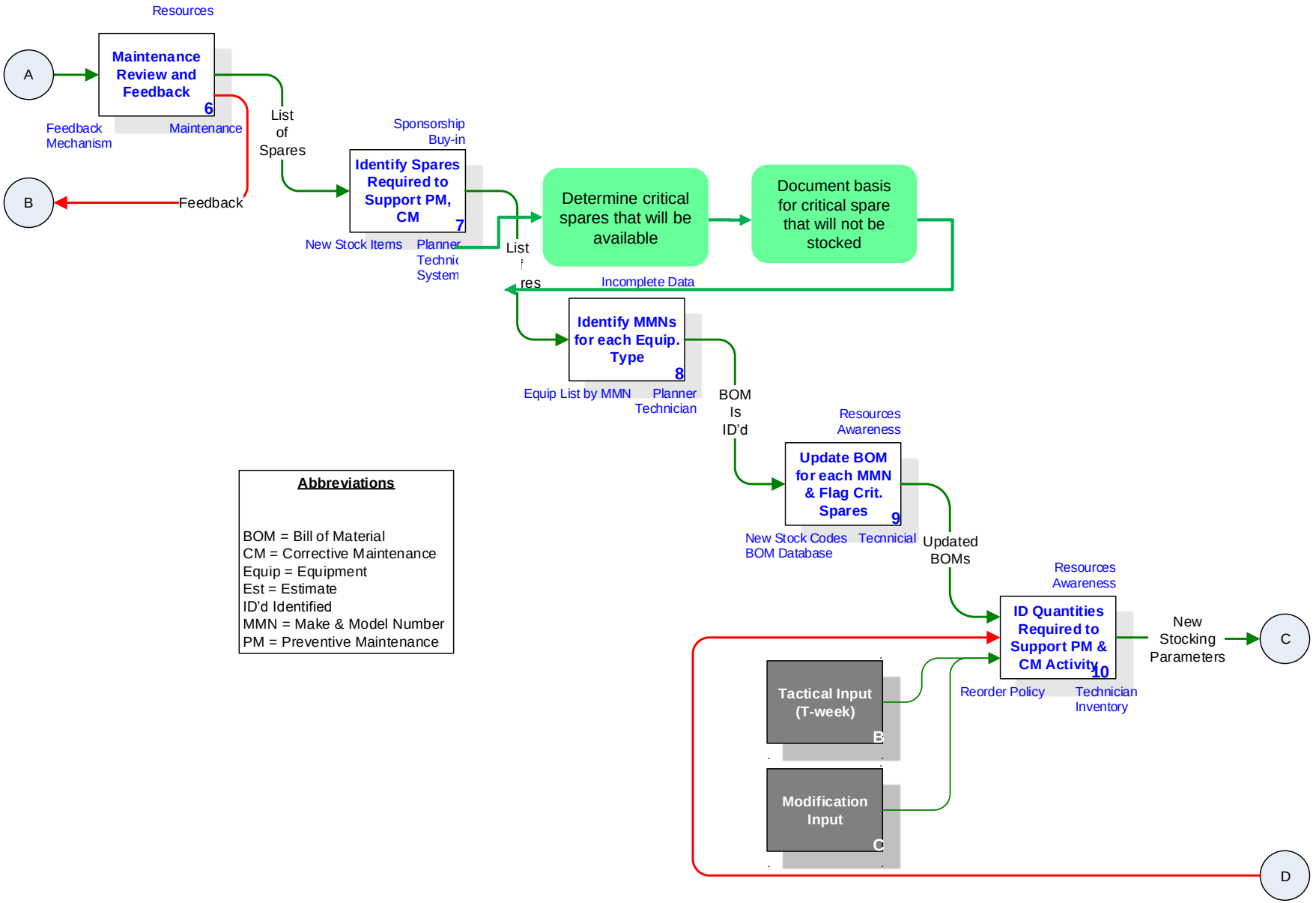
For these Tier 3 parts the following actions are recommended to enhance part quality and availability:

- Age related degradation managed – Shelf life or PMs
- Standard Purchasing Specification
- Commercial Receipt or SR receipt
- Stocking Strategy –Work Management need
- Failure Investigation – Condition Report

Tweaking the Critical Spares Process



Tweaking the Critical Spares Process



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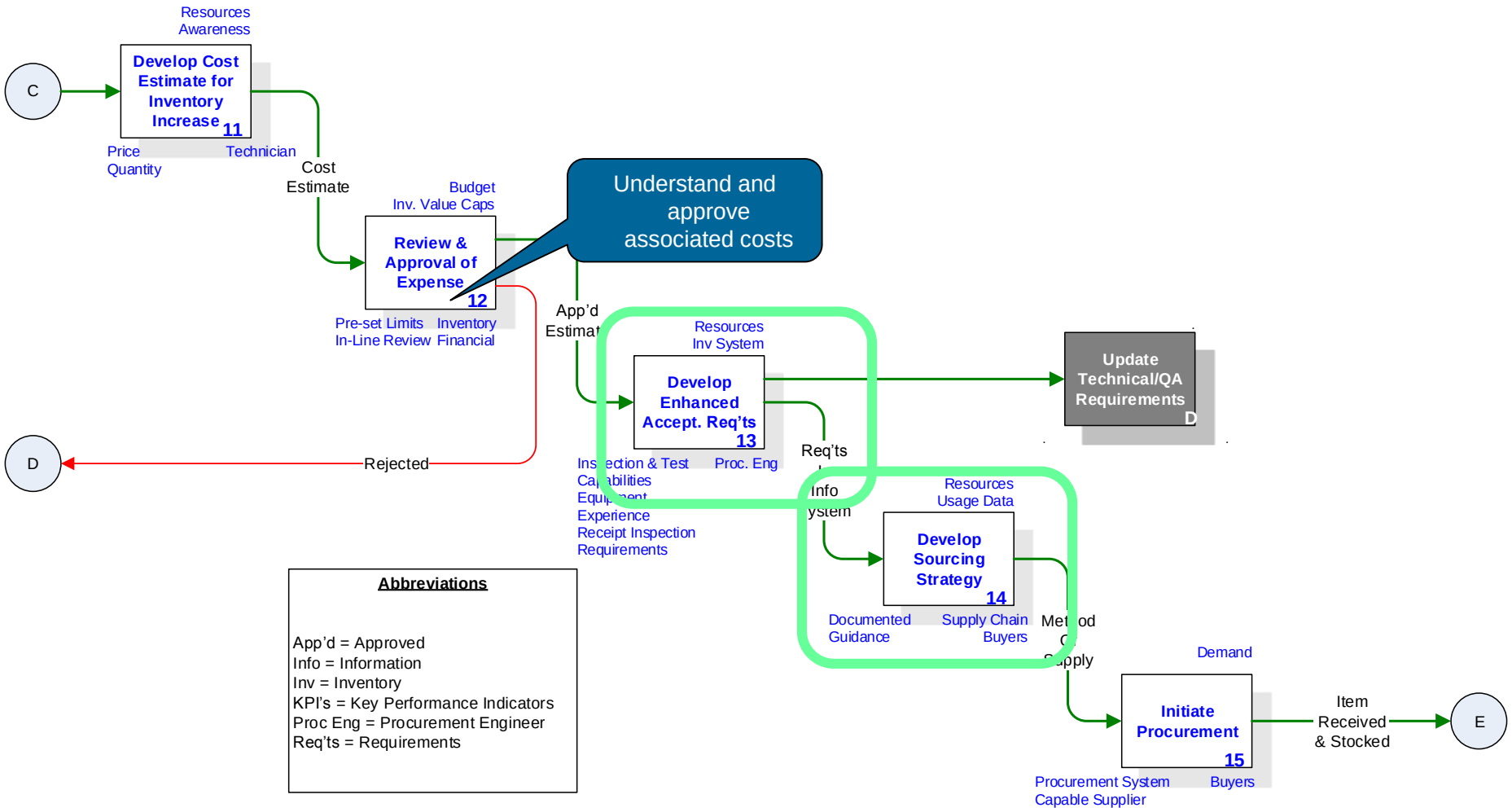

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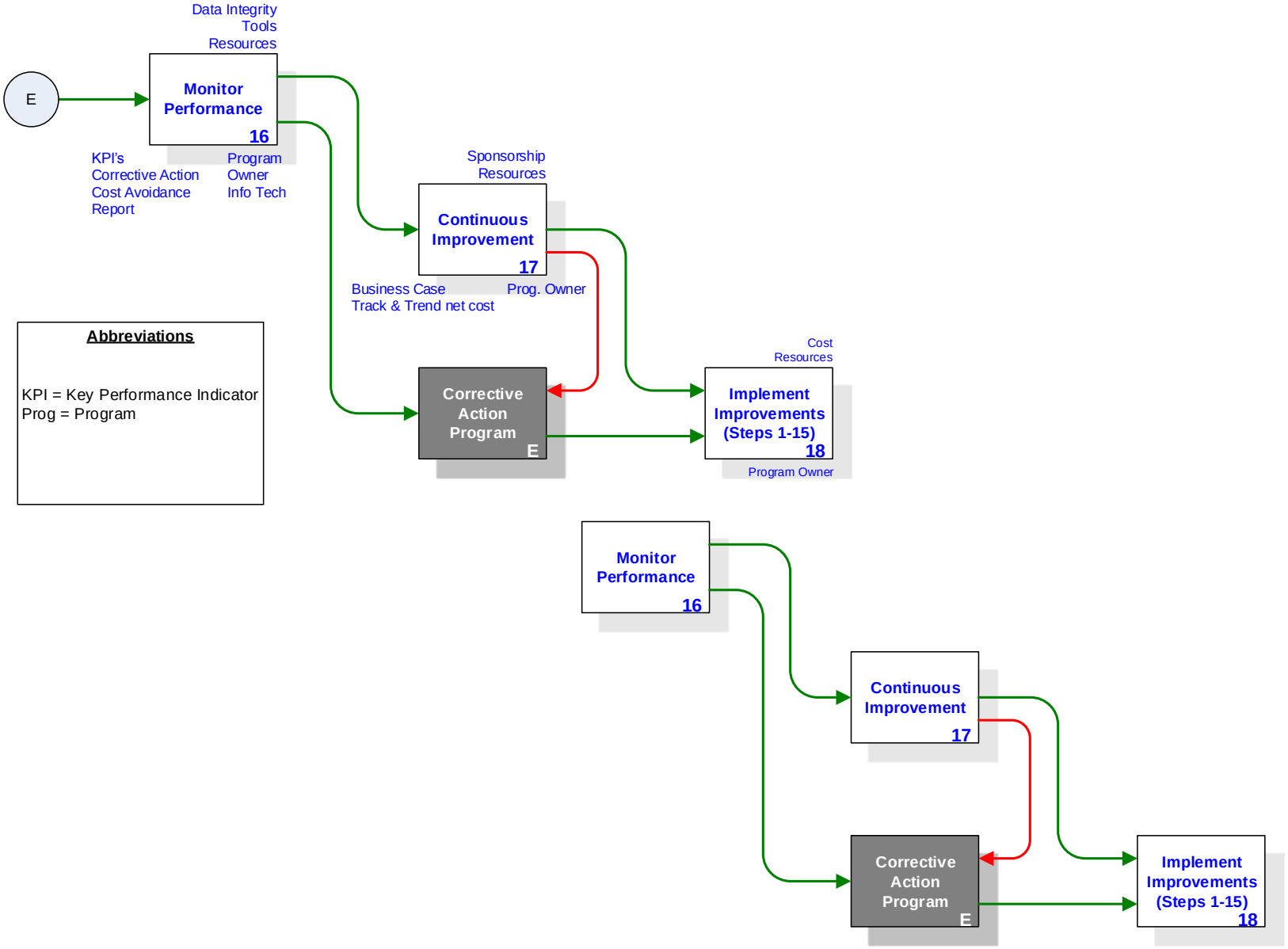
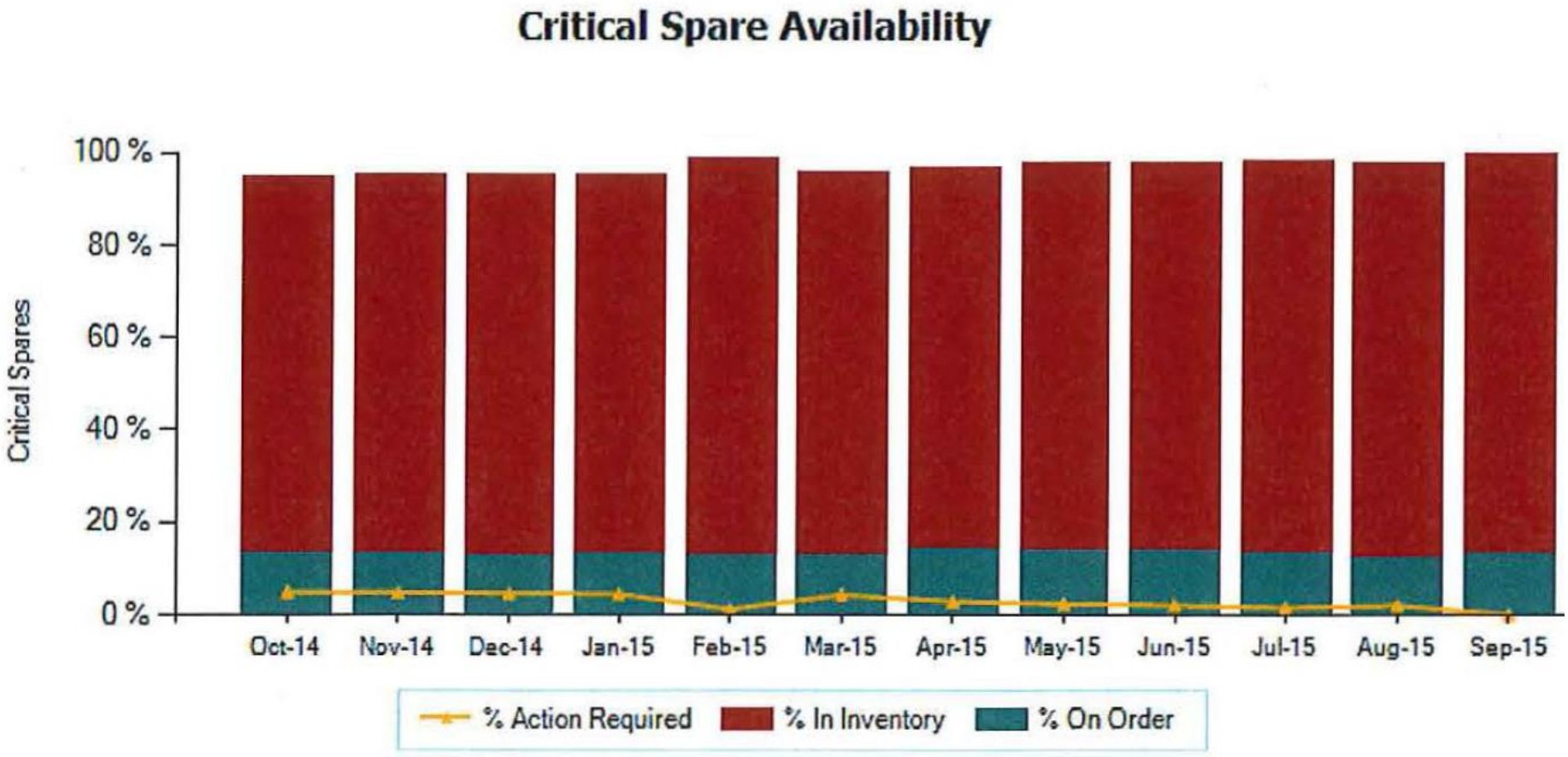


Diablo Canyon Critical Spares Metrics



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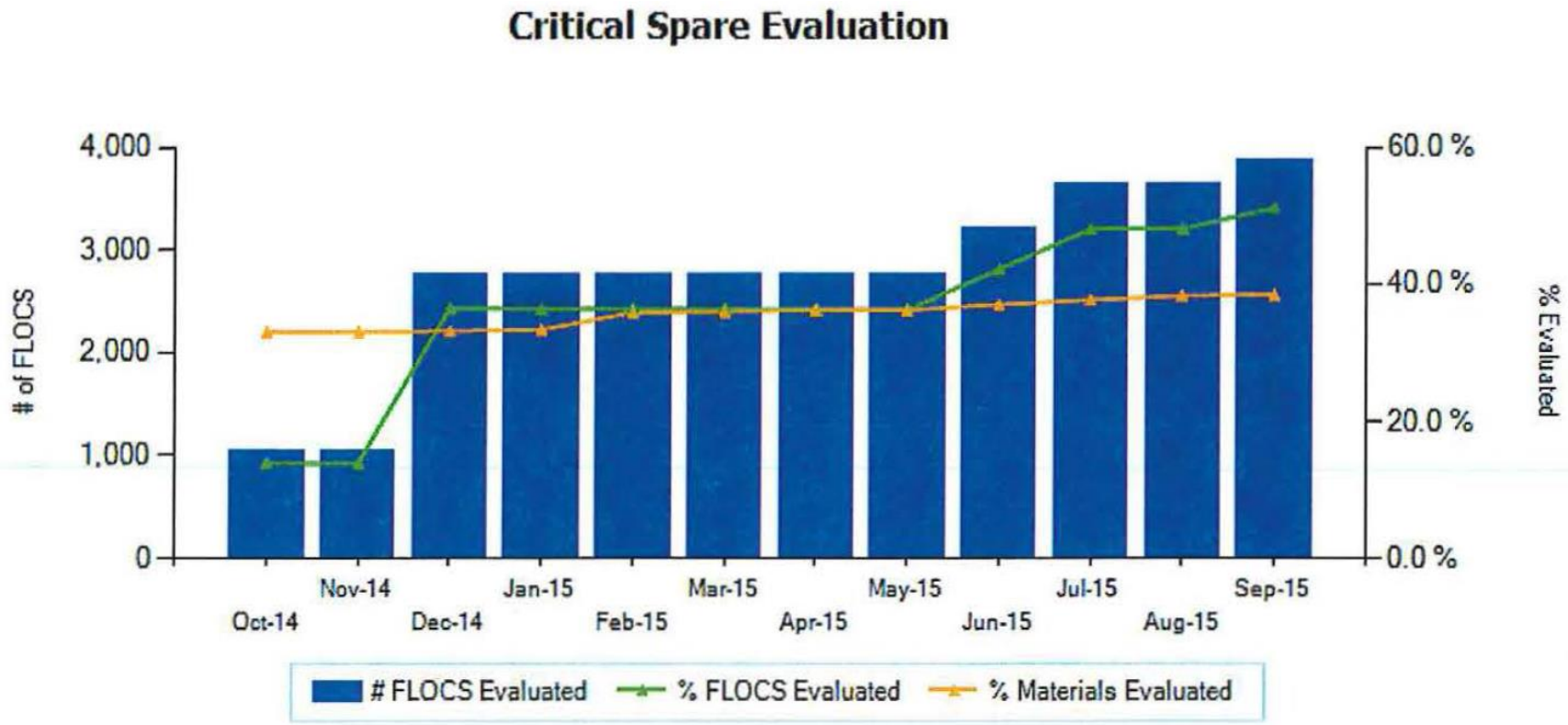

FLOCS = Functional Location of Critical Spare / Equipment ID

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