FLUKE®
Reliability

Data Collection Do's and Don'ts

Best Practices Webinar Series

Meet the Speaker

Blake A. Baca, CMRP, CRL

Owner/Asset Management Coach, BDB Solutions LLC

- Asset Management professional with over 35 years of experience in industry including mining, refining, refining, smelting, oil & gas, power generation, foundry, manufacturing, and material processing.
- Worked for Alcoa, Inc. for the first 20 years of career.
- Finished up Alcoa career as the Maintenance and Engineering Manager at Alcoa Rockdale Operations in Rockdale, Texas as the facility was shut down due to business conditions in December 2008.
- Asset Management Consultant since 2009.
- Bachelor of Science in Mechanical Engineering degree from Texas Tech University.
- Certified Maintenance and Reliability Professional (CMRP) and a Certified Reliability Leader (CRL).
- Served as Maintenance Manager for Barrick Gold Corporation (Goldstrike and Cortez Hills Mines) in Elko, Nevada from 2017-2019.

POLL QUESTION

Why are we here?

- Provide an understanding of the purpose of Data Collection and what it will support
- Provide for attendees what is required for good Data Collection vs. Bad Data Collection
  - Do’s and Don’t’s

Asset Management

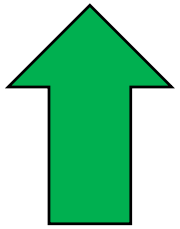
Asset Management

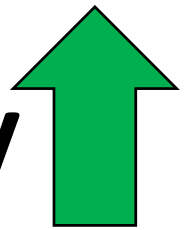
Per ISO 55000, the Institute for Asset Management definition:

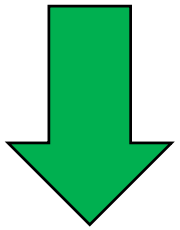
- “coordinated activity of an organization to realize value from assets.”
- “An asset is an item, thing, or entity that has potential or actual value to an organization.”

Simply put, Asset Management is a systematic process of deploying, maintaining, upgrading, and disposing of assets cost-effectively

Why Asset Management?

Reliability 

Availability 

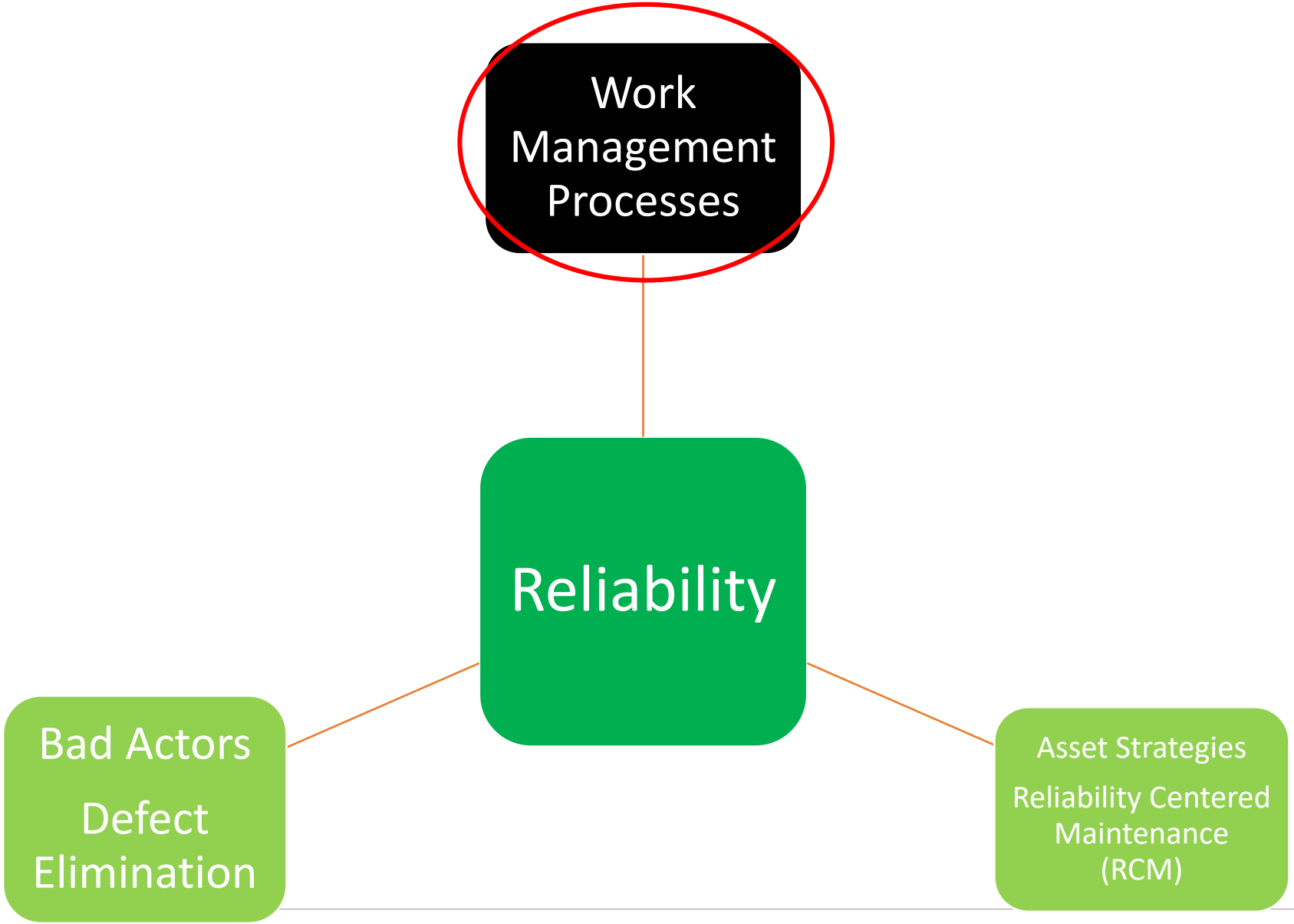
$$/unit 

FLUKE® Reliability

Asset Management Foundation

- In order to have Reliability, what is the foundation?
  - Equipment Register
    - Master Equipment List (MEL)
    - Equipment Hierarchy
    - Master Data

Asset Management



Work Management Process – What is it?

- Reliability - Identifying and Eliminating the Defects that result in failures, *costs, and reduction in availability*
  - If we're unable to eliminate the defects, we must detect, plan, schedule, execute, and mitigate consequence, *costs, thus improving availability*

Work Management

Work Management Philosophy

- Charge ***ALL*** labor and materials to the proper work order
  - Why?

- Each work order should be written or mapped to the proper asset and the proper level in the hierarchy
  - Why?

Work Management Goals and Expectations

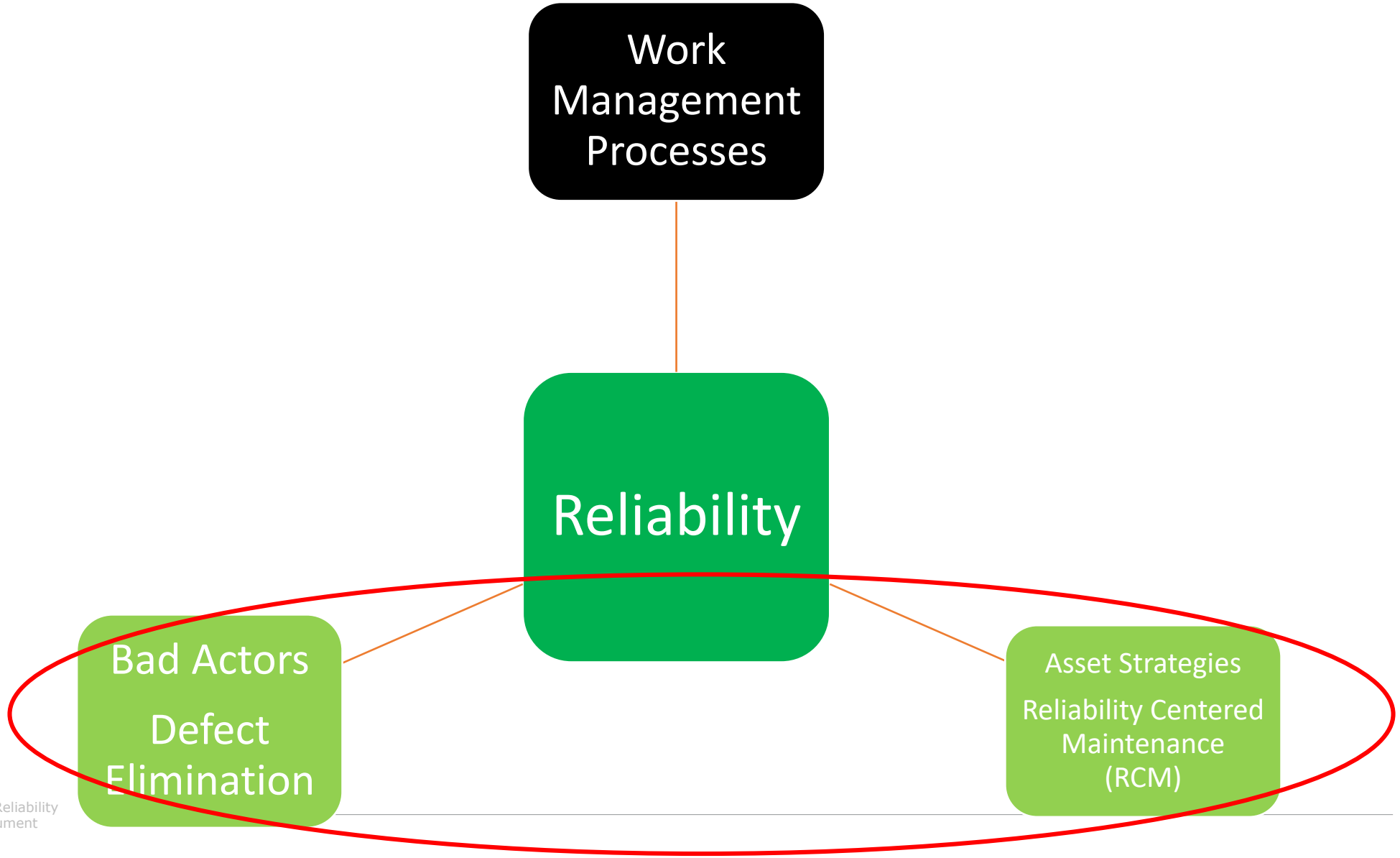
- Leadership and Operations must have confidence in Maintenance execution to see the ***value*** in the investment of the Work Management versus the ***cost*** of the Work Management

- Maintenance must provide efficient, effective, and quality work to:
  - Allow for efficient execution of the schedule to reduce scheduled down duration to improve availability
  - Eliminate or substantially postpone failures
  - Increase the Mean Time Between Failures (MTBF) or Failure Free Period
  - Eliminate or reduce rework

Zero Injuries

100% Availability

Asset Management



Requirements for Asset Management = Reliability Engineering

- Reliability Engineering
  - Application of appropriate Reliability Methodologies (Criticality, RCFA, FMEA, RCM, RAM, etc.)
  - Application of effective Condition Based/Predictive/Proactive Maintenance Tactics
  - **Reliability (Eliminating Failures) focus**

What is a failure?

Root Cause Failure Analysis (RCFA)

A failure is an unwanted event

Reliability Centered Maintenance (RCM)

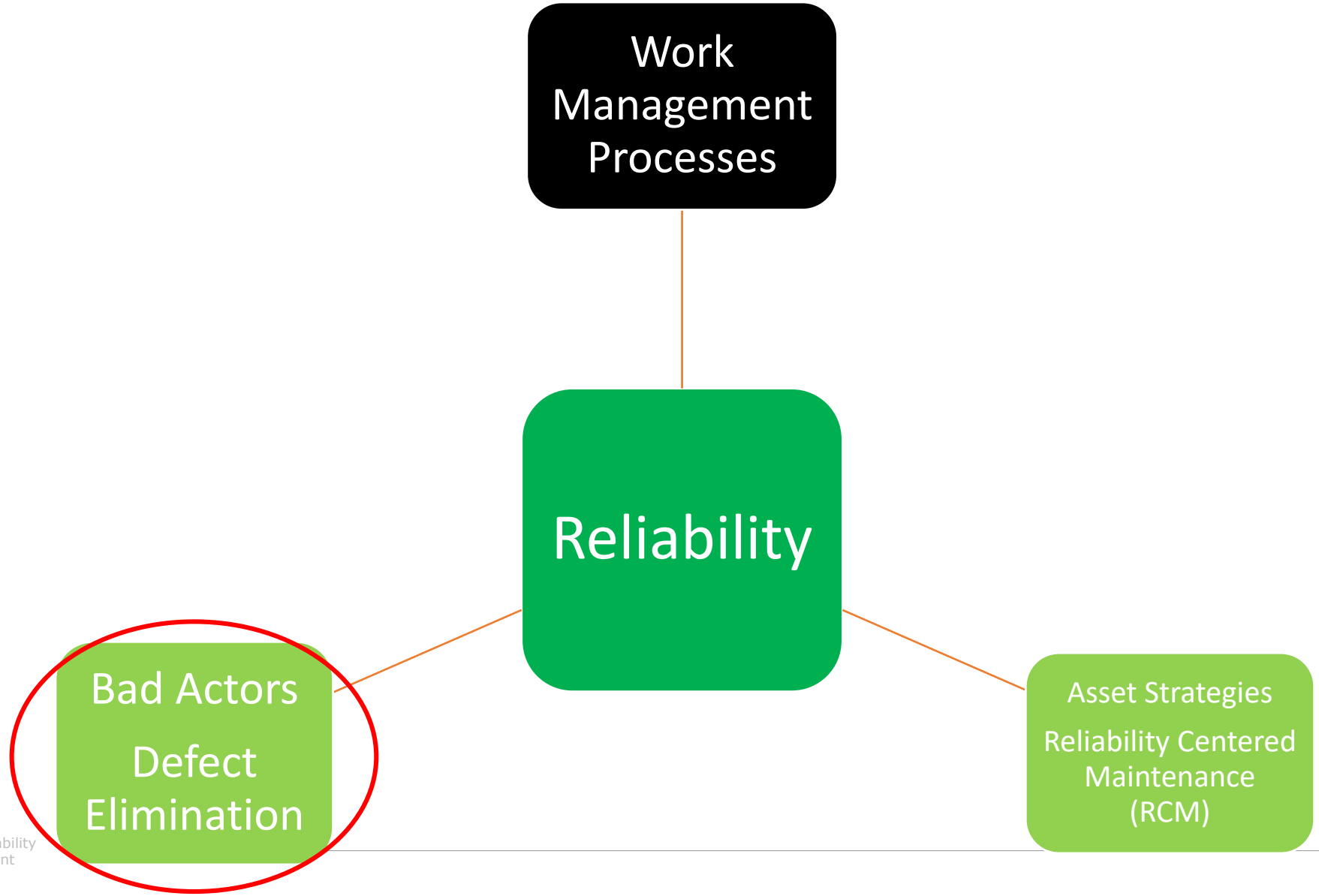
A failure is the inability of an asset to perform user's expectations

What is a failure?

Root Cause Failure Analysis (RCFA)

A failure is an unwanted event

Asset Management



Recognizing Interdependence – The Philosophy

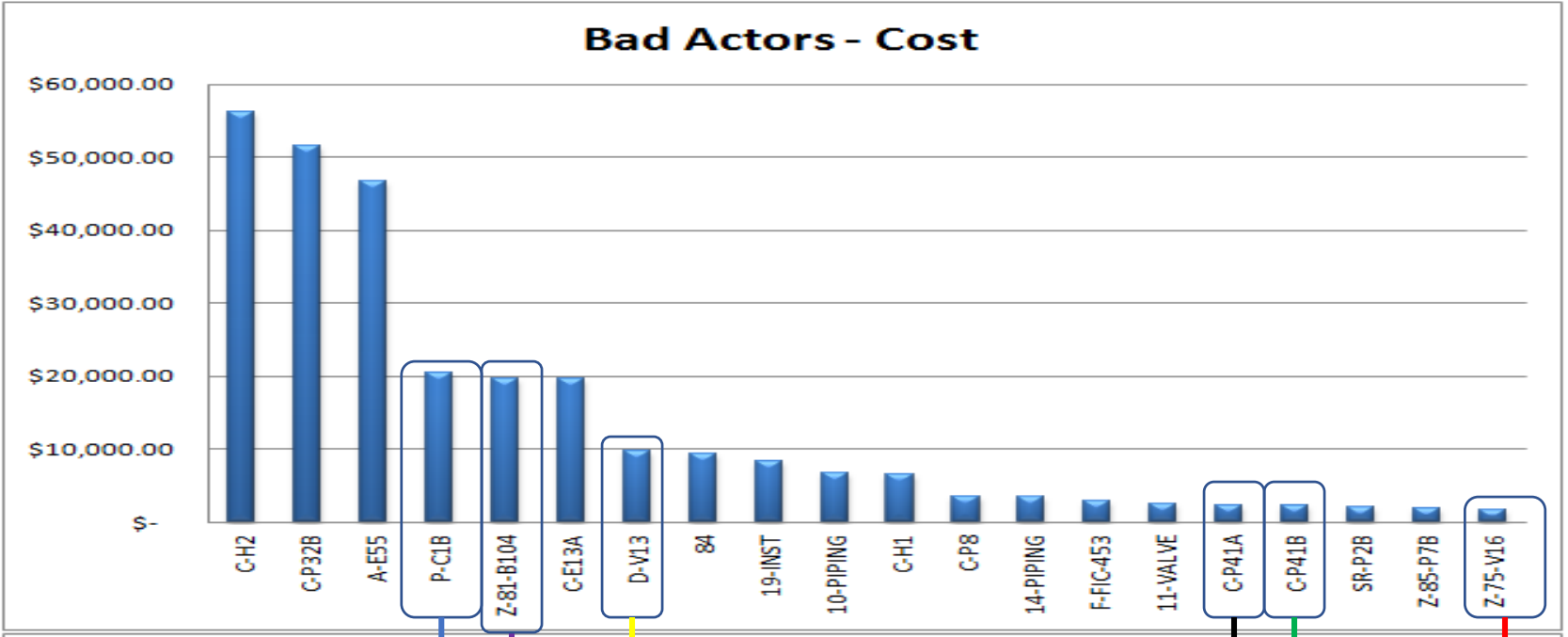
Bad Actors/Defect Elimination

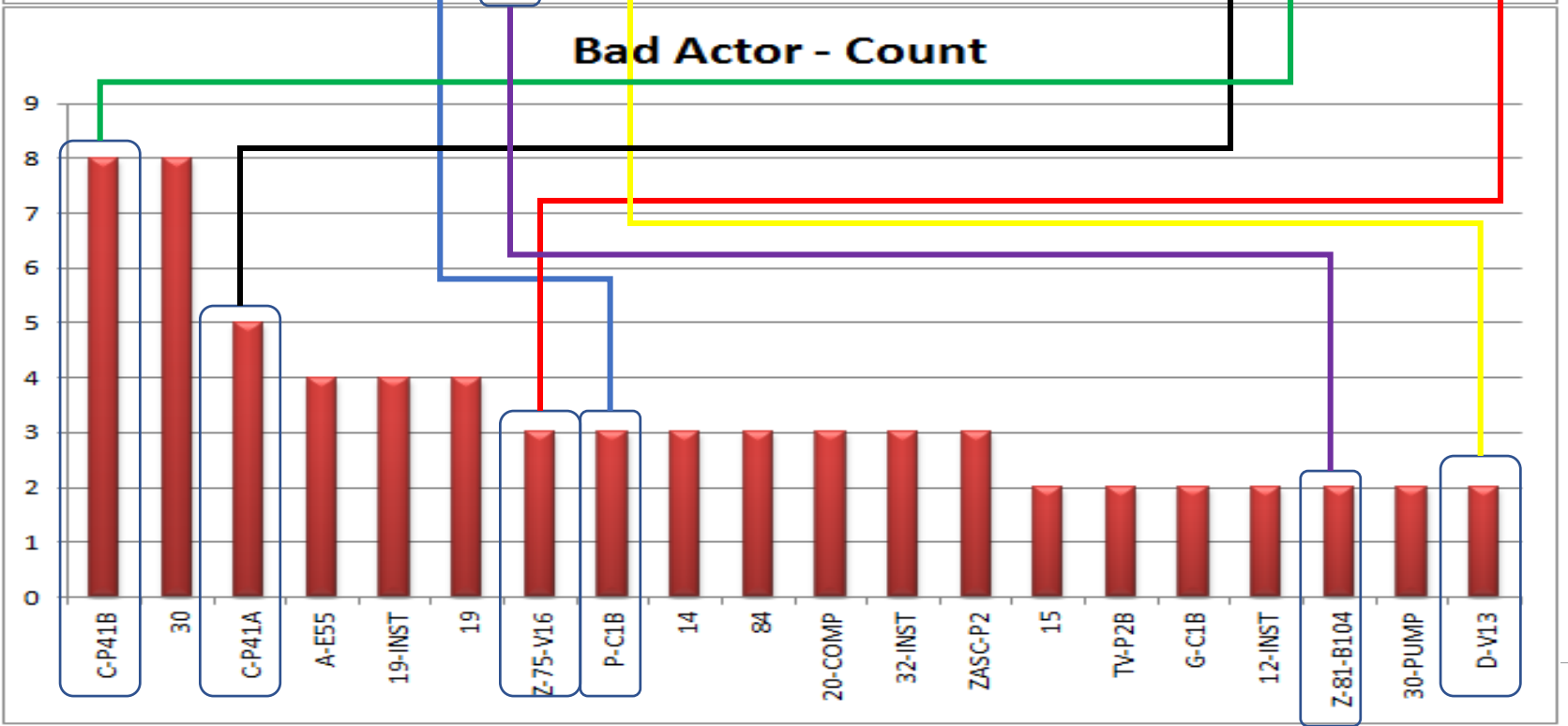
- Through the Work Management Process, are you capturing the frequency and associated **cost** (labor and materials) in the CMMS associated Urgent/Immediate Break-in work orders?
  - Is pareto analysis available?

- Does a process exist with roles and responsibilities to formally and periodically review the pareto of high frequency and high **cost** failures associated with those Urgent/Immediate Break-in work orders **with Leadership?**

- Do reliability engineers exist who are **focused** on the elimination of failures?
  - Are they trained in formalized Root Cause Failure Analysis (RCFA)?

- Is the **cost** associated with those failures or the impact to cash flow from lost production understood?
  - Corrective actions can result in improved asset strategies and reduced labor and materials associated with Work Management.

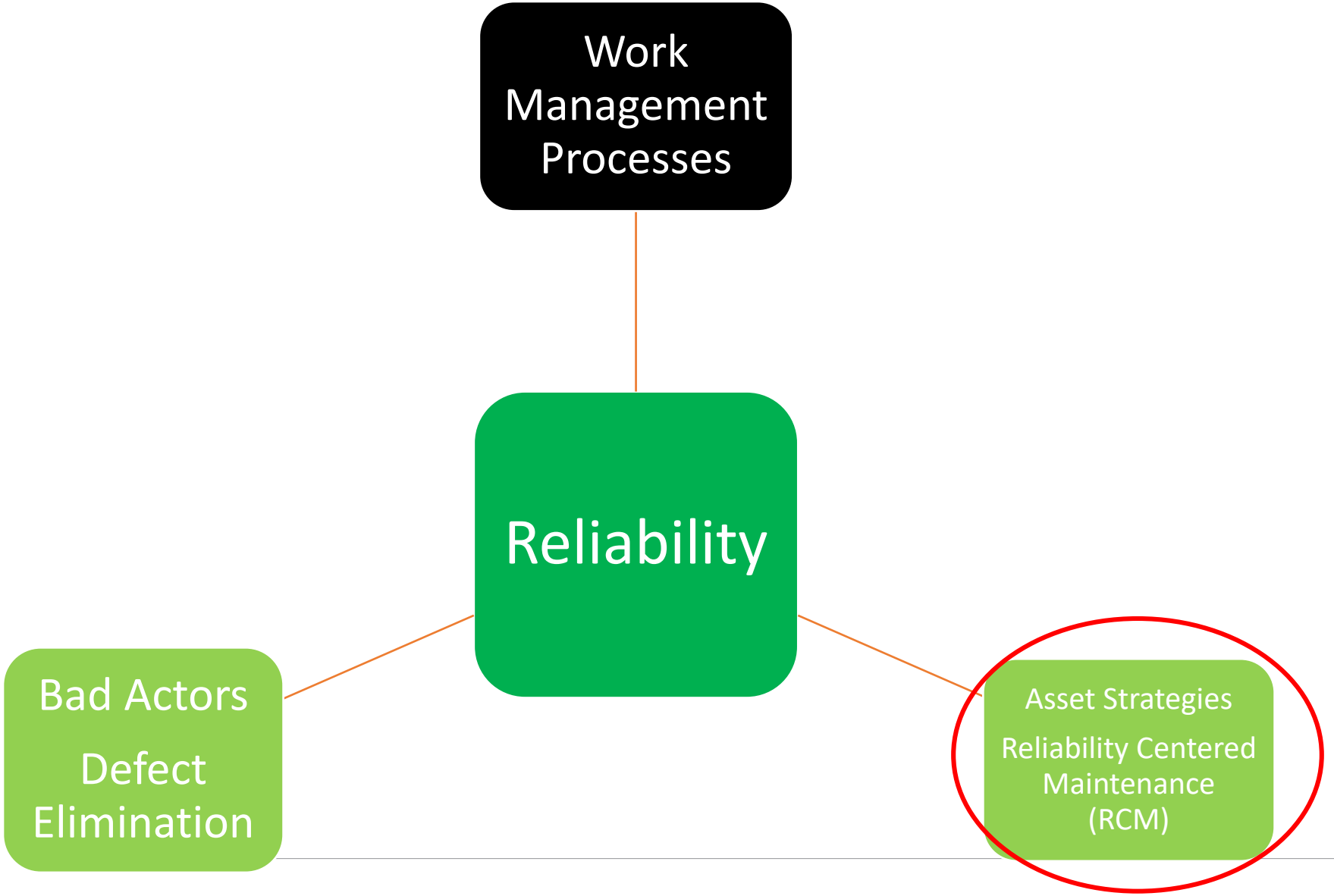




Correlate Data from the CMMS and Downtime (Availability)

FLUKE Reliability

Asset Management

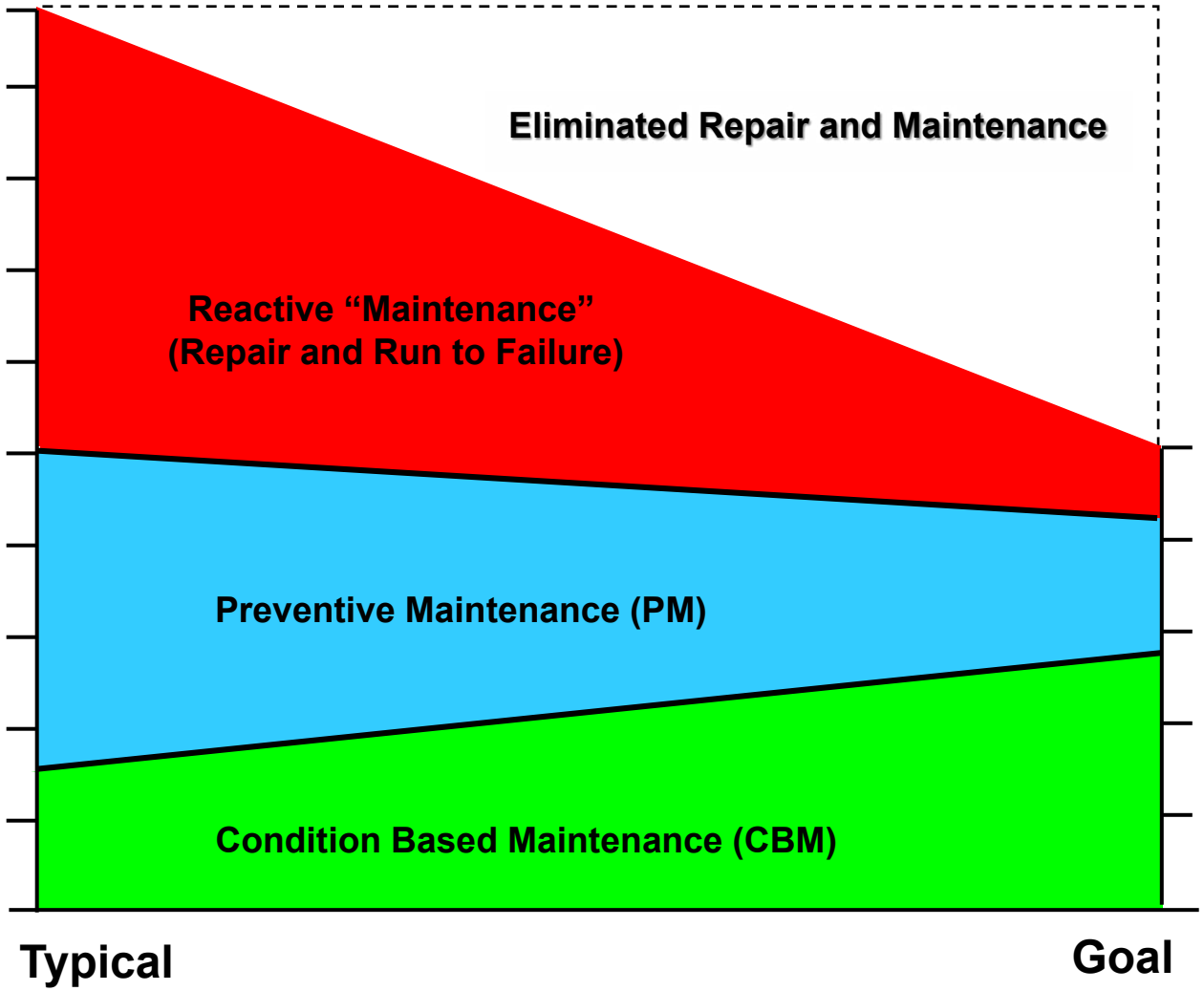


Recognizing Interdependence – The Philosophy

Asset Strategies

- Do you have Asset Strategies?
  - Preventive Maintenance (PM's)
  - Condition Based Maintenance (CBM)
  - Run to Failure (RTF) or No Scheduled Maintenance (NSM)
- How were they created?
  - OEM Recommendations
  - Failures
  - Best Practices
  - Someone requested them because of a failure
  - Reliability Centered Maintenance (RCM)?
- Have the Asset Strategies been optimized?
  - PM Optimization

Where are you spending your maintenance labor to support reliability and availability?



50% - No Strategies

35% - Original Equipment Manufacturer (OEM), Leading Practice, and Some RCM?

15% - OEM, Leading Practice, Some RCM?

Due to RCM and RCFA

15% - "No Scheduled Maintenance" **Strategies** – Due to RCM Activities

30% - Due to RCM Activities

55% - Due to RCM Activities

FLUKE® Reliability

What is a failure?

RCFA

A failure is an unwanted event

RCM

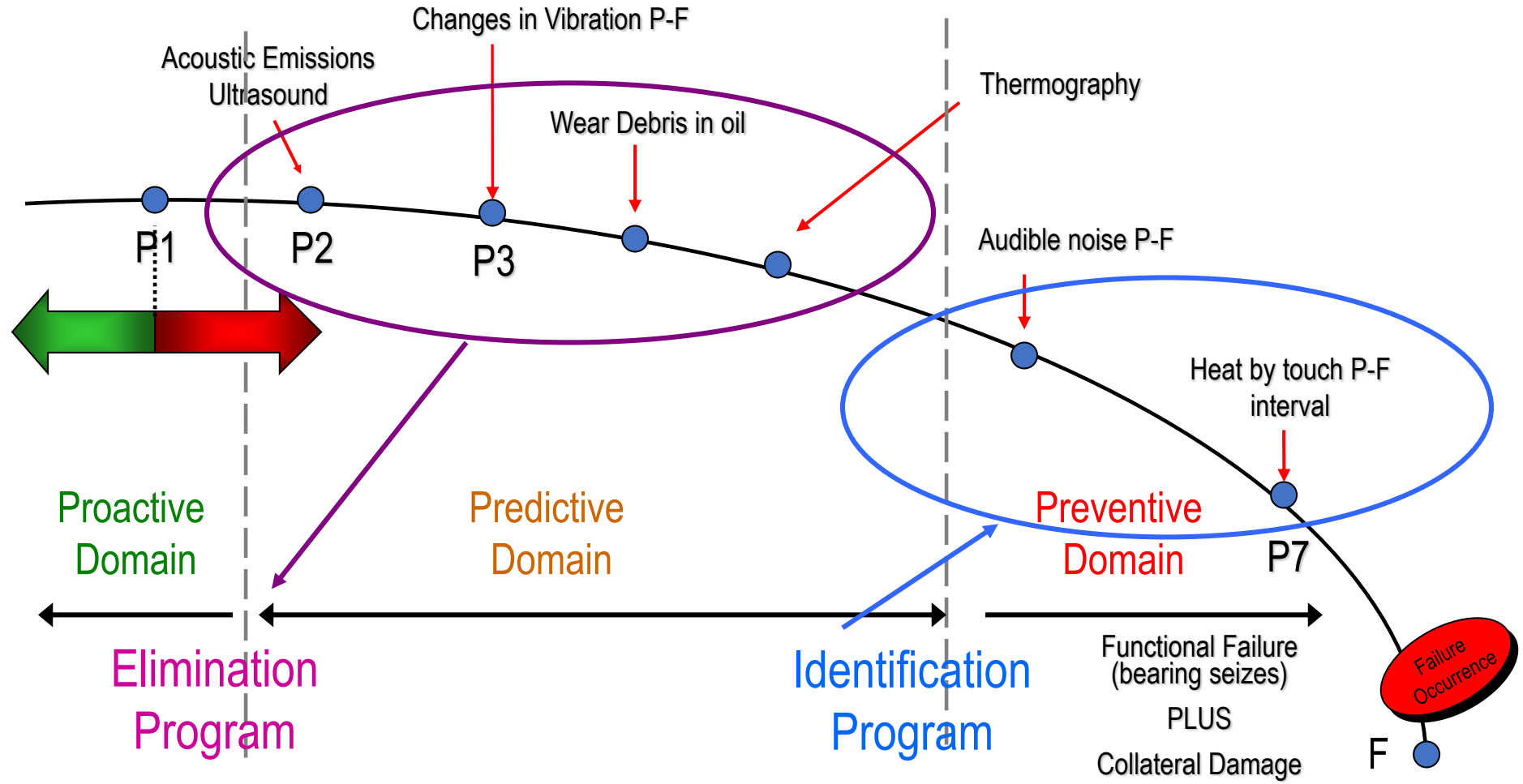
A failure is the inability of an asset to perform user's expectations

What is a failure?

RCM

A failure is the inability of an asset to perform user’s expectations

The Reliability Challenge



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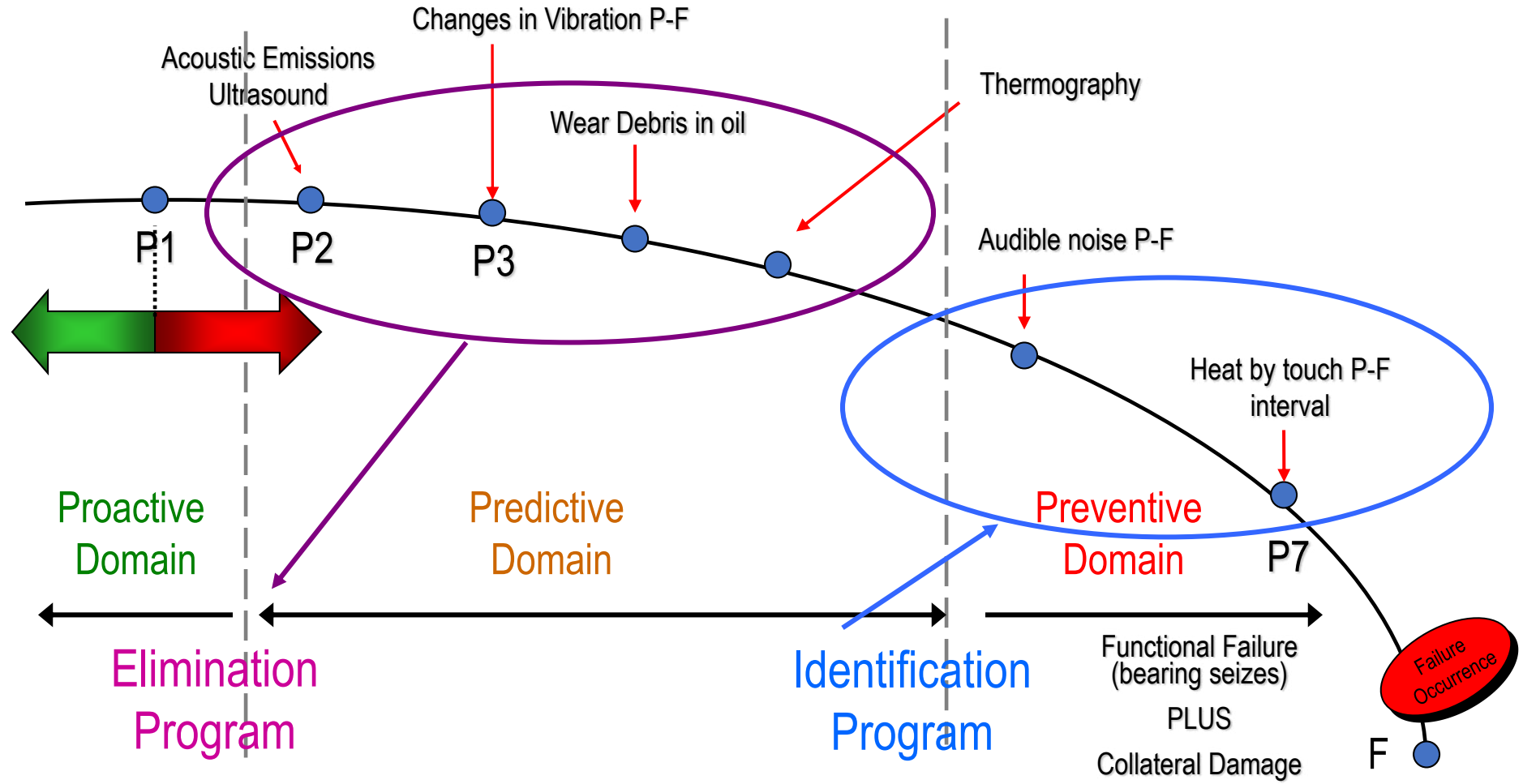
Asset Strategy

PME/PMO

- Preventive Maintenance Procedure (PM) Evaluation/Optimization
  - Preventive/Predictive Maintenance Procedures *eliminate or substantially postpone* a failure
  - Review existing PM's
    - Sample, Inspect, Review, and Check
    - Employee knowledge
    - PM Best Practice
  - Revise or Eliminate where necessary
  - Apply accurate time estimates, craft and available technology

The Reliability Challenge



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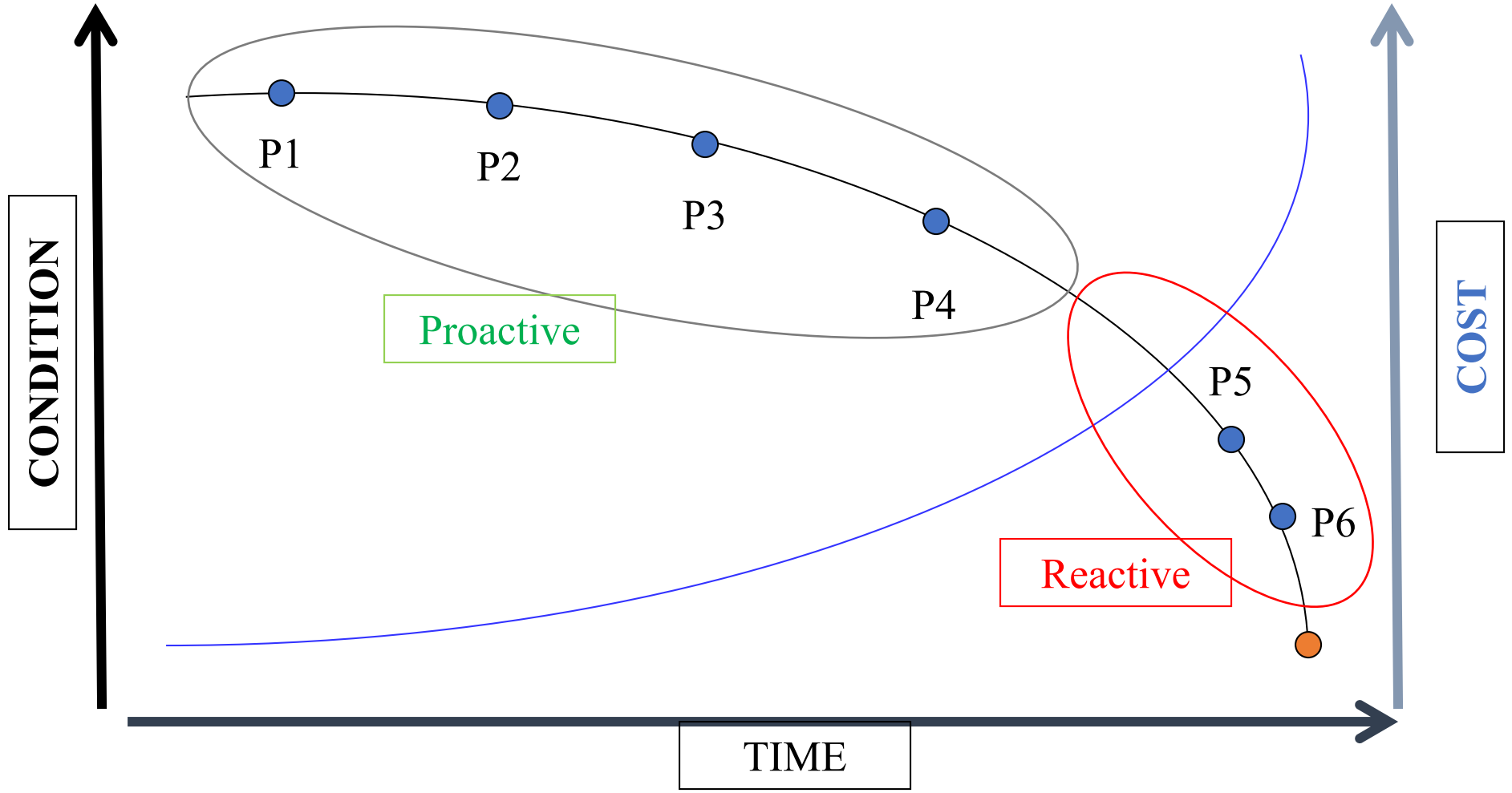
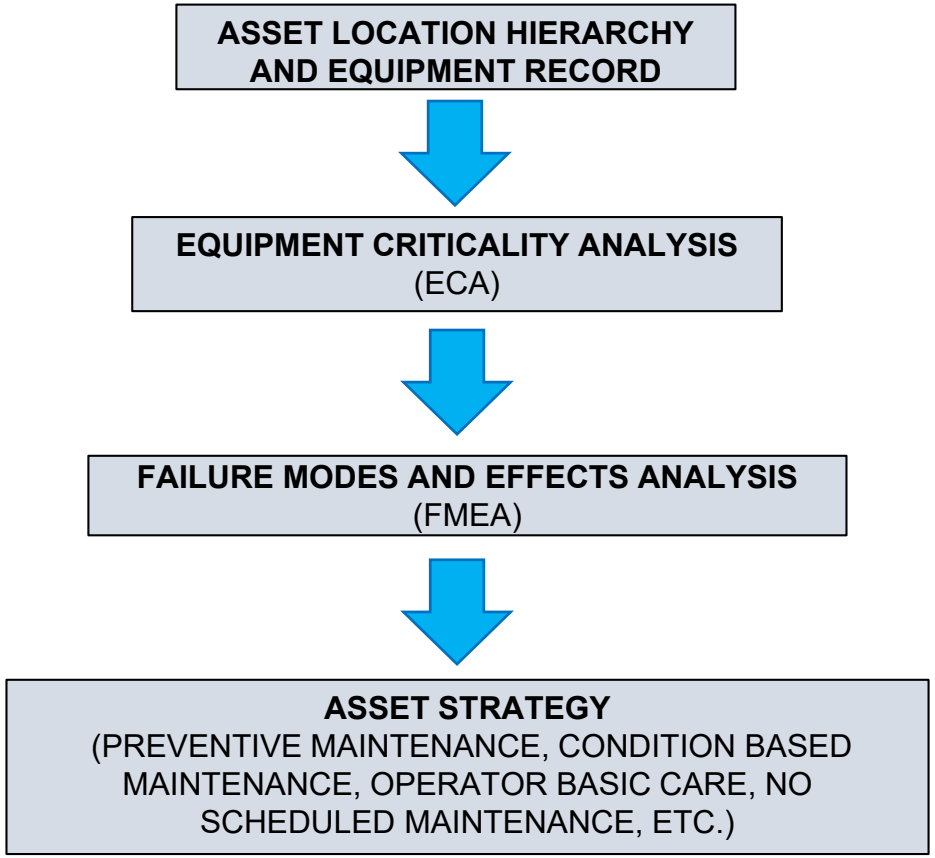
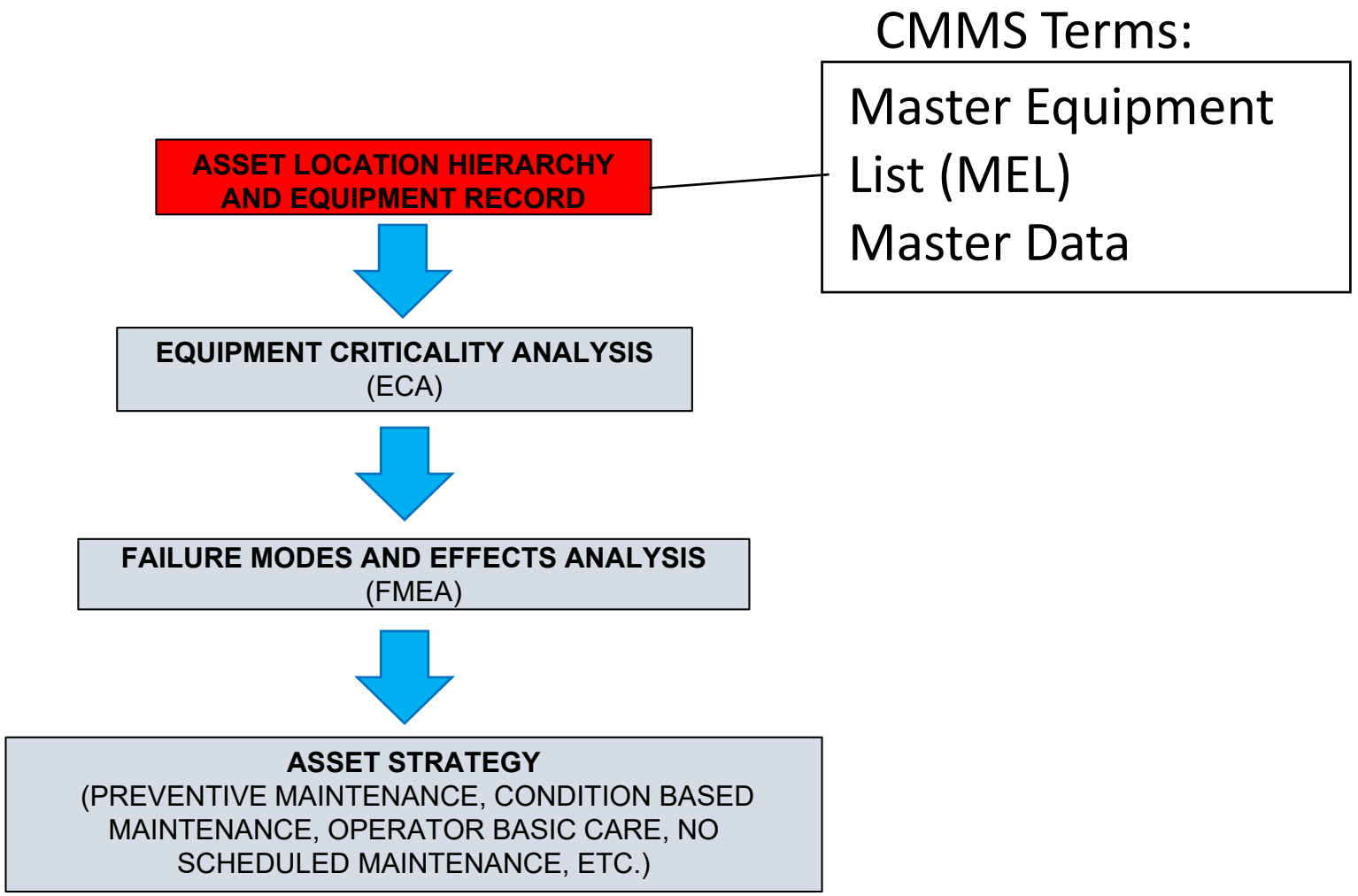
P-F and Cost Chart



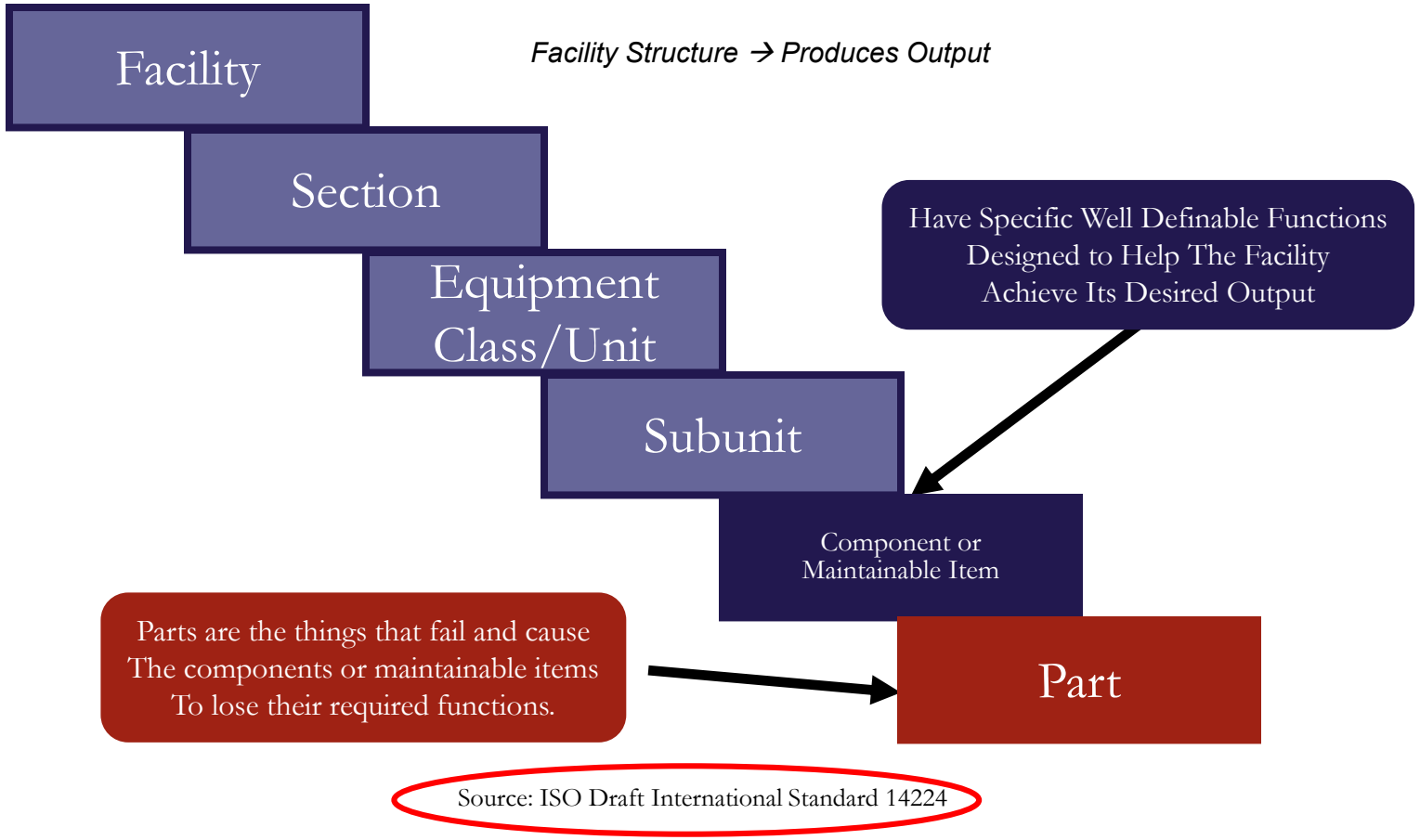
Reliability Centered Maintenance (RCM)



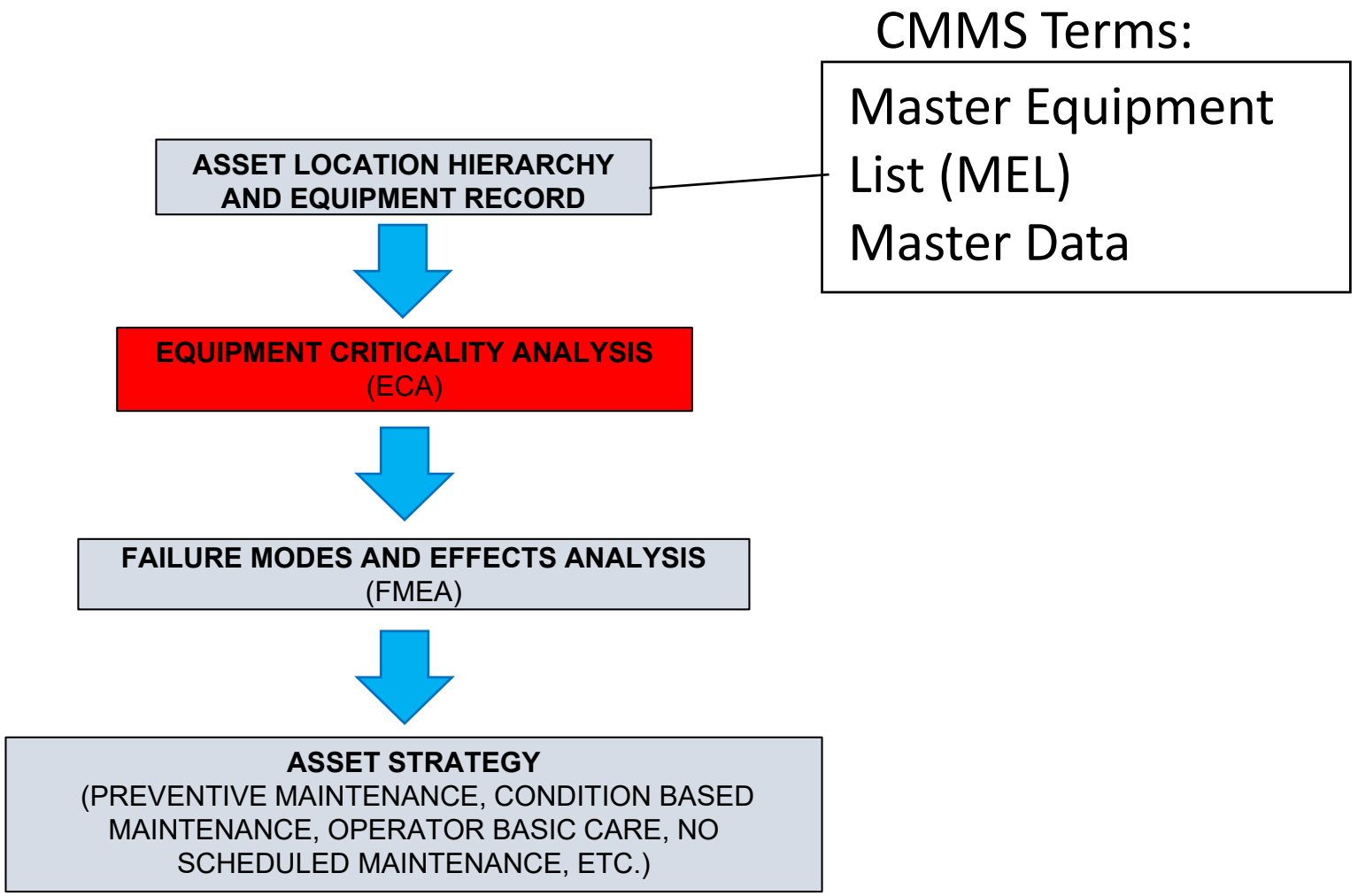
Reliability Centered Maintenance (RCM)



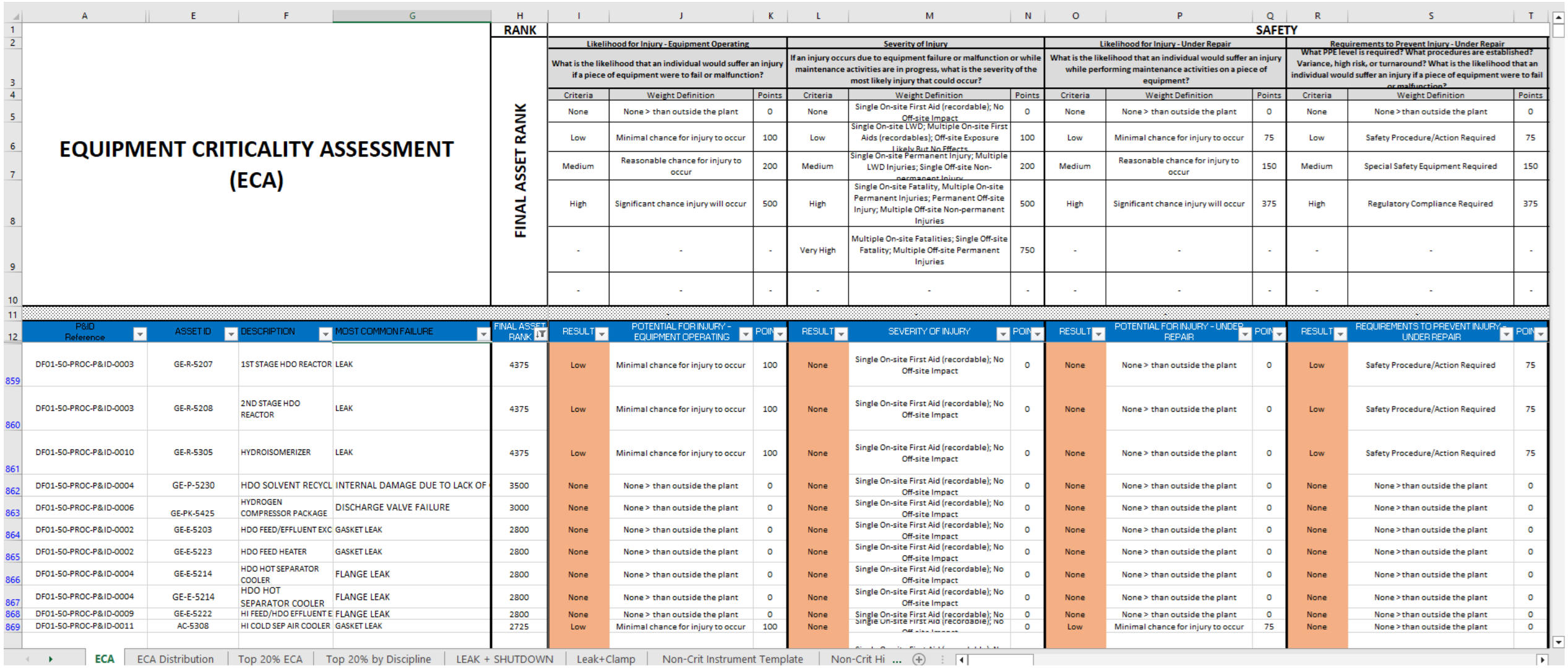
Define Hierarchy



Reliability Centered Maintenance (RCM)



Equipment Criticality Analysis Workbook



EQUIPMENT CRITICALITY ASSESSMENT (ECA)

RANK — **FINAL ASSET RANK**

SAFETY

Likelihood for Injury - Equipment Operating			Severity of Injury			Likelihood for Injury - Under Repair			Requirements to Prevent Injury - Under Repair		
What is the likelihood that an individual would suffer an injury if a piece of equipment were to fail or malfunction?			If an injury occurs due to equipment failure or malfunction or while maintenance activities are in progress, what is the severity of the most likely injury that could occur?			What is the likelihood that an individual would suffer an injury while performing maintenance activities on a piece of equipment?			What PPE level is required? What procedures are established? Variance, high risk, or turnaround? What is the likelihood that an individual would suffer an injury if a piece of equipment were to fail or malfunction?		
Criteria	Weight Definition	Points	Criteria	Weight Definition	Points	Criteria	Weight Definition	Points	Criteria	Weight Definition	Points
None	None > than outside the plant	0	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	None	None > than outside the plant	0
Low	Minimal chance for injury to occur	100	Low	Single On-site LWD; Multiple On-site First Aids (recordables); Off-site Exposure Likely But No Effects	100	Low	Minimal chance for injury to occur	75	Low	Safety Procedure/Action Required	75
Medium	Reasonable chance for injury to occur	200	Medium	Single On-site Permanent Injury; Multiple LWD Injuries; Single Off-site Non-permanent Injury	200	Medium	Reasonable chance for injury to occur	150	Medium	Special Safety Equipment Required	150
High	Significant chance injury will occur	500	High	Single On-site Fatality, Multiple On-site Permanent Injuries; Permanent Off-site Injury; Multiple Off-site Non-permanent Injuries	500	High	Significant chance injury will occur	375	High	Regulatory Compliance Required	375
-	-	-	Very High	Multiple On-site Fatalities; Single Off-site Fatality; Multiple Off-site Permanent Injuries	750	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-

	P&ID Reference	ASSET ID	DESCRIPTION	MOST COMMON FAILURE	FINAL ASSET RANK	RESULT	POTENTIAL FOR INJURY - EQUIPMENT OPERATING	POIN	RESULT	SEVERITY OF INJURY	POIN	RESULT	POTENTIAL FOR INJURY - UNDER REPAIR	POIN	RESULT	REQUIREMENTS TO PREVENT INJURY - UNDER REPAIR	POIN
859	DF01-50-PROC-P&ID-0003	GE-R-5207	1ST STAGE HDO REACTOR	LEAK	4375	Low	Minimal chance for injury to occur	100	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	Low	Safety Procedure/Action Required	75
860	DF01-50-PROC-P&ID-0003	GE-R-5208	2ND STAGE HDO REACTOR	LEAK	4375	Low	Minimal chance for injury to occur	100	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	Low	Safety Procedure/Action Required	75
861	DF01-50-PROC-P&ID-0010	GE-R-5305	HYDROISOMERIZER	LEAK	4375	Low	Minimal chance for injury to occur	100	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	Low	Safety Procedure/Action Required	75
862	DF01-50-PROC-P&ID-0004	GE-P-5230	HDO SOLVENT RECYCL	INTERNAL DAMAGE DUE TO LACK OF	3500	None	None > than outside the plant	0	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	None	None > than outside the plant	0
863	DF01-50-PROC-P&ID-0006	GE-PK-5425	HYDROGEN COMPRESSOR PACKAGE	DISCHARGE VALVE FAILURE	3000	None	None > than outside the plant	0	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	None	None > than outside the plant	0
864	DF01-50-PROC-P&ID-0002	GE-E-5203	HDO FEED/EFFLUENT EXC	GASKET LEAK	2800	None	None > than outside the plant	0	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	None	None > than outside the plant	0
865	DF01-50-PROC-P&ID-0002	GE-E-5223	HDO FEED HEATER	GASKET LEAK	2800	None	None > than outside the plant	0	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	None	None > than outside the plant	0
866	DF01-50-PROC-P&ID-0004	GE-E-5214	HDO HOT SEPARATOR COOLER	FLANGE LEAK	2800	None	None > than outside the plant	0	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	None	None > than outside the plant	0
867	DF01-50-PROC-P&ID-0004	GE-E-5214	HDO HOT SEPARATOR COOLER	FLANGE LEAK	2800	None	None > than outside the plant	0	None	Single On-site First Aid (recordable); No Off-site Impact	0	None	None > than outside the plant	0	None	None > than outside the plant	0
868	DF01-50-PROC-P&ID-0009	GE-E-5222	HI FEED/HDO EFFLUENT E	FLANGE LEAK	2800	None	None > than outside the plant	0	None	Single On-site First Aid (recordable); No	0	None	None > than outside the plant	0	None	None > than outside the plant	0
869	DF01-50-PROC-P&ID-0011	AC-5308	HI COLD SEP AIR COOLER	GASKET LEAK	2725	Low	Minimal chance for injury to occur	100	None	Single On-site First Aid (recordable); No	0	Low	Minimal chance for injury to occur	75	None	None > than outside the plant	0

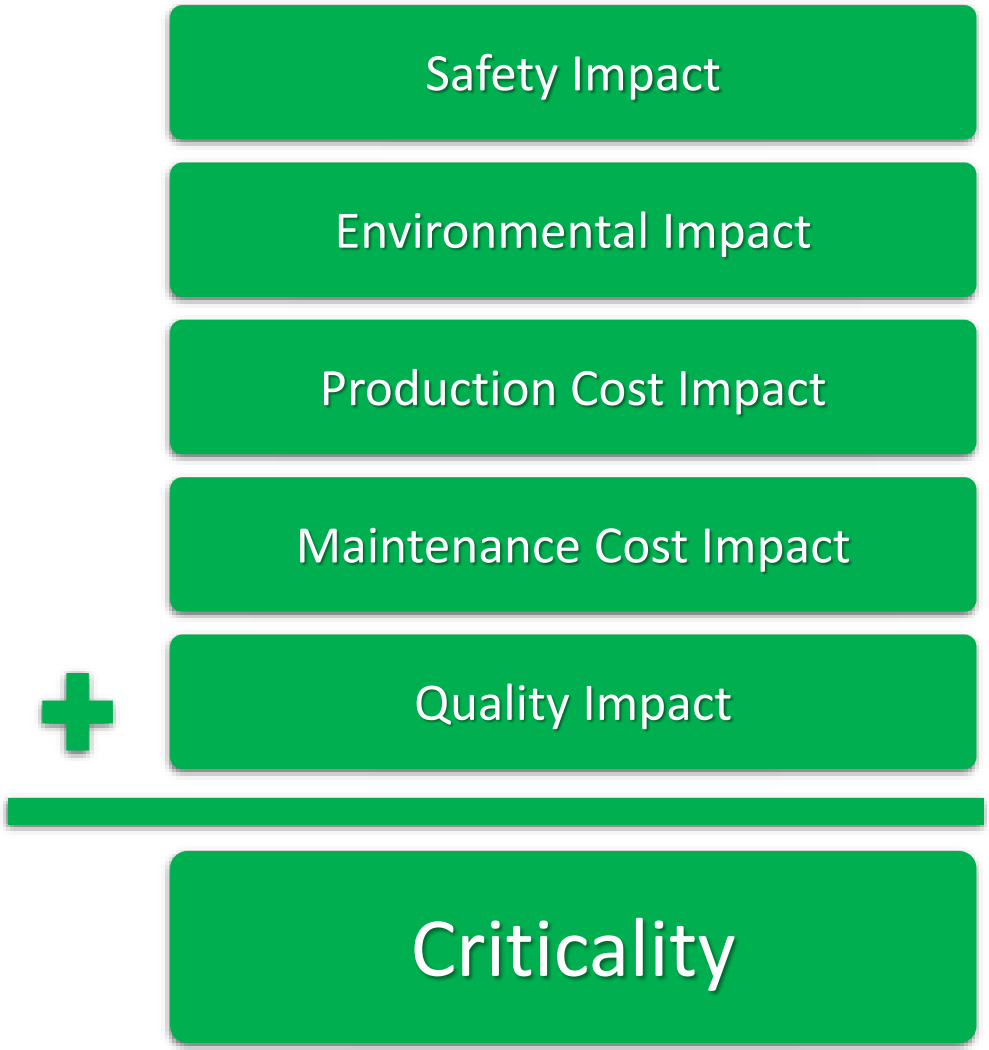
ECA | ECA Distribution | Top 20% ECA | Top 20% by Discipline | LEAK + SHUTDOWN | Leak+Clamp | Non-Crit Instrument Template | Non-Crit Hi ...

FLUKE® Reliability

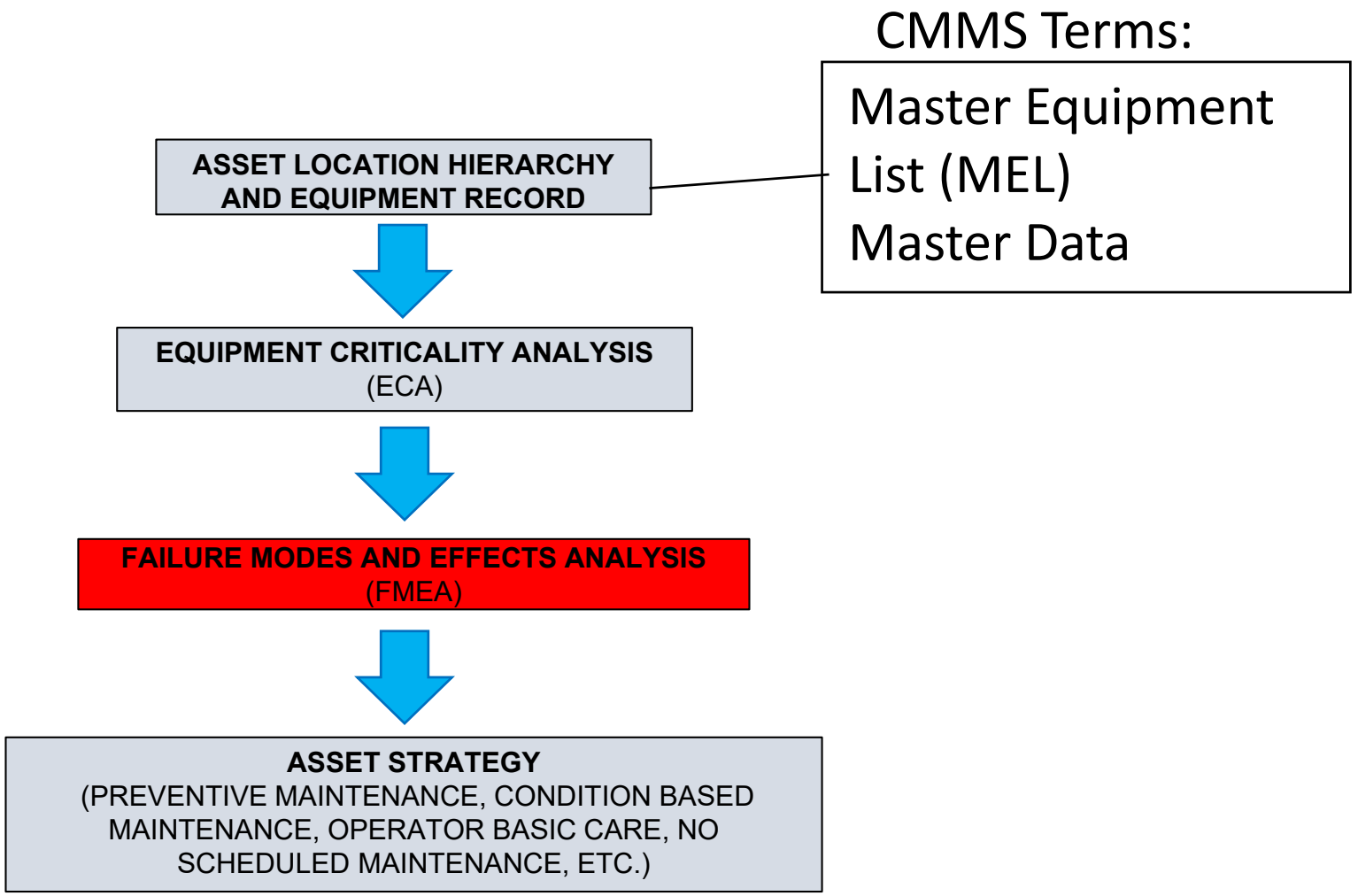
Rate Assets

- Identify the most common failures
- Consider frequency of failures and impacts for each asset based on team input and validated by data collection where possible
- Based on the impact criteria tables, criticality is consistently assessed and assigned to each asset

Criticality = Sum of Impact Criteria



Reliability Centered Maintenance (RCM)



Information to be Documented

(RCM – 7 Questions)

1. What are the functions and associated performance standards of the asset in the present operating context? (FUNCTION)

2. In what ways does it fail to fulfill its functions (FUNCTIONAL FAILURE)

3. What causes each functional failure (FAILURE MODE)

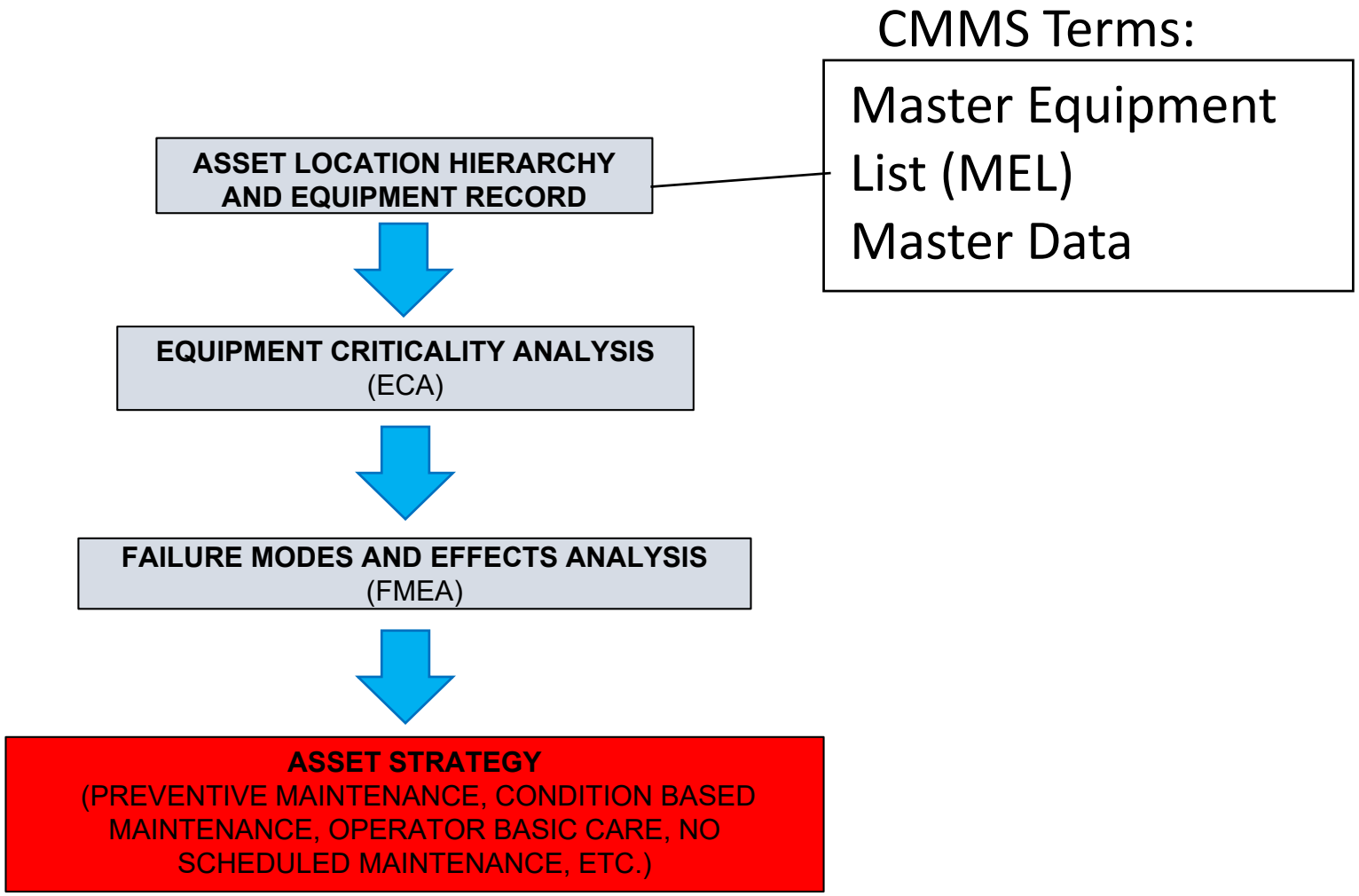
4. What happens when each failure occurs (FAILURE EFFECTS)

5. Why does the failure matter? (FAILURE CONSEQUENCES)

6. What can be done to predict or prevent each failure? (TASK SELECTION)

7. What should be done if a suitable task cannot be found?

Reliability Centered Maintenance (RCM)



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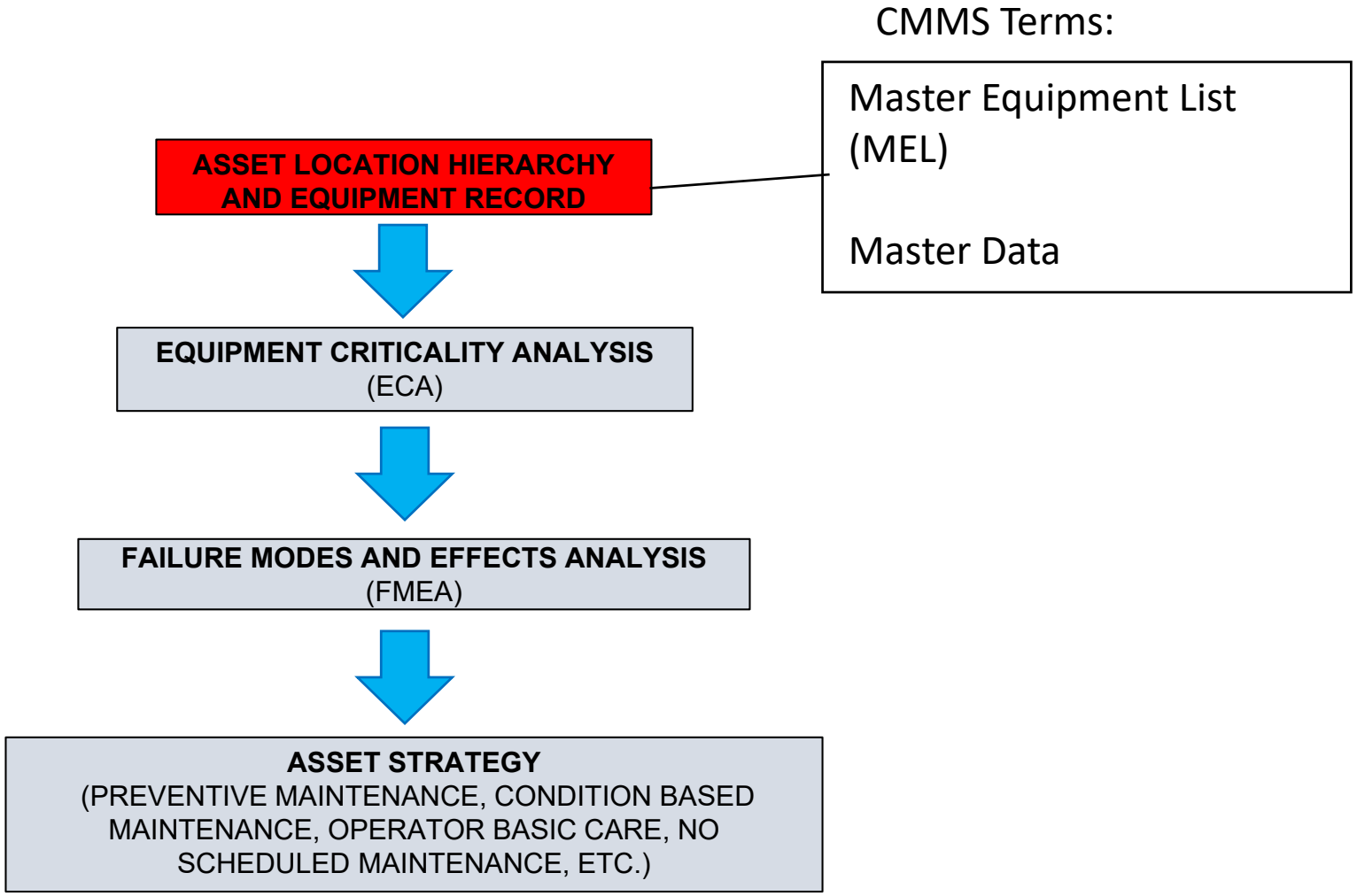

Data Collection Purpose

- To provide a plant/facility with agreed-to standardized definitions, designs, processes, and guidelines for building the Asset Hierarchy and Equipment Register
  - CMMS terms: Master Equipment List (MEL) and Master Data

- To provide a documented starting point for Continuous Improvement.

Data Collection - Objectives

To ensure:

- The plant/facility is broken down into logical units using a structured and consistent approach.
- There are business rules in place for what is defined as a location vs. an equipment record vs. a component/spare part vs. a failure code.
- That the lowest level location boundaries are defined in a consistent manner, recognizing that equipment must always be viewed through the regulatory and operating contexts.
- Reliability analysis is enabled and facilitated throughout the hierarchy and across common elements in the hierarchy.

Data Collection – Objectives continued

To ensure:

- Budgeting and cost tracking / drill-down is available from the top level through the equipment level.
- That taxonomy is defined and implemented consistently, i.e. how locations and equipment are described and how the various fields in the CMMS are used to group and classify these entities.
- A structure is in place to enable consistent collection and analyzing of data, to turn into information, so that timely and appropriate action can be taken.

ISO 14224

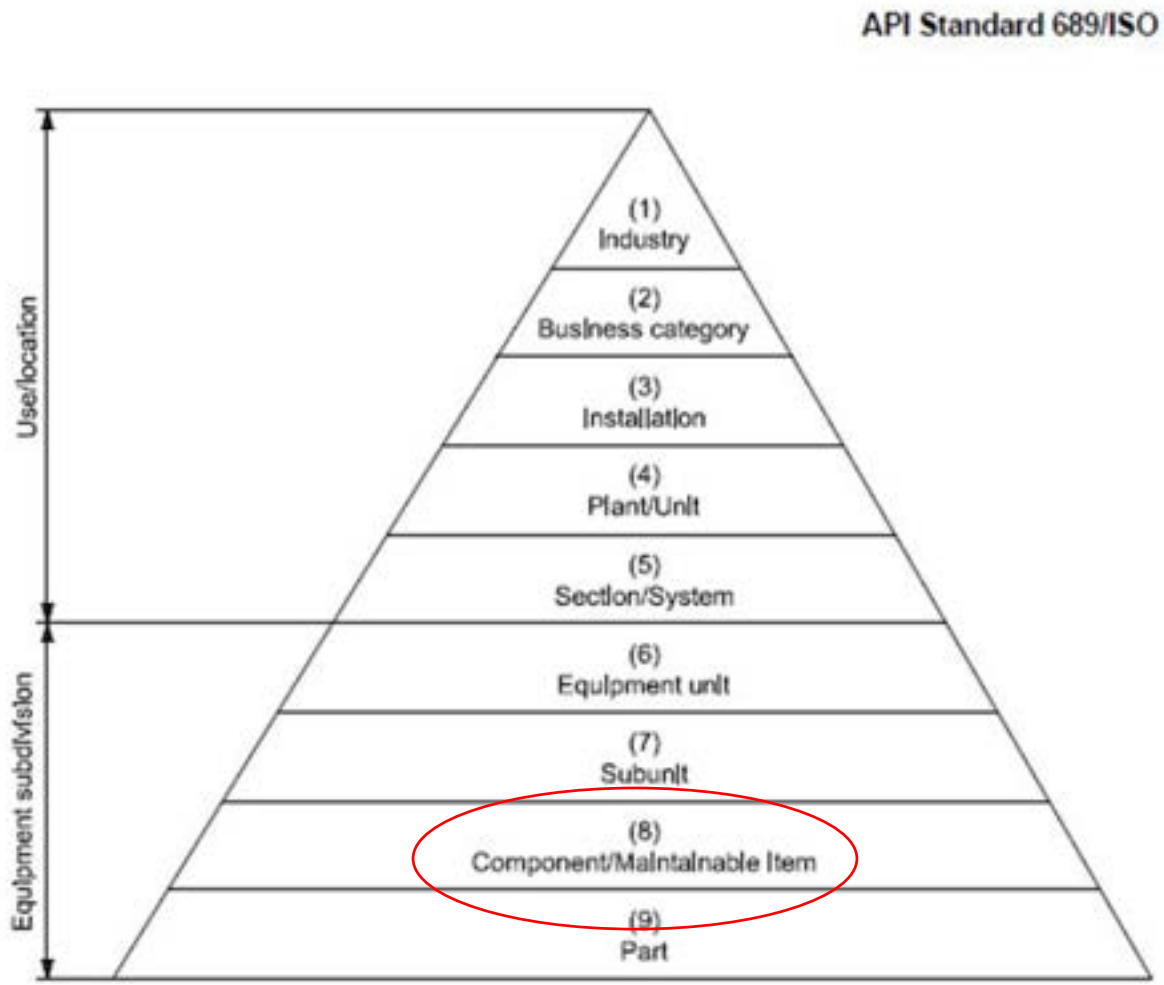

Figure 3 — Taxonomy

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If doing data collection/cleanse/CMMS upgrade…Do's

- Establish a standard for hierarchy and parent/child relationships (ISO 14224 baseline)
  - Ensure all assets/equipment linked through the hierarchy

- Establish the hierarchy order as it will be viewed in a tree view
  - Example 1: Equipment ordered by respective process flow location by System
  - Example 2: Equipment categorized by asset class by System

- Establish a standard format for asset descriptions
  - Example: NOUN, DESCRIPTOR, IDENTIFIER, ASSET NUMBER

If doing data collection/cleanse/CMMS upgrade…Do's

- Define at what level the hierarchy stops
  - Example: Component (lowest level of maintainable component) – BEARING, BELT, SHEAVE
  - Component level hierarchy can require subject matter expert knowledge and/or equipment drawings/manuals

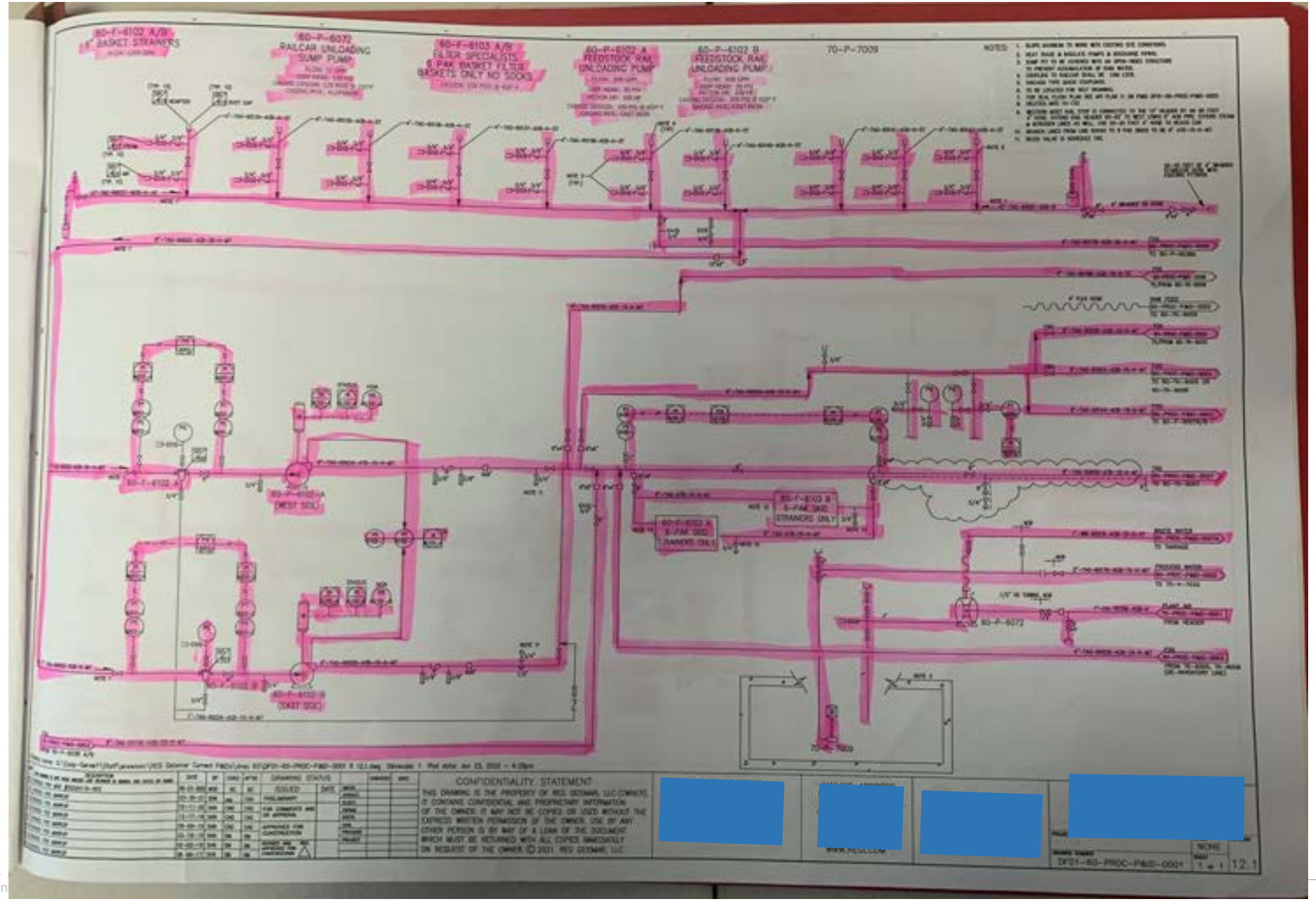
- Define and Understand the difference between hierarchy and Bill of Materials (BOM)
  - Bill of Materials requires equipment drawings and/or manuals (BOM is a topic in itself)

If doing data collection/cleanse/CMMS upgrade…Do's

- Use a P&ID (Piping and Instrument Diagram) or PFD (Process Flow Diagram) as the roadmap for filed verification

- Verify existing data
- Collect asset class attributes
  - Example: Motor>>HP, RPM, FRAME SIZE, VOLTAGE
- Include the asset number in data collection
  - Verify a minimum of a 3-way match (P&ID/Drawing, Field Tag, CMMS Data)
- Assign each asset an asset class
- Tag assets with the correct Asset Number (see above)
  - Consider RFID tags to enable mobile device scanning

FLUKE® Reliability



If doing data collection/cleanse/CMMS upgrade…Do’s

- Ensure account reporting is attached at the correct level and appropriate asset data will roll up

If doing data collection/cleanse/CMMS upgrade…Don't's

- Assume that your CMMS is correct
- Put the minimum amount of data to create an asset record in the system and assume you'll "build it as you go"
- Assume the IT department can take a simple spreadsheet and put the information in the CMMS (except eMaint)
- Assume the IT department has a template that includes asset class attributes (except eMaint)
  - Example: Motor>>HP, RPM, FRAME SIZE, VOLTAGE

If doing data collection/cleanse/CMMS upgrade…Don’t’s

- Forget to check for duplicates
  - Asset Descriptions
  - Asset Numbers (actual asset numbers, not system generated numbers)

Questions

QUESTIONS?

?

Thank you!

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THANK YOU!