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Reliability

Unshroud the Mystery of Rarely Used Parts

Determining how to stock and manage parts that are rarely used

Best Practices Webinar Series

Meet the Speakers

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- PEMAC Board of Directors
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Maintenance Storerooms… Not as Simple as it Seems…

Looking behind the curtain;

- > 60% of ordering values are wrong
- ~ 30% of parts will never be used
- ~25% of maintenance time is spent looking for parts
- ~50% of open work orders are due to missing / not fit for purpose parts
- Average of 251 days before for a new part is first used

Information provided by Xtivity

Understanding the Types of Spare Parts

Active	• >10 per month • Account for 5-15% of storeroom inventory
Commodity	• >1 per month • Account for <5% of storeroom
Rarely Used	• <1 per month • Typically account for 80-90% of storeroom inventory

POLL QUESTION No. 1

Do you feel you have the right level of stock for Rarely Used items?

(Click only one answer)

- We have too much
- We don’t have enough
- We have the right amount
- I have no idea…

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Challenges with Rarely Used Parts

- Costs
  - Typically have a high cost
  - Make up the majority of costs in a storeroom
- Emotions
  - Yelled at in the past for not having a part
  - Cost Bias
- Competing Initiatives
- Lack of Data / Trends
  - Lead time, usage
  - Standard forecast models/distributions don’t work
- Obsolescence
  - Will I be able to get this part?
- Will it Work?

Managing the Active & Commodity Spare Parts

- Min = (usage per year / 365) x lead time
- EOQ = √(2DS/H)
  - D = Usage per year
  - S = Ordering cost per order
  - H = Inventory carrying cost
- Max = Min + EOQ

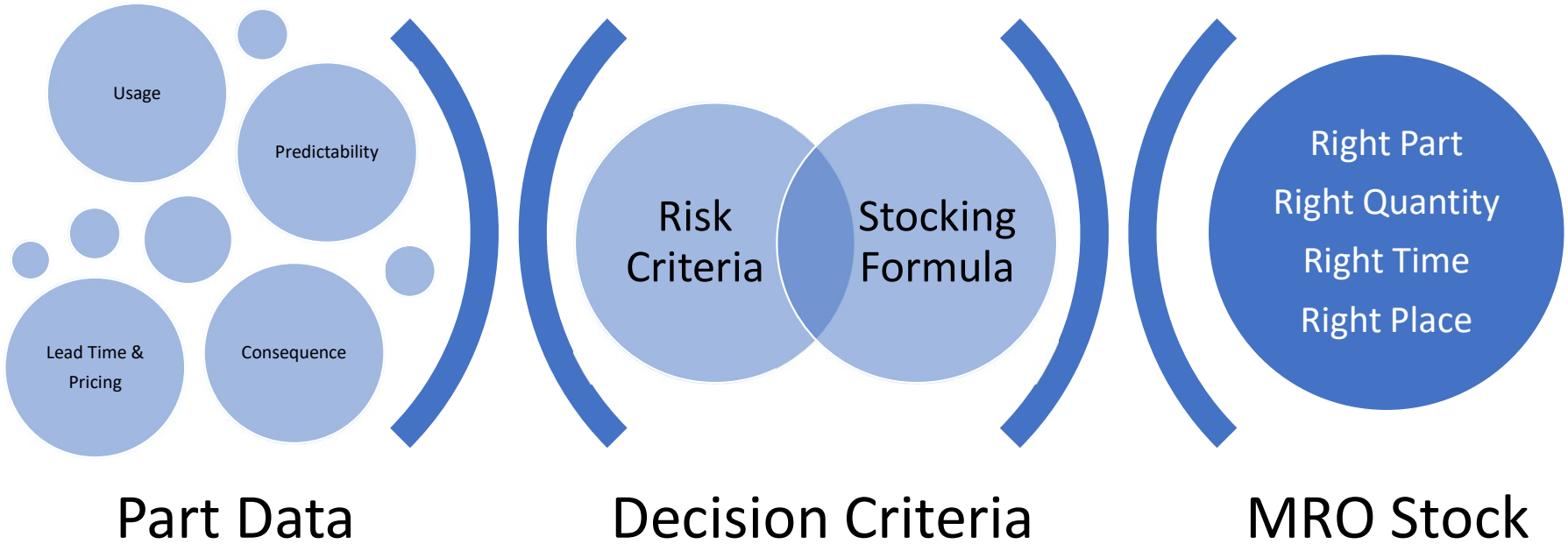
- Usage & Lead Times Trends
  - Moving Average
  - Exponential Smoothing
  - Predictive Models

Bearing Example

Cost: $25
Lead Time: 2 Days
Usage: 60 per year
Ordering Cost: $75
Carrying Cost: 24%

Min: 1
EOQ: 39
Max: 40

Managing Rarely Used Parts



Managing Rarely Used Parts

- Risk based evaluation criteria
  - Cost of lost production
  - Lead time of parts
  - Usage rates
  - Detectability of impending failure
  - Available workarounds
  - Cost
  - Risk of failure in the storeroom

What else could be considered in risk?

Consequences

Not Enough Parts: reduced asset availability. Lost production costs

Too Many Parts: Carrying costs and tied up capital

Managing Rarely Used Parts Continued

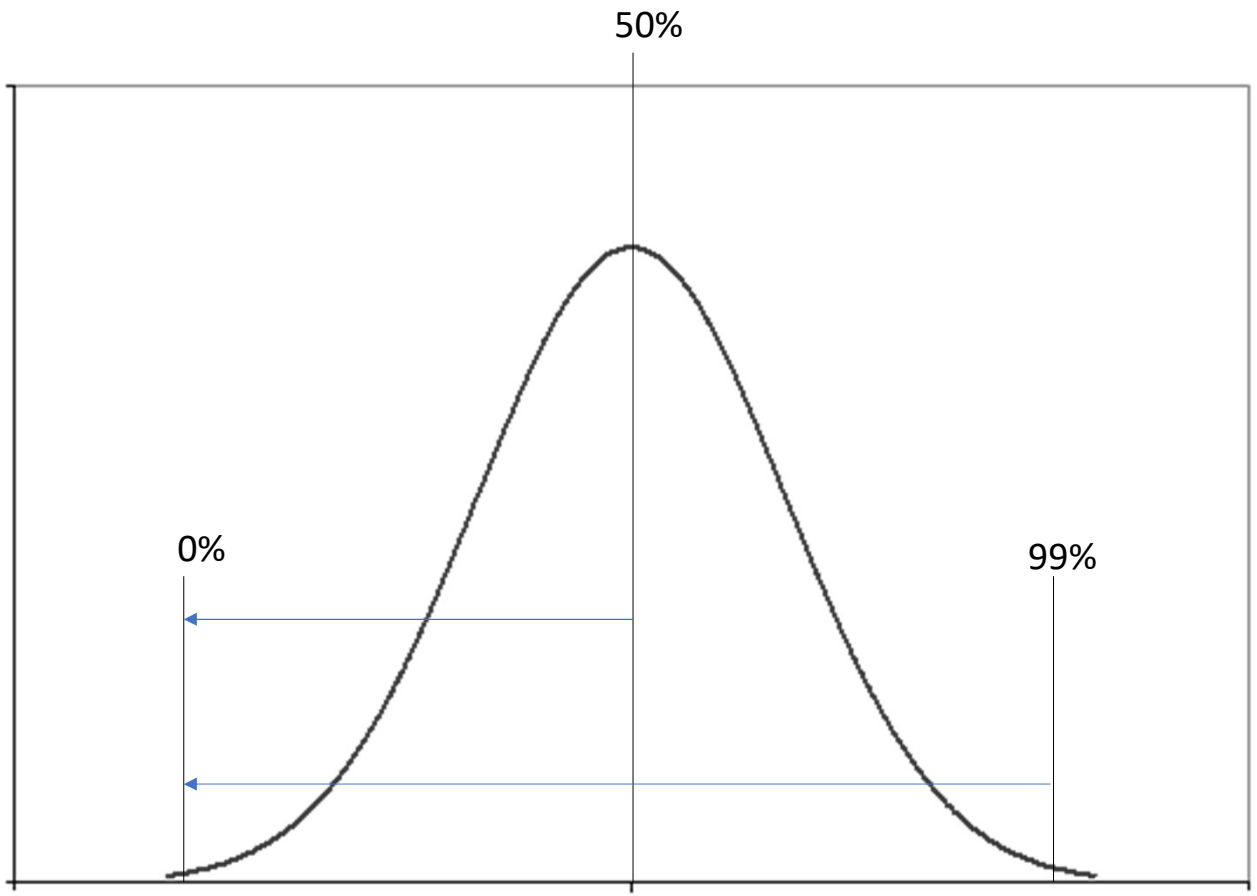
- Do we stock based on the risk?
- Min = (Probability of usage per year / 365) x lead time + Safety Stock
- EOQ = √(2DS/H)
  - D = Usage per year
  - S = Ordering cost per order
  - H = Inventory carrying cost
- Max = Min + EOQ

  Important: We only want to stock to cover the next re-order period

With limited data, we use probabilities instead of usage history, but can verify and refine with recent usage history.

Use the probabilities from an FMEA and add them together.

Service Levels



Managing Rarely Used Parts Continued

- Safety Stock for Predictable Usage = (Max Lead Time – Normal Lead Time) x Normal Consumption Rate
  - Normal Consumption Rate = Expected Annual Usage / 365
- Safety Stock for Unpredictable Usage K x √D
  - K = Acceptable level of coverage

Level of Acceptable Coverage	50%	75%	80%	85%	90%	98%	99%	99.9%
K Factor	0.0	0.7	0.8	1.0	1.3	2.1	2.3	3.3

  - D = Average consumption during lead time = (expected usage per year / 365) x max lead time

Standard Min/ROP Formula	Min/ROP for Variable Lead Time	Min/ROP for Variable Usage	Min/ROP with Customer Service Factor
Min = (usage per year / 365) x lead time + Safety Stock Min = (U)(LT) + (K x √D)	Min = Expected Usage during Lead Time + Safety Stock Min = (U)(LTavg) + (Z)(U)(S)	Min = Expected usage during lead time + safety stock Min = (Uavg)(LT) + (Z)(√LT)(S)	Min = (LT x U) + (CSF x MAD x √LT)

Where;
- U = Constant usage rate per day
- LT = Replenishment Lead Time
- K = Acceptable Level of Coverage
  - 95% service = 1.64
  - 99% service = 2.3
  - 99.9 service = 3.3
- D = Average consumption during max lead time
	Where;
	- U = Constant usage rate per day
	- LTavg = Replenishment average leadtime
	- Z = Factor from normal distribution service level
	  - 95% service = 1.64
	  - 99% service = 2.33
	  - 99.9% service = 3.09
	- S = Standard Deviation of Lead Time
	
	Source: Production Spare Parts; Moncrief, Schroder, Reynolds
		Where;
		- Z = Factor from normal distribution service level
		  - 95% service = 1.64
		  - 99% service = 2.33
		  - 99.9% service = 3.09
		- S = Standard Deviation of Usage Rate
		- Uavg = Average Usage per day
		- LT = Replenishment Lead Time
		
		Source: Production Spare Parts; Moncrief, Schroder, Reynolds
			Where;
			- LT = Replenishment Lead Time
			- U = Usage
			- CSF = Customer Service Factor based on MAD
			- Mean Average Deviation
			
			Source: Smart Inventory Solutions; Slater

POLL QUESTION No. 2

What is the biggest challenge to managing your spare parts?

(Click only one answer)

- Lack of data
- Lack of risk framework/alignment
- Lack of time to analyze spares
- Lack of organizational knowledge on managing spares

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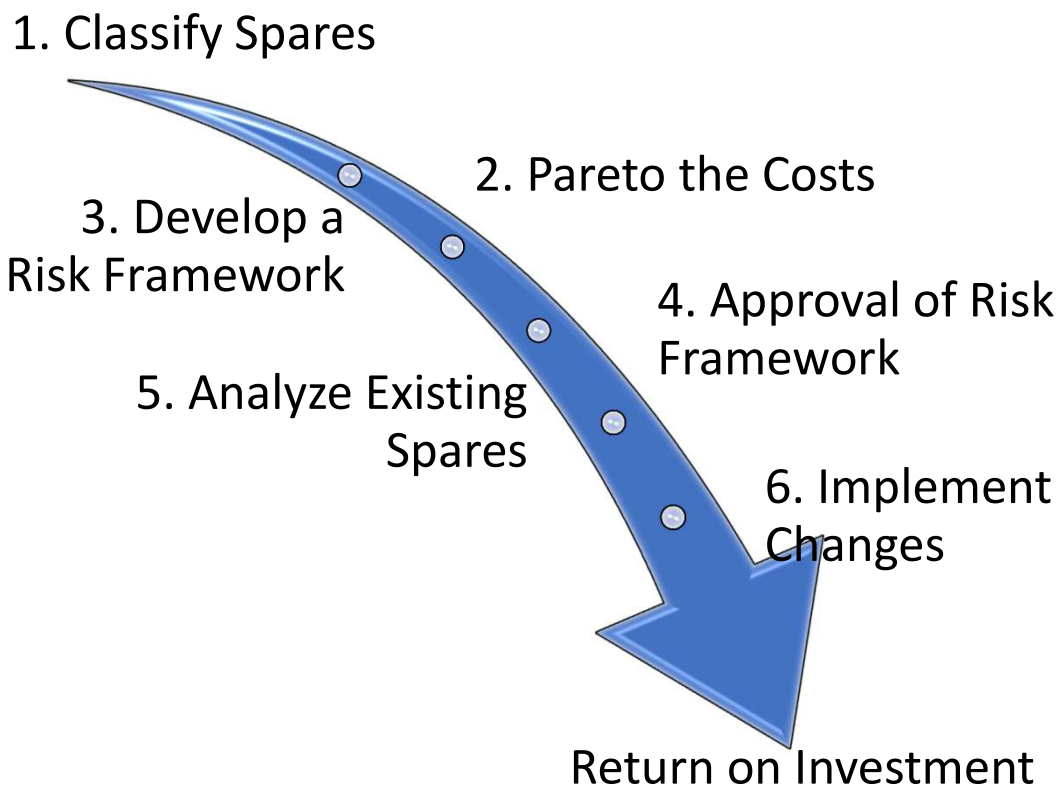
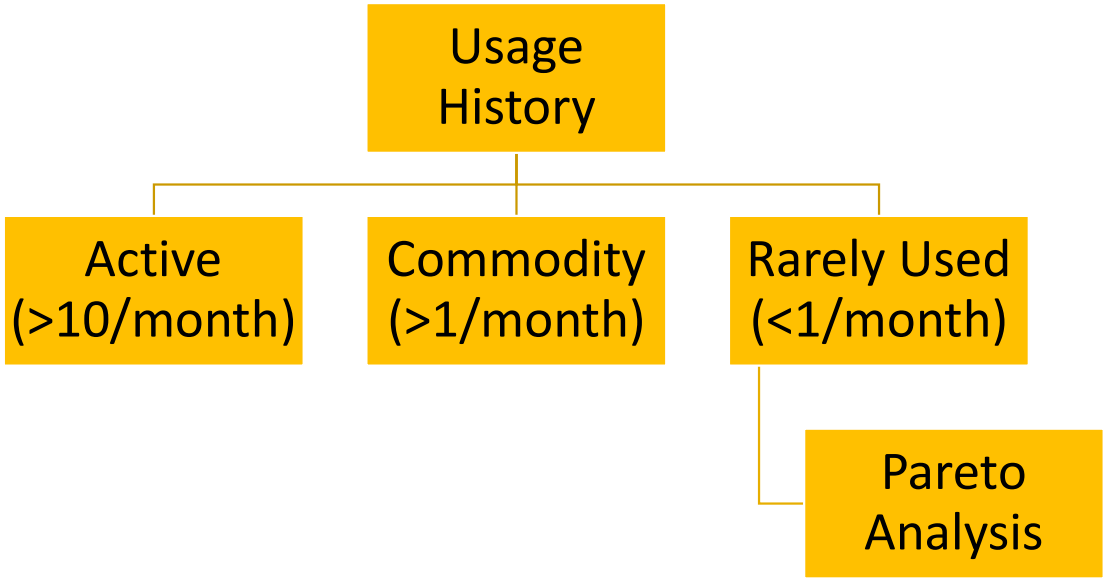
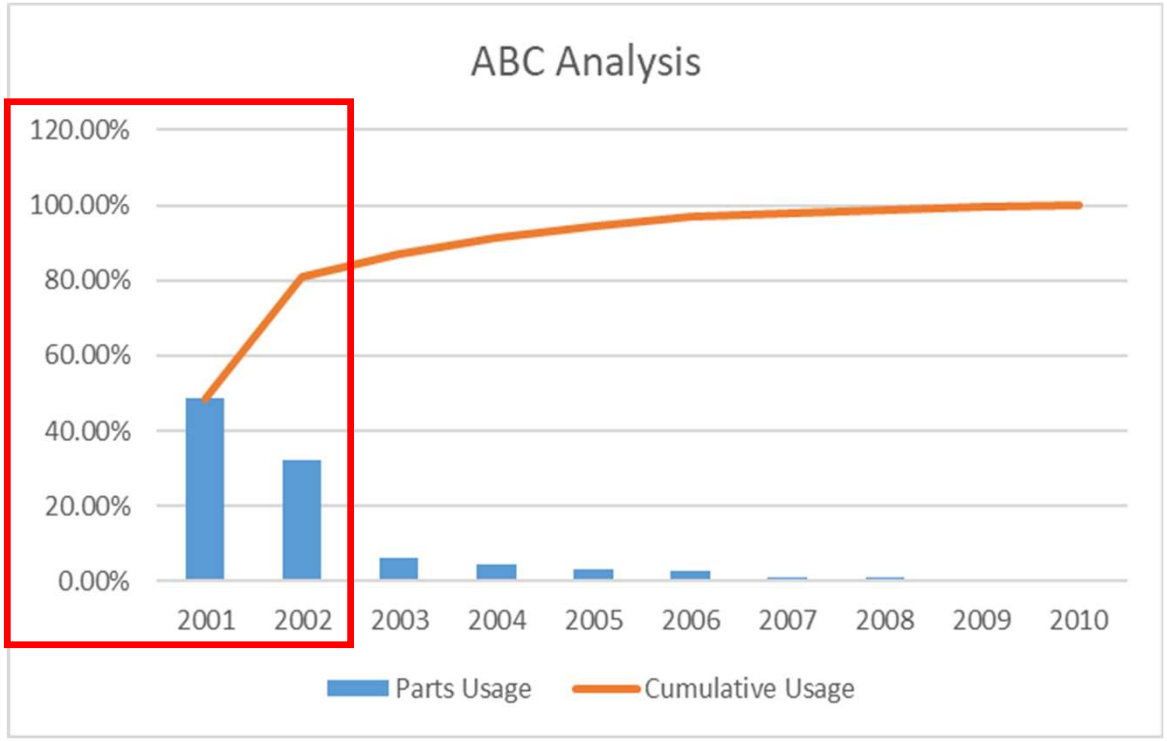
Roadmap to Improving Spares



Classify Spares



Pareto the Costs



Category	Items	Percentage of Items	Percentage Usage
A	2001, 2002	20%	80.98%
B	2003, 2004, 2005, 2006	40%	16.17%
C	2007, 2008, 2009, 2010	40%	2.85%

Developing Risk Framework

Criteria	A	B	C
Lead Time	>1 Month	<1 Month >1 Week	<1 Week
Consequence of Stockout	>$250K	<$250K >$10K	<$10K
Consumption Rate	>5	<5 >2	<2

A part has a lead time of 18 days, a consequence of $50k, and we consume on average of 10 per year. What is the ranking of this part?

18 days – B $50K – B 10x year - A

To Stock, or Not to Stock?

Class of Parts	Lead Time	Consequences of Stockout	Consumption Rate	Recommend Stocking?
A	A	A	A	Stock
	A	A	B	Stock
	A	A	C	Stock
	A	B	A	Stock
	A	B	B	Stock
B	B	A	A	Stock
	B	A	B	Stock
	B	A	C	Stock
	B	B	A	Stock
	B	B	B	Stock
	A	B	C	Non-Stock
	B	B	C	Non-Stock
	A	C	A	Stock
	B	C	A	Stock
	A	C	B	Non-Stock
	B	C	B	Non-Stock
	A	C	C	Non-Stock
	B	C	C	Non-Stock

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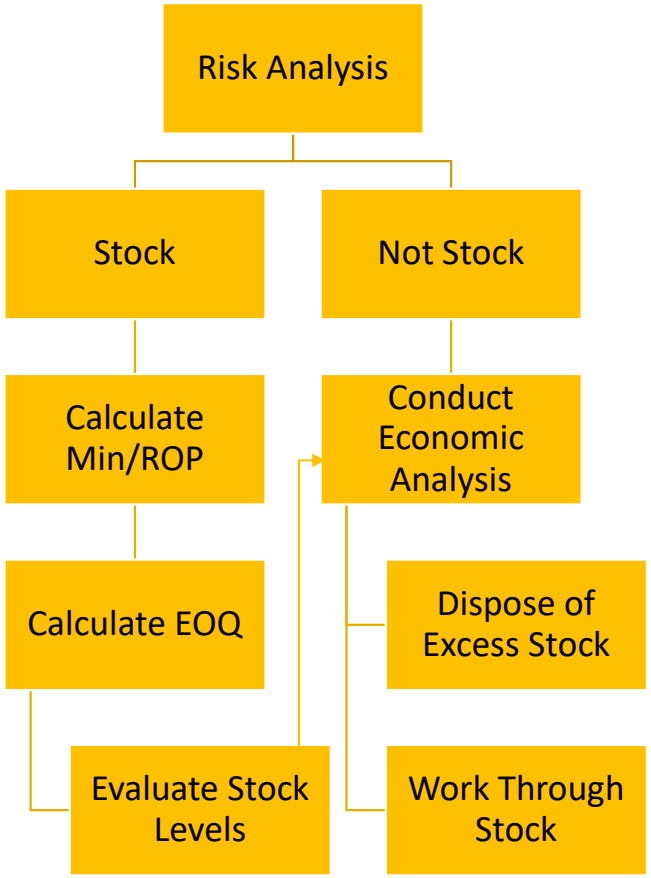
To Stock, or Not to Stock?

Class of Parts	Lead Time	Consequences of Stockout	Consumption Rate	Recommend Stocking?
C	C	A	A	Stock
	C	A	B	Stock
	C	A	C	Non-Stock
	C	B	A	Stock
	C	B	B	Stock
	C	B	C	Stock
	C	C	A	Stock
	C	C	B	Non-Stock
	C	C	C	Non-Stock

Alignment & Approval of Risk Framework

- Need to get stakeholders aligned to the risk framework
- If a part is not available, it is because the risk framework stated it would not be needed
- This prevents individuals from be punished for not having a part

Analyzing Existing Spares



Economic Analysis

Does the cost of keeping the excess parts out weigh the cost of buying new when needed?

Dispose of Stock
Dispose of stock through transfers, sales, or scrap

Work Through Stock
Consume inventory but do not replenish until new stock levels are achieved

Implement the Changes

- Revise Min/ROP
- Revise Order Quantity
- Perform an Economic Analysis on whether to keep the excess inventory or dispose of it
- Dispose of excess inventory if warranted

Insight: Be sure to track the savings / cost reductions from the very beginning.

Getting Vendors On-Board

- See if Vendors can assist is optimizing inventory by reducing lead time.

Lead Time	Usage (per year)	Min/ROP
5	12	0.16
20	12	0.65
40	12	1.31
60	12	6.57
90	12	9.86

Calculate the Return on Investment (ROI)

- Inventory Reduction $$$
- Stock-Outs
- Stock Turns
- Carrying Cost Reduction
- Reduction in Lost Production
- Reduction in Scrap Costs

Calculate the Return on Investment (ROI) Continued

Carrying Costs	Ordering Costs
• Salaries • Taxes • Building Expenses • Opportunity Costs • Obsolescence Costs • Shrinkage Costs • Third Party Costs	• Salaries • Office Expenses • IT Costs • Administrative Costs • Legal Costs
20-30% of Inventory Value	$75-$150 per PO

Summary

- Identify what type of part you have
- Build a risk framework
- Focus on the vital few
- Evaluate stocking levels
- Implement the changes
- Document the ROI

Questions

QUESTIONS?

Thank you!

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Additional references:

- https://info.eruditiollc.com/reliability-resources

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Next webinar August 4: FMEA

BEST PRACTICE WEBINAR

Wednesday, August 4, 11 a.m. ET

How to use Failure Modes and Effects Analysis (FMEA) to get the reliability you need

For every action taken to maintain a piece of equipment, a Failure Mode—or cause of failure—is managed. That is why a Failure Modes and Effects Analysis (FMEA) is an essential part of physical asset management. When done properly, an FMEA helps organizations: 1) Define equipment goals, 2) Identify what could cause Reliability to suffer, and 3) Assign criticality.

Join Nancy as she shares how to avoid common FMEA pitfalls, and how to use a properly executed FMEA to make effective maintenance decisions.

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