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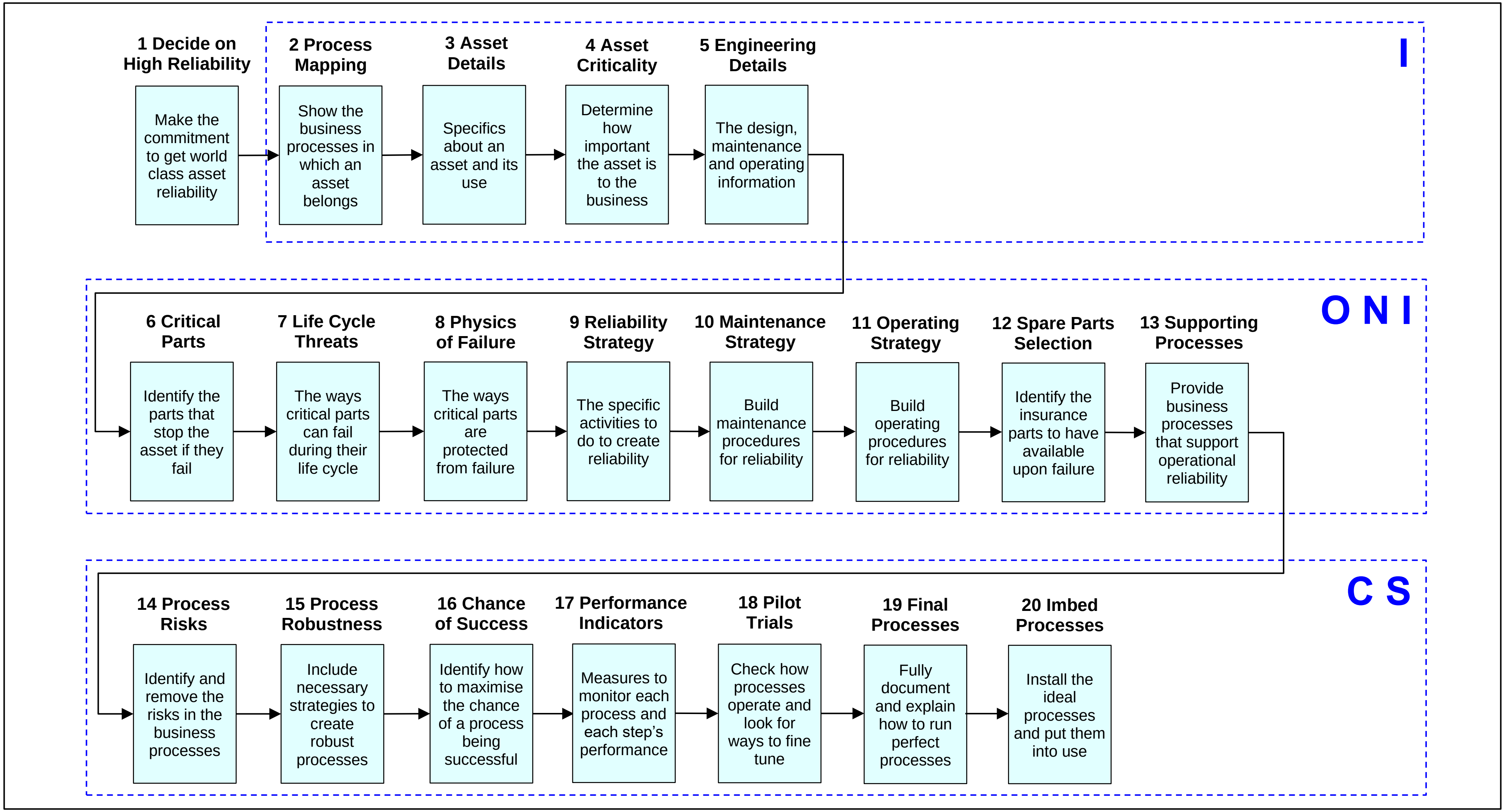
Plant Wellness Way Methods Summary

Let a Plant Wellness Way EAM System-of-Reliability halve your Annual Maintenance Costs

CONTENTS

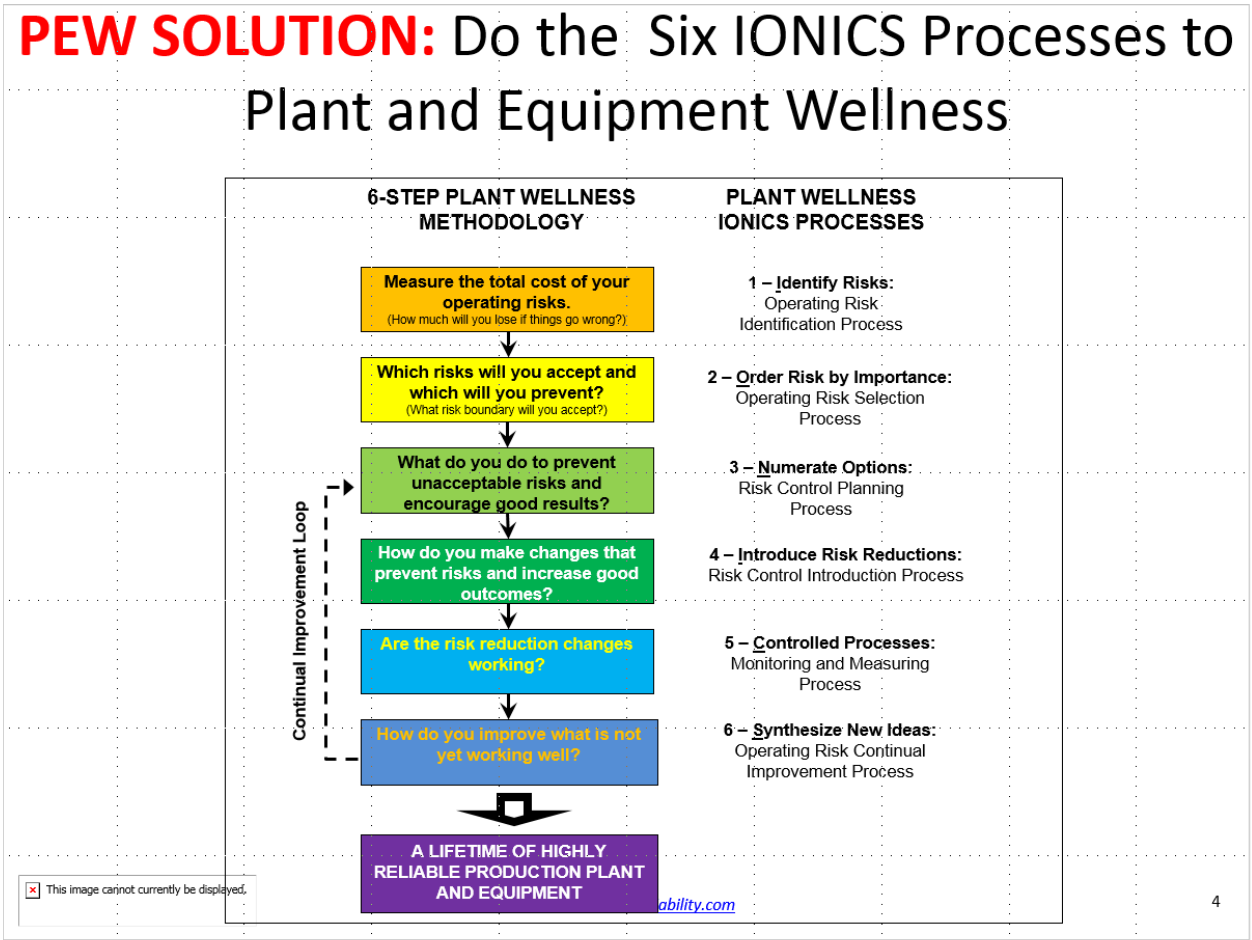
Plant Wellness Way Methodology Six Step IONICS Process Map



1. Decide You Want World Class Reliability

The Plant Wellness Way is business paradigm to create world-class performance and results in any operation by the correct selection and use of engineering, operating, maintenance, and reliability strategy and practices.

The six IONICS steps are used to develop lifecycle asset management, reliability improvement and maintenance management strategy and activities needed for endless operational excellence. Simply identify where you are in the above process map, come in at that point, and then continue on through the process to the point where your answers are available.



There are a range of worked tutorials available at the LRS Global website that further explain and describe various aspects of the Plant Wellness Way methodology. Use them in conjunction with this manual and with the training presentation slides to better understand why and how the techniques of the Plant Wellness Way are used.

I envisaged an extensive book when I started to write this 'Manual'. But I soon realised there is already much material online at the website and in the Licensee Dropbox that people can reference. Another issue was that it's impossible to know what Clients will want done and it made no sense to write a 'manual' for every imaginable situation. It would be massive but most of it would not be useful for the circumstances being confronted.

Like any new method, you have to use it to get comfortable using it. Which again means a big 'manual' is not going to be much use since the analysis methods we use are imbedded in simple spreadsheets that are self-explanatory once you know the PWW concepts and techniques.

Licensees who understand how to use the techniques and methods of PWW can pick the appropriate method for the situations they confront. Once you start using the analysis spreadsheets it will become easy and straight forward for you to apply the PWW methods they contain.

2. Asset Lifetime Details

The Plant Wellness Way produces highly reliable plant and machinery because it identifies how to create individual equipment component health and insures the required means and actions are applied. As each part in each assembly is made to work properly at the least material-of-construction stresses it is highly reliable for its entire operating life and so the whole equipment item becomes highly reliable for its entire service life.

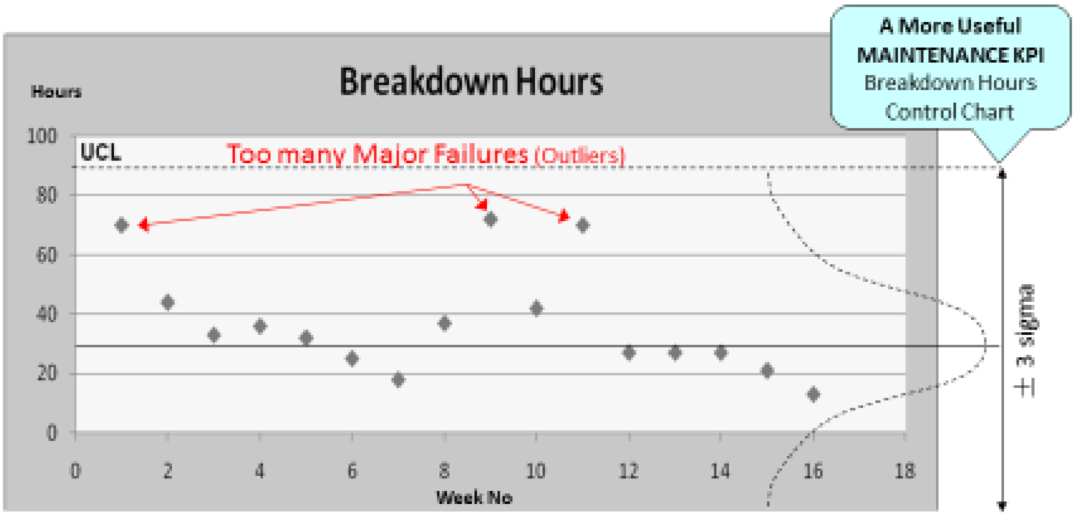
Describe the asset and understand its required duty and service life.

- Tag or Equipment Number
- Asset description
- Asset Criticality (highest rating from Step 2 – Asset Criticality)
- Asset location
- Asset purpose and required operational output(s)
- Installed new or second-hand? If second-hand, where was it used prior to this operation?
- Date installed in the operation
- Frequency of use during current service life
- Sub-assemblies (Children)
- Sub-assemblies Tag or Equipment Number (if used)
- Sub-assemblies description
- Histories of failures in this Asset
    - At the operating site (list in PM10 spreadsheet format)
    - Types of failures similar assets experience in the industry (list in a separate spreadsheet)

Asset Failure Frequency Distribution

- Create the failure run chart, i.e. the failure timeline, for each important asset for its entire service life to-date. Where possible identify the cause(s) of each failure event. You may need to look at the operating history in log books, the maintenance history in the CMMS and shift logs, and even conduct interviews with knowledgeable operations and maintenance personnel.
- Develop a failure event frequency distribution curve for the asset using the failure history timeline
- Identify which failure types and/or causes occur too often

PEW SOLUTION: Measure the Business Process' Statistical Stability and Capability



This is a statistically stable process of breakdown creation – **this business makes breakdowns as one of its 'products'.**

"TO GET BETTER RESULTS YOU MUST CHANGE TO A BETTER PROCESS."

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3. Asset Criticality

Because the use of organisational resources need to be prioritised so as to maximise the benefits from their use, it is necessary to know the degree of importance each item of equipment has in an operation.

Identify the business-wide impacts of each asset's failure. Develop the Criticality Analysis using the worksheet titled: *Equipment_Risk_Assessement_Spreadsheet*

- Risk based analysis using ISO 31000 Risk Management Guidelines
    - Ensure the client's risk matrix is mathematically correct and if not convert it to one that applies $\log_{10}$-$\log_{10}$ in a mathematically correct fashion
    - Expand the client's risk matrix into at least a 16x13 $\log_{10}$-$\log_{10}$ layout; preferable use proper $\log_{10}$-$\log_{10}$ axes.

- Develop an 'operating risk window' on the client company's risk matrix from worst possible impact event to least impact event. Consider range of business impacts from its failure, including safety, financial, environmental, operational, etc.
    - Use DAFT Costs of each event in the criticality analyse
    - Downtime from each event (least to maximum duration)
    - Include 'acts of God' where such are possible, e.g. lightening, floods, earthquake, tornado, etc.

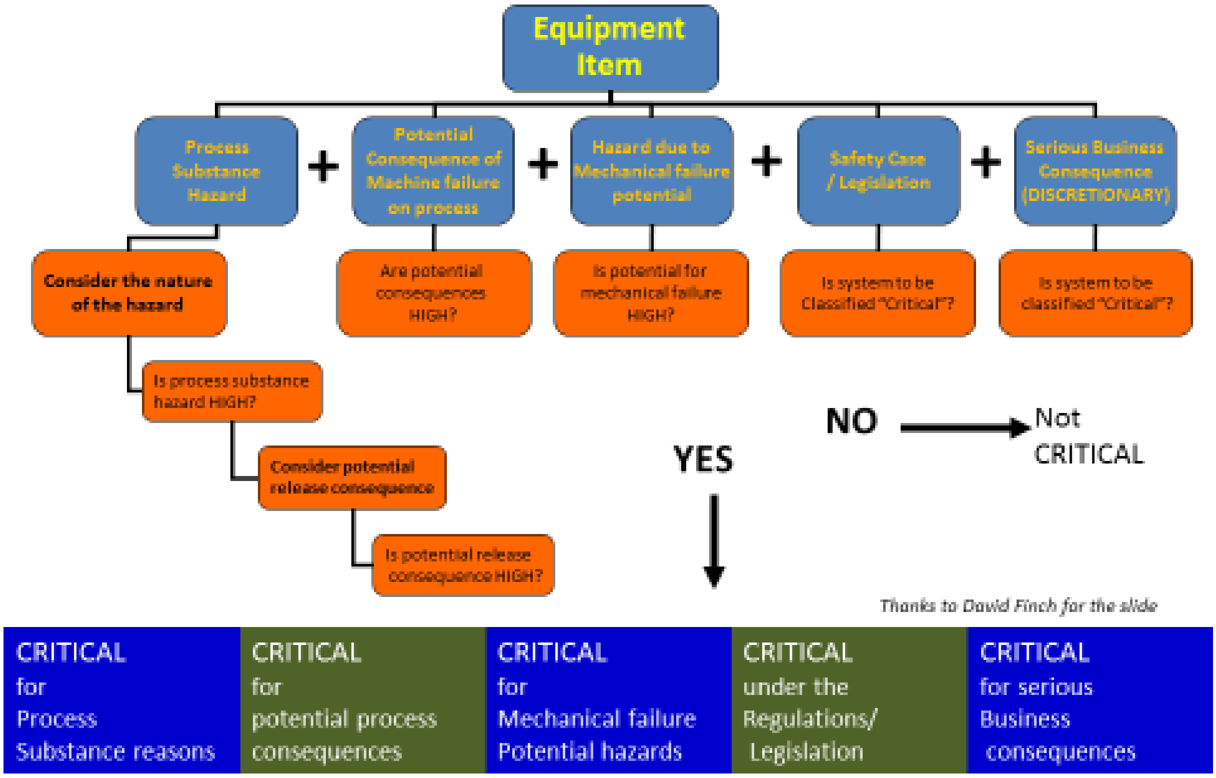
- Take into consideration the knock-on impacts of an asset's failure
    - What else stops when the asset fails?
    - Would subsequent harm to personnel, environment, etc. also occur?
    - What redundancy exists for the asset?
    - Time taken to supply failed parts once order is placed?

Sub-Assembly Criticality

Due to the size and complexity of an asset it may be necessary to separately investigate its sub-assemblies.

- Repeat the above for each of the sub-assemblies (Children)

Equipment Criticality Includes All Risks



4. Asset Engineering Design, Drawings, Manuals and Parts Lists

It is necessary that the construction, use and correct performance of an item of equipment is fully understood at the design engineering level.

Gather together all the technical, maintenance and operational information about the asset, such as equipment manufacturer's information, manuals, drawings, etc.

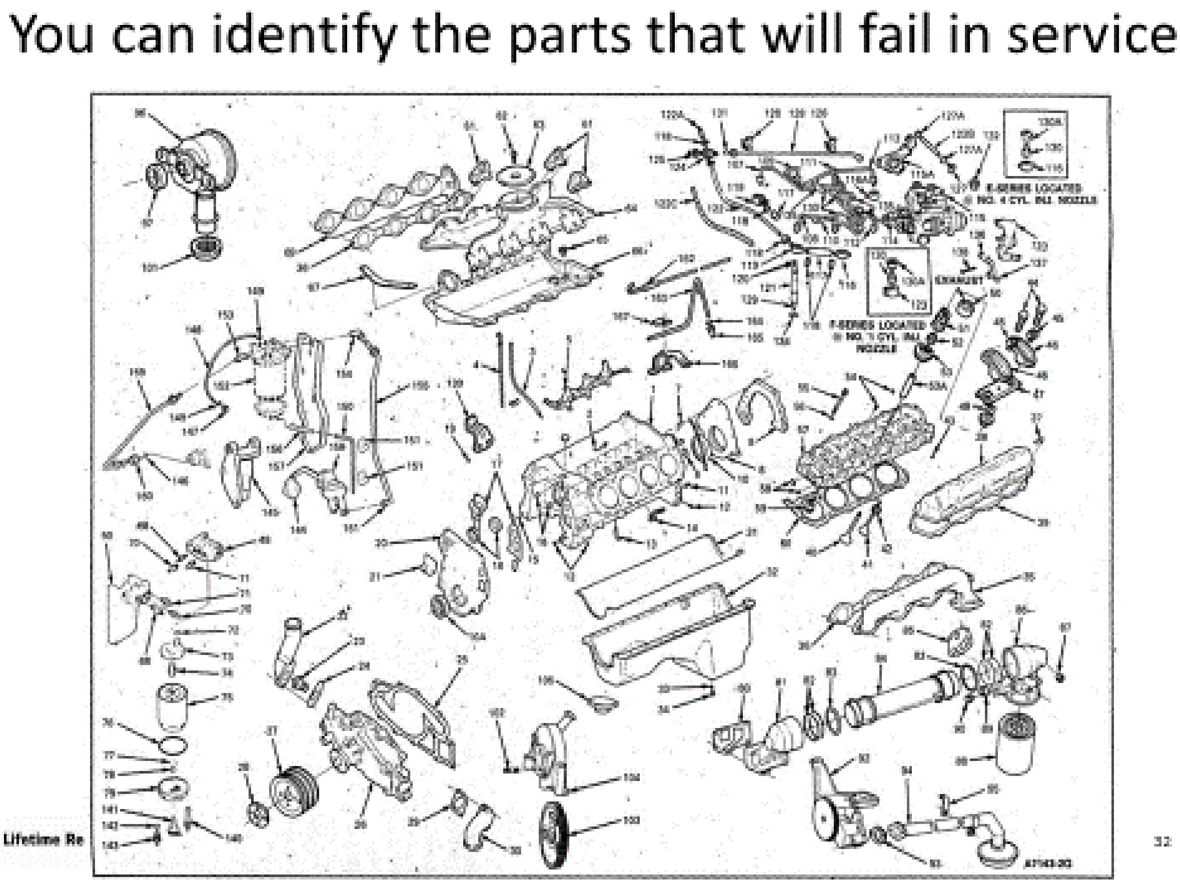
- Service duty when in use
- Design data, e.g., max/min pressures(s), max/min flow(s), max/min temperature(s), max/min hours of operation, etc.
- Operating and Maintenance Manuals
- General Assembly Drawings
- Identify all sub-assemblies
- Identify all parts
- All parts materials-of-construction

5. Identify the Critical Parts

Identify the parts in an asset where their failure would stop the asset operating—these are called critical parts. They are often the working parts, or the moving parts, in the asset. They can also be the structural components and/or the fastening components.

Record this information using the Physics of Failure (PoF) spread sheet titled: *PoF_Strategy_with_8_Lifecycle_Questions*

- Identify on the Bill of Materials list those parts that cause adverse production impacts if they fail
- Rate each critical parts' risk to the operation using the method in Step 2 – Asset Criticality – using the asset's failure history and DAFT Costs



6. Critical Part Life Cycle Threats

No failure happens by magic. Equipment is failed. Every plant and equipment failure event in an operation is never caused by only one reason, always there are many more than one cause for the failure. Every failure will have definable and clear scientific explanations for its causes. But the latent causes of a failure are not so easy to find and fix as are the scientific causes.

A root of failure can happen anywhere in the life cycle and remain a defect to cause a failure at any future point in the life cycle when the necessary trigger events occur.

You now need to identify **if** failures can happen to each critical part in the Client's operation due to normal usage, random events, infant mortality, human error, and wear-out aging. If a part can fail it becomes necessary to explore what events across its lifecycle could happen to become the root causes of the failure (this will be done in the following Step 7).

Answer the 8 Lifecycle Questions

Complete the *PoF_Strategy_with_8_Lifecycle_Questions* spreadsheet with the answers to the 8 Life Cycle Questions for each critical part

PEW SOLUTION: 8 Life Cycle Questions

There are eight questions to be answered during the Life Cycle Impact analysis. These are listed below.

Economic Factors

1. Are the business-wide DAFT Cost consequences of an equipment failure acceptable?
2. Where failure is acceptable how frequently can it occur before it becomes unacceptable?

Physics of Failure Factors of Parts Failure

3. How can the part's atomic/microstructure structure be overstressed?
4. How can the part's atomic/microstructure structure be fatigued?
5. How can the part's atomic/microstructure structure be degraded?

Organisational Factors in Parts Failure

6. Will/What human error/factors allow the part to fail?
7. Will/What business processes allow the part to fail?
8. What design dependencies/issues allow the part to fail?

The answers to the economic factors determine if an analysis is required for the equipment. Where the failure of an item of equipment is unimportant the default decision is to run-to-failure and rectify the situation in a timely manner suited to the operational needs.

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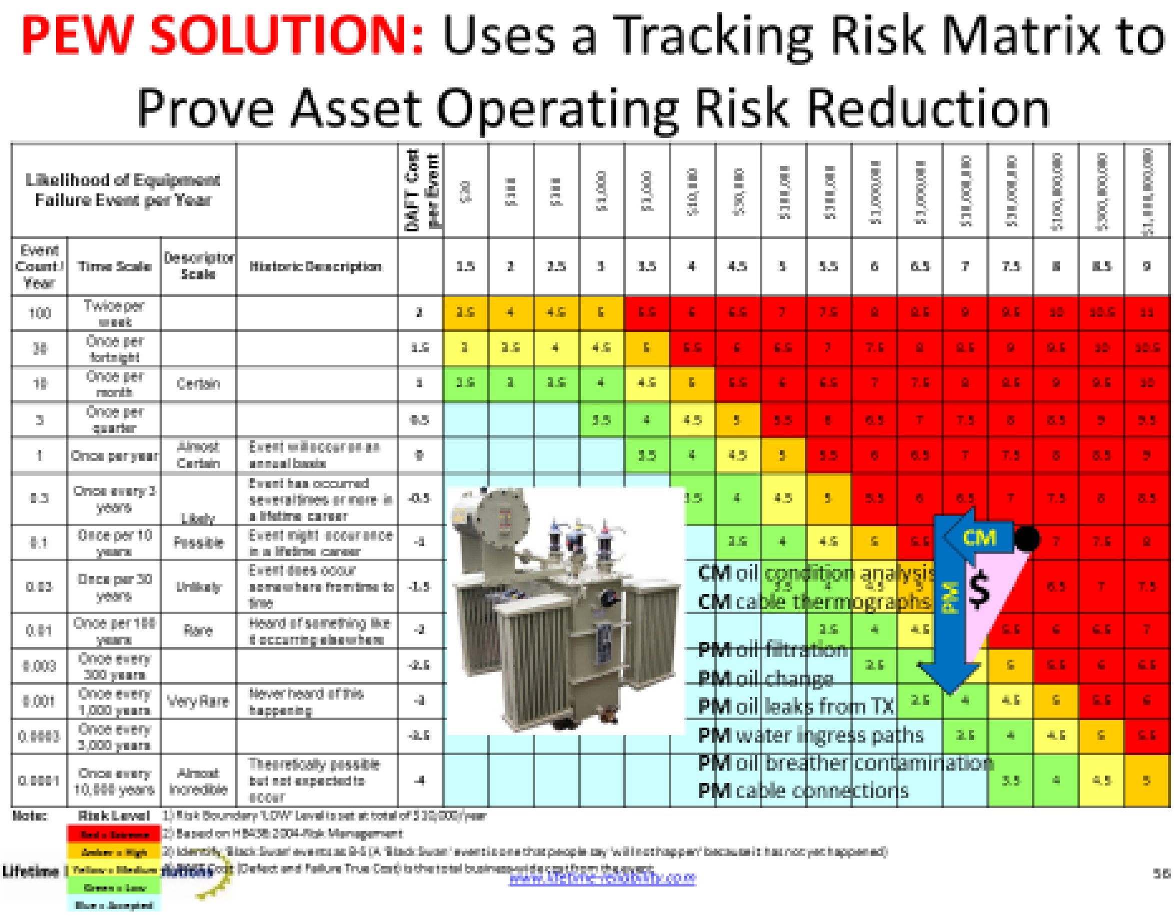
Risk to Critical Parts Operating Life

You want to gain a good understanding of the opportunities and situations when critical parts can fail and the circumstances that lead to a component's various ways of failing. It is highly likely that you will find the same component types in the equipment used in an operation tend to fail in a limited number of ways and they repeat from equipment to equipment. This means you will eventually be able to copy and paste the same causes against many assets.

For each critical part identify if they can be failed from:

- Early Life Failures occurring from situations such as;
  - Manufacturing error
  - Human error during rebuild
  - Human error during installation
  - Human error during commissioning
- Random events, including:
  - extreme stress events
  - cumulative stress events
- Failures from asset usage, e.g. filters will block, brake pads will wear-out, etc.
  - Causes of a part's failure during operation
  - Hours of operation, number of times used, and/or production throughput between failure events
- Potential and extent of materials-of-construction fatigue
- Potential and extent of materials-of-construction wear-out (Aging)

You can show on the client's risk matrix the risks they carry in their company from their equipment parts failure when the above situations arise.



7. Physics of Failure Reliability Analysis

For those parts that currently carry unacceptable operating risk from their failure it is necessary to identify the situations where excessive stress from deformation during the life cycle and/or excessive stress from degradation during its operating life can arise to cause each risk event.

For each critical part list all the possible causes of the causes of its failure in the spread sheet titled: *PoF_Strategy_Development_Template*

- Use the Physics of Failure guideword list to identify what events can cause a critical part's failure from deformation or degradation
- During each life cycle phase
- Do it for each potential failure event identified in the 'Critical Part Life Threats' Step

8. Reliability Strategy by Equipment Part

Your aim is to minimise the stress in critical parts at every stage of their life cycle by selecting effective mitigations to apply at each phase of life. To identify what can be done to achieve maximum reliability for the whole operating life we define a zone of outstanding operation for each critical part based on using the Precision Maintenance criteria noted in Table 1 below. We want the part to always remain within its world class reliability 'window' and we therefore will select engineering, maintenance and operating activities, practices and monitoring that insure and prove a component suffers the least stress possible in every situation it is used.

To allow for the effects of probability we set the 3T (Target – Tolerance – Test) quality values of:

- A Target Value (ideally this is world class performance, or else it is a magnitude better performance than 'average' performance)
- A maximum to minimum Tolerance Range (the minimum is that value specified by the original equipment manufacturer in their manuals).

In the case of dimensions, instead of specifying each part's specific tolerance values, you can use International Tolerance Grade Numbering, as this automatically allows for changes in sizes and distances.

Though the list below applies to mechanical equipment, the intention of each requirement can be extrapolated to address other types of parts, including electrical and electronic items.

Item	Description	3T Quality Criteria
1	Accurate Fits and Tolerance at Operating Temperature	
2	Impeccably Clean, Contaminant-Free Lubricant Life-long	
3	Distortion-Free Equipment for its Entire Lifetime	
4	Shafts, Couplings and Bearings Running True to Centre	
5	Forces and Loads into Rigid Mounts and Supports	
6	Collinear Alignment of Shafts at Operating Temperature	
7	High Quality Balancing of Rotating Parts	
8	Low Total Machine Vibration	
9	Correct Torques and Tensions in all Components	
10	Correct Tools in the Condition to do the Task Precisely	
11	Only In-specification Parts	

Table 1 Necessary Health Conditions for Mechanical Parts

The answers to these criteria for each critical part in an item of equipment become the operating, maintenance and reliability strategies to be adopted for the component during its lifetime. The sum of an equipment's parts strategies become the asset's lifecycle management strategy. All the parts' strategies will be detailed in the asset's associated operating, maintenance and reliability procedures and other relevant documents.

PEW SOLUTION: Outstandingly Reliable Machines Require…

REQUIREMENT	TARGET	TOLERANCE
1. Chemically correct, Contaminant-Free Lubricant	Right Viscosity; <100ppm water; ISO12/9	<14/11
2. Accurate Fits and Tolerance at Operating Temperature	Form IT5, Temperature to design	<IT7
3. Shafts, Bearings and Couplings Running True to Centre	IT5	<IT7
4. Distortion-Free Equipment for its Entire Lifetime	IT5	<IT7
5. Forces and Loads into Rigid Mounts and Supports	No Looseness; Safely absorb/dampen forces	
6. Accurate Alignment of Shafts at Operating Temperature	Coupling/Feet offset <10µm/20µm	<20µm/40µm
7. High Quality Balanced Rotating Parts	<G1	<G2.5
8. Total Machine Vibration Low	<1.5mm/s rms	<2.5mm/s
9. Correct Torques and Tensions in all Components	±5% of correct tension	<±10%
10. Correct Tools in Precise Condition to do Task to Standard	As new condition/calibrated	
11. Only In-specification Parts	OEM approved material and design specs	
12. Precision Skills and Techniques	Competence to deliver precision standards	
13. Failure Cause Removal during Maintenance	Creative Disassembly; Precision Assembly	
14. Proof Test for Precision Assembly Quality	Every task proven correct	Milestone Checks
15. A quality assurance system to make all above happen	ACE 3T Quality System	ITP (Inspection & Test Plan)

NOTE: These parameters are indicative of 2, 4 and 6 pole speed machinery. They may not apply to your particular machines. Confirm minimum requirements with the manufacturer.

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PEW SOLUTION: Develop and Use Reliability Creating ACE 3T Error Proof Procedures

Build ACE 3T Mistake Proofing into SOPs

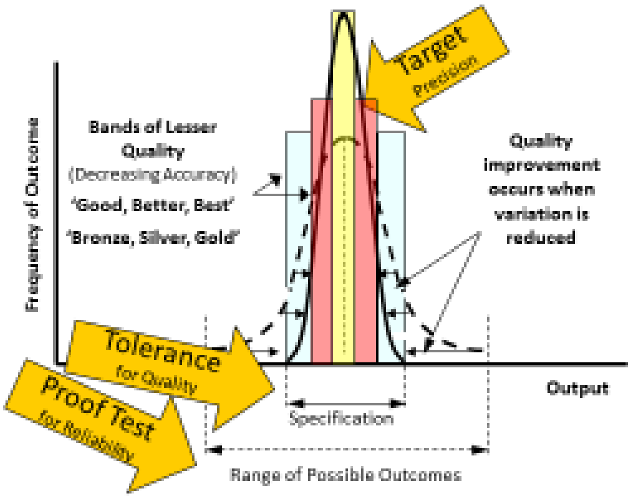
- Set a target for each task.
- Specify the acceptable tolerance.
- Do a test to prove accuracy.

3Ts of Failure Prevention…

. Target

. Tolerance

. Test



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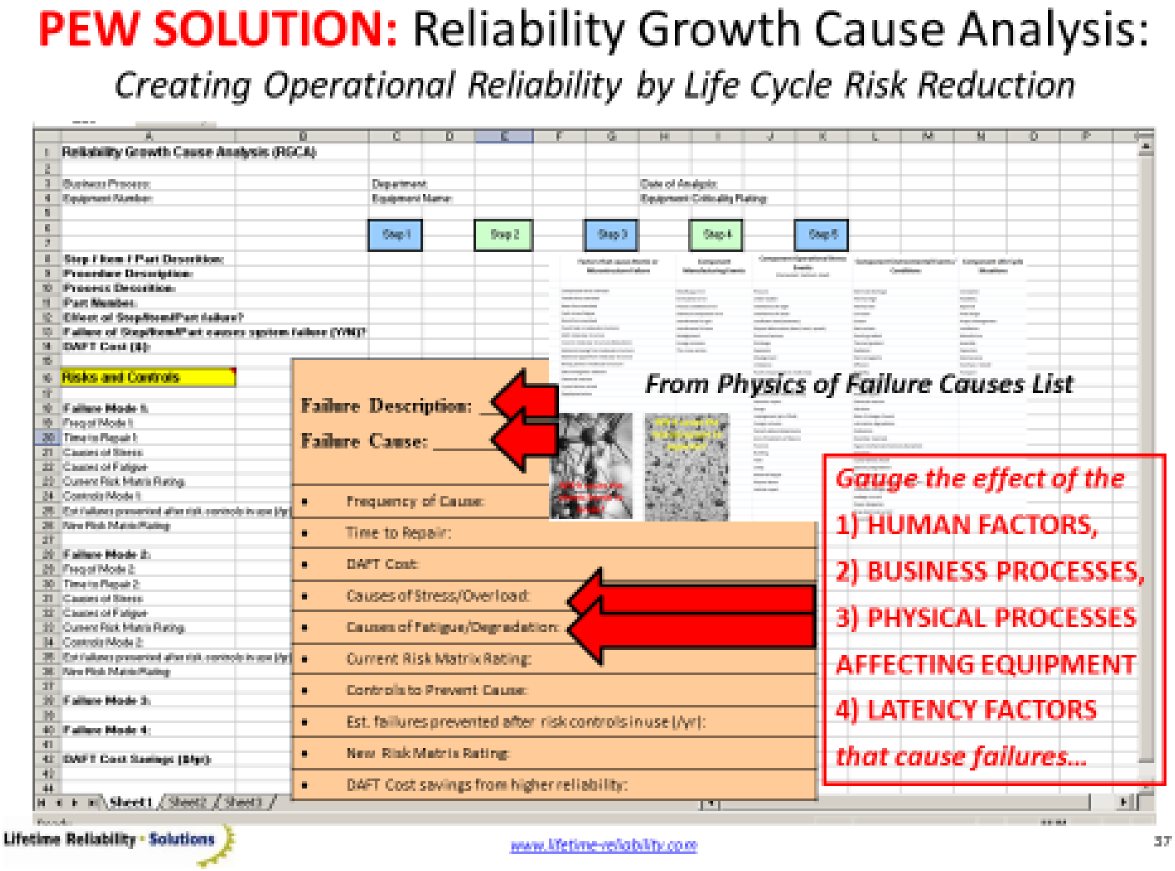
Reliability Growth Cause Analysis

This technique is used to identify the entire range of reliability creation options available to make a part survive for its maximum possible service life.



9. Maintenance and Installation Strategy by Part (Deformation Management)

The requirements are to have all equipment parts in their least stress condition when under operation and to sustain those conditions throughout the equipment's service life.

Develop the answers for each critical part in the PEW maintenance and installation strategy spread sheet titled: *PoF_Strategy_Development_Template*

Where Laws and Regulations apply to an asset, e.g. cranes, pressure vessels, lifts, etc., include the necessary maintenance requirements into an additional column in the spread sheet.

- For each critical part identify:
  - Necessary health conditions for the part, e.g. precision tolerance range, temperature range, moisture/humidity range, etc. The information identified in response to the list of 3T quality parameters required by Table 1 in Step 8 will satisfy this requirement
  - Necessary health conditions of neighbouring parts in contact, e.g. surface finish, temperature range, etc.
  - Likelihood that the health conditions will be achieved during installation
  - Likelihood that the health conditions will be sustained during operation
  - What installation and maintenance opportunities can arise to cause deformation, e.g. installation during construction, overhaul during service life, major failure requiring rebuild, etc.?
  - How frequent will the identified installation and maintenance opportunities for deformation arise?

- Check the Physics of Failure Guidewords to confirm all situations are identified and covered by a suitable and effective strategy for the part, and also for its neighbours.

Develop Maintenance Procedures

For each critical part put the required controls needed for each cause of deformation into a written 3T (Target-Tolerance-Test) maintenance procedure to create a component with low stress in a healthy environment.

In time a library of procedures for component health will accumulate to be used repeatedly in future for those assets where critical parts suffer the same situations and threats of failure.

Identify Work-Around on Failure

Where there are means to minimise the production impact of an asset's failure, then list and explain the options(s), e.g. redundancy; hire mobile equipment; transfer production to another line; etc.


PEW SOLUTION: 'Component Stress to Business Process' Asset Management Model
Reliability Engineering
Human Capability Management
Document & Configuration Management
Learning Organisation
Capital Project Management
Business Risk Management
ACE Quality Standards
ACE Quality Management
Knowledge Management
Business Process Improvement
Integrated Business Systems
ACE Precision Standards
Planning and Scheduling
Life Cycle Costing
ACE Engineering Standards
ACE Operation Standards
Lean Workplace Practices
Supply Chain Management
Stores & Materials Management
Operating Risk Reduction
Precision Maintenance Skills
Robust Engineering Design
Materials of Construction Selection
Precision Operator Skills
Total Productive Maintenance
Preventive Maintenance
Predictive Maintenance
ACE 3T Precision Installation
Proactive Maintenance
ACE 3T Precision Operation
Parts' Environment Management
Operating Stress Reduction
Distortion Management
Degradation Management
Failure Cause Prevention
Equipment & Parts' Health
(Low Atomic Stress)
ADOPT DEFECT ELIMINATION STANDARDS AND PRACTICES
DEVELOP EQUIPMENT RISK REDUCTION STRATEGIES
DEVELOP ACE 3T MAINTENANCE PROCEDURES
START HERE
for world-class system
INCORPORATE RELIABILITY REQUIREMENTS INTO BUSINESS PROCESSES
DEVELOP ACE 3T OPERATING PROCEDURES
IMMEDIATELY INTRODUCE STRESS REMOVING BEST PRACTICES
(Series Property #3)
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10. Operating Strategy by Part (Degradation Management)

The requirement is to have all equipment parts in their least stress condition when under operation and sustain those conditions throughout the equipment's service life.

Develop the answers for each critical part in the PEW maintenance and installation strategy spread sheet.

- For each critical part:
  - Necessary operating conditions for the part, e.g. operating pressure range, operating temperature range, operating moisture/humidity range, etc.
  - Likelihood that the operating conditions will always be achieved
  - Likelihood that the operating conditions will be sustained during service life
  - What operating opportunities can arise to cause degradation, e.g. change-overs, process disruptions, poor raw material, contamination, etc.?
  - How frequent will the identified operating opportunities for degradation arise?

- Check the Physics of Failure Guidewords to confirm all situations are identified and covered by a suitable and effective strategy.

Develop Operating Procedures

For each critical part put the required controls needed for each cause of degradation into a written 3T (Target-Tolerance-Test) operating procedure to create a component with low stress in a healthy environment.

In time a library of procedures for component health will accumulate to be used repeatedly in future for those assets where critical parts suffer the same situations and threats of failure.

Identify Work-Around on Failure

Where there are means to minimise the production impact of an asset's failure, then list and explain the options(s), e.g. redundancy; hire mobile equipment; transfer production to another line; etc.


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11. Spares Selection by Part

The spare parts required to be speedily available are chosen based on the operational risk from a part's failure.

Develop the answers for each critical part in the PEW maintenance and installation strategy spread sheet.

- Determine the DAFT Cost consequence of a critical part's failure, allowing for what work-around is available to the client
- Frequency of a critical part's failure:
  - in the operation
  - in the industry
- Time for Supplier to deliver replacement part when ordered
- Risk reduction if part is available in a timely manner.

12. Supporting Business Processes

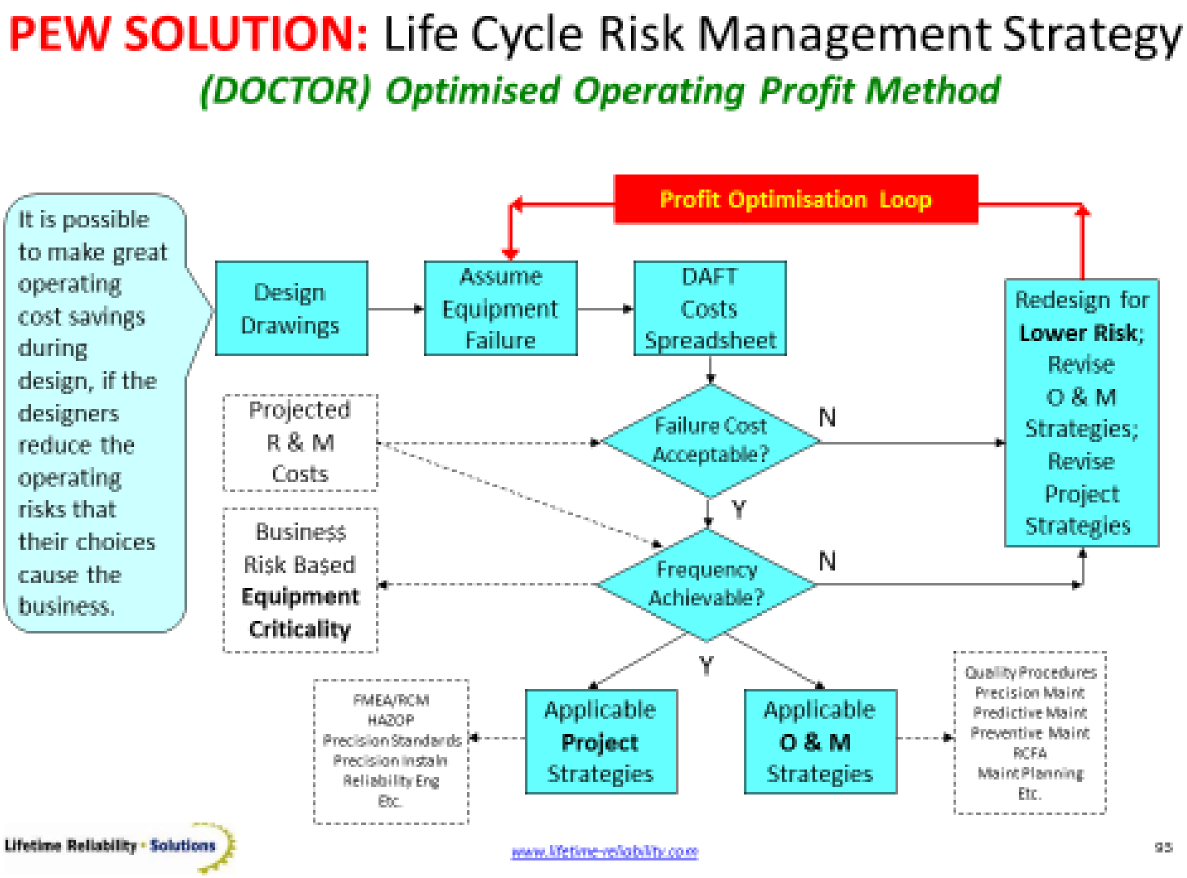
We use the 'Stress to Process' model to identify who must be involved throughout the organization to insure the integrity and security of the asset and its critical parts for both degradation management and deformation management during:

1) Design selection
2) Manufacturing
3) Procurement and delivery
4) Initial installation
5) Throughout its service life
6) Decommissioning and disposal

- Develop the answers for the lifecycle of each asset in the PEW maintenance and installation strategy spread sheet titled: *PoF_Strategy_Development_Template*
    - By critical part
    - By skill set and minimum competence
    - By Role or Function
    - By Department
- Also identify all those documents that are to contain each of the necessary lifecycle strategies, actions and monitoring, e.g. procedure, work instruction, duty statement, etc. so ownership of responsibilities are clearly allocated. The same information can be required to reside in more than one document.

Design and Operating Costs Totally Optimised Risk (DOCTOR)

The DOCTOR business risk assessment it to be immediately introduced into all capital projects and plant change projects.



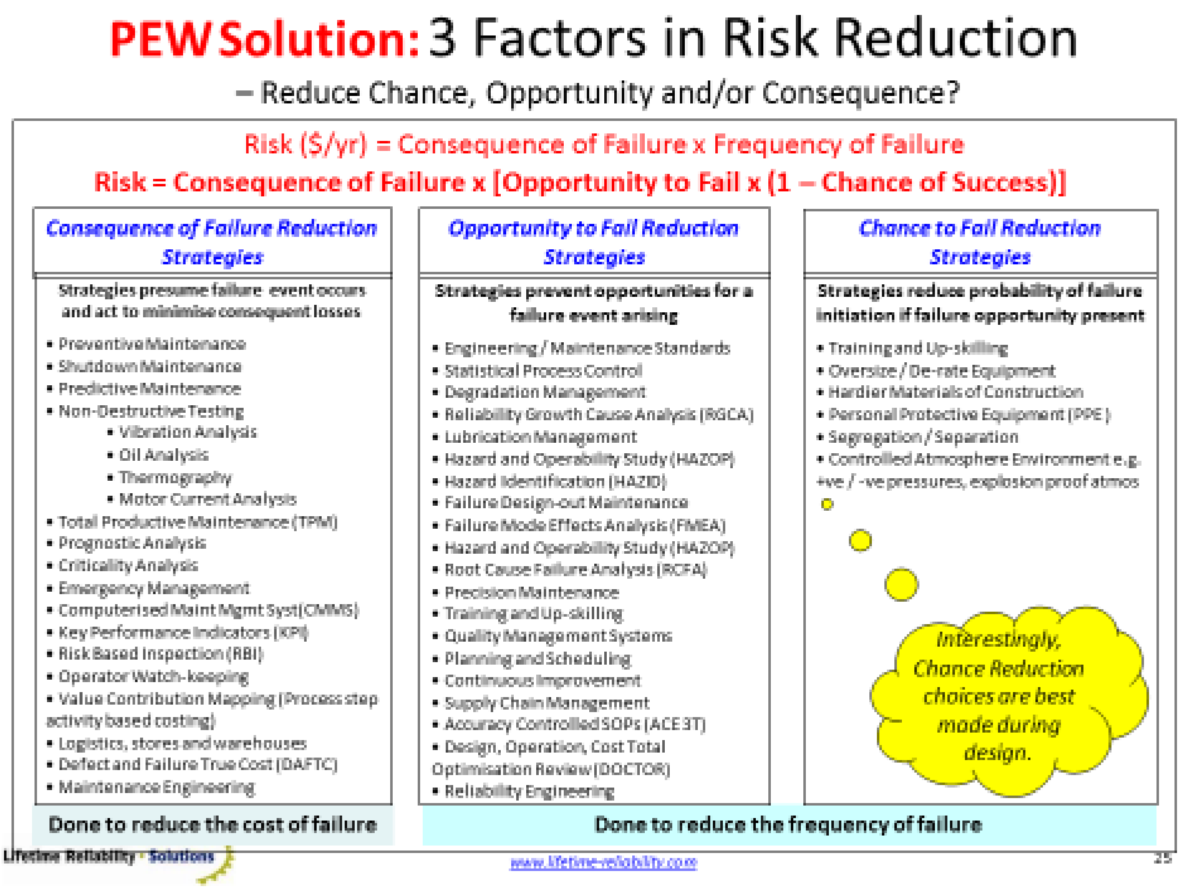
13. 3-Factors Risk Analysis of Processes

In this step we check to see what situations, scenarios and events can arise in the operation to cause the failure of any critical parts in an asset. Once potential problems are identified strategies to SUBSTANTIALLY reduce the risk can be determined and mapped onto a risk matrix to confirm sure risk reduction will occur when the actions are performed as intended.

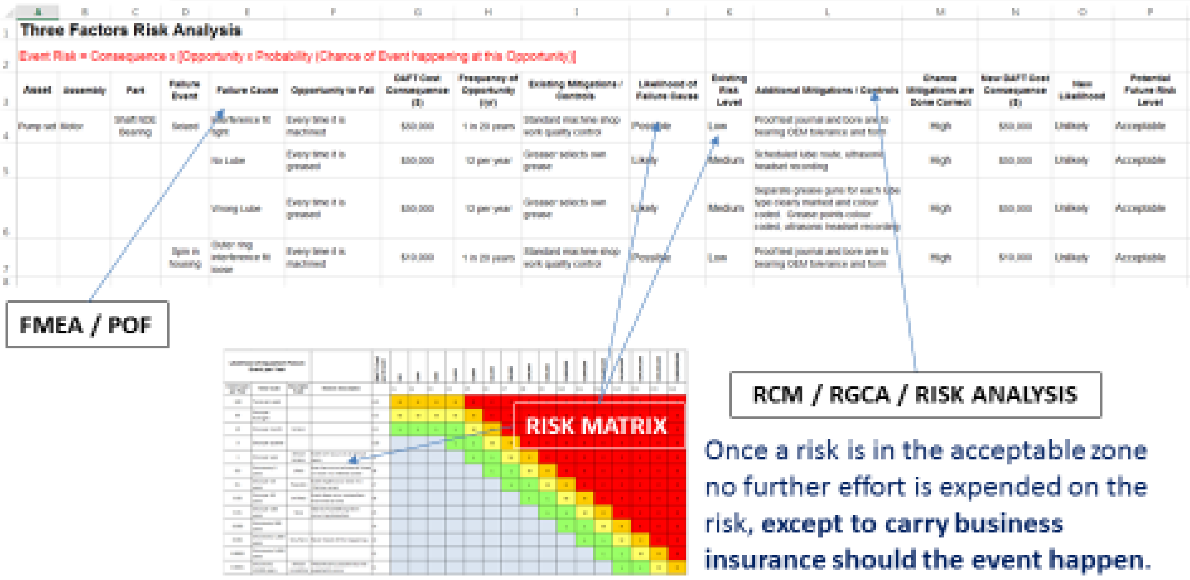
In 3-factors risk analysis risk is divided into its three separate components—consequence, opportunity, and uncertainty—so each element can be more clearly and unambiguously identified so its effects and business implications are better understood: *3_Factors_Risk_Analysis*

The 3-factors risk analysis methodology can be applied to address the risks in:

- A complete asset
- Sub-assemblies
- Parts and components
- A business process and its individual steps
- Work procedures



PEW Solution: 3 Factors Risk Analysis Optimization



Three Factors Risk Analysis

Event Risk = Consequence x [Opportunity x Probability (Chance of Event happening at this Opportunity)]

Asset	Assembly	Part	Failure Event	Failure Cause	Opportunity to Fail	DAFT Cost Consequence ($)	Frequency of Opportunity (/yr)	Existing Mitigations / Controls	Likelihood of Failure Cause	Existing Risk Level	Additional Mitigations / Controls	Chance Mitigations are Done Correct	New DAFT Cost Consequence ($)	New Likelihood	Potential Future Risk Level
Pump set	Motor	Shaft NDE Bearing	Seized	Interference fit tight	Every time it is machined	$50,000	1 in 20 years	Standard machine shop work quality control	Possible	Low	Proofted journal and bore are to bearing OEM tolerance and form	High	$50,000	Unlikely	Acceptable
				No Lube	Every time it is greased	$50,000	12 per year	Greaser selects own grease	Likely	Medium	Scheduled lube route, ultrasonic headset recording	High	$50,000	Unlikely	Acceptable
				Wrong Lube	Every time it is greased	$50,000	12 per year	Greaser selects own grease	Likely	Medium	Separate grease guns for each lube type clearly marked and colour coded. Grease points colour coded, ultrasonic headset recording	High	$50,000	Unlikely	Acceptable
			Spin in housing	Outer ring interference fit loose	Every time it is machined	$10,000	1 in 20 years	Standard machine shop work quality control	Possible	Low	Proofted journal and bore are to bearing OEM tolerance and form	High	$10,000	Unlikely	Acceptable

Once a risk is in the acceptable zone no further effort is expended on the risk, **except to carry business insurance should the event happen.**

When can you claim a RISK REDUCTION?

1. Stress in component is **substantially** reduced
2. Opportunities for cause are **substantially** removed
3. Probability of cause is **substantially** lowered
4. Consequence is **substantially** less

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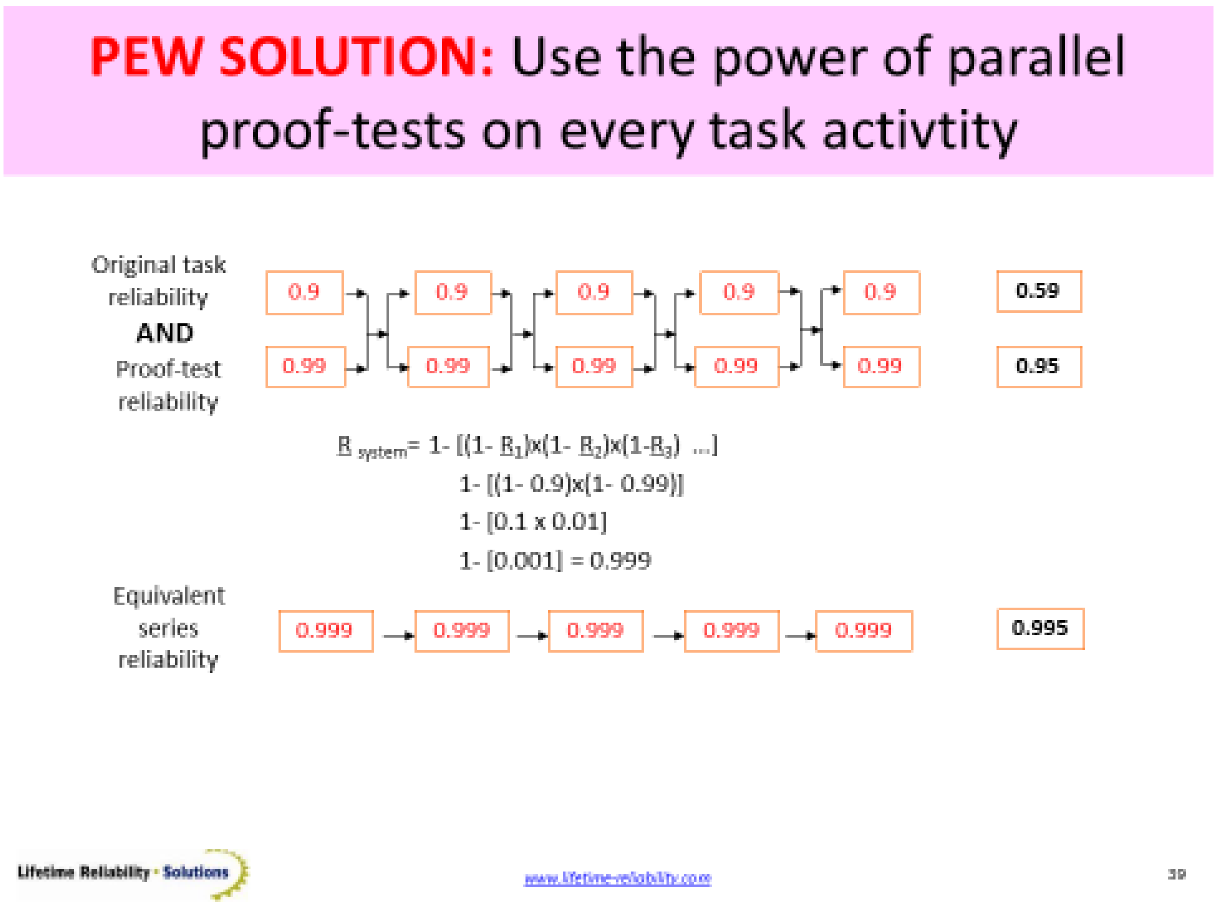
14. Build Process Robustness

Following from the 3-Factors Risk Analysis of Processes, additional means to make processes anti-fragile and robust can be developed and incorporated into current business processes, or new processes developed to support existing weak processes or where this is process weakness.

- Consequence reduction strategies
- Opportunity reduction strategies
- Uncertainty reduction strategies
- Parallel tasks (application of the Carpenter's Creed, 'measure twice, cut once')
- Convert to 3T (Target-Tolerance-Test) activities
- Monitoring and measuring
    - Leading indicators
    - Lagging indicators

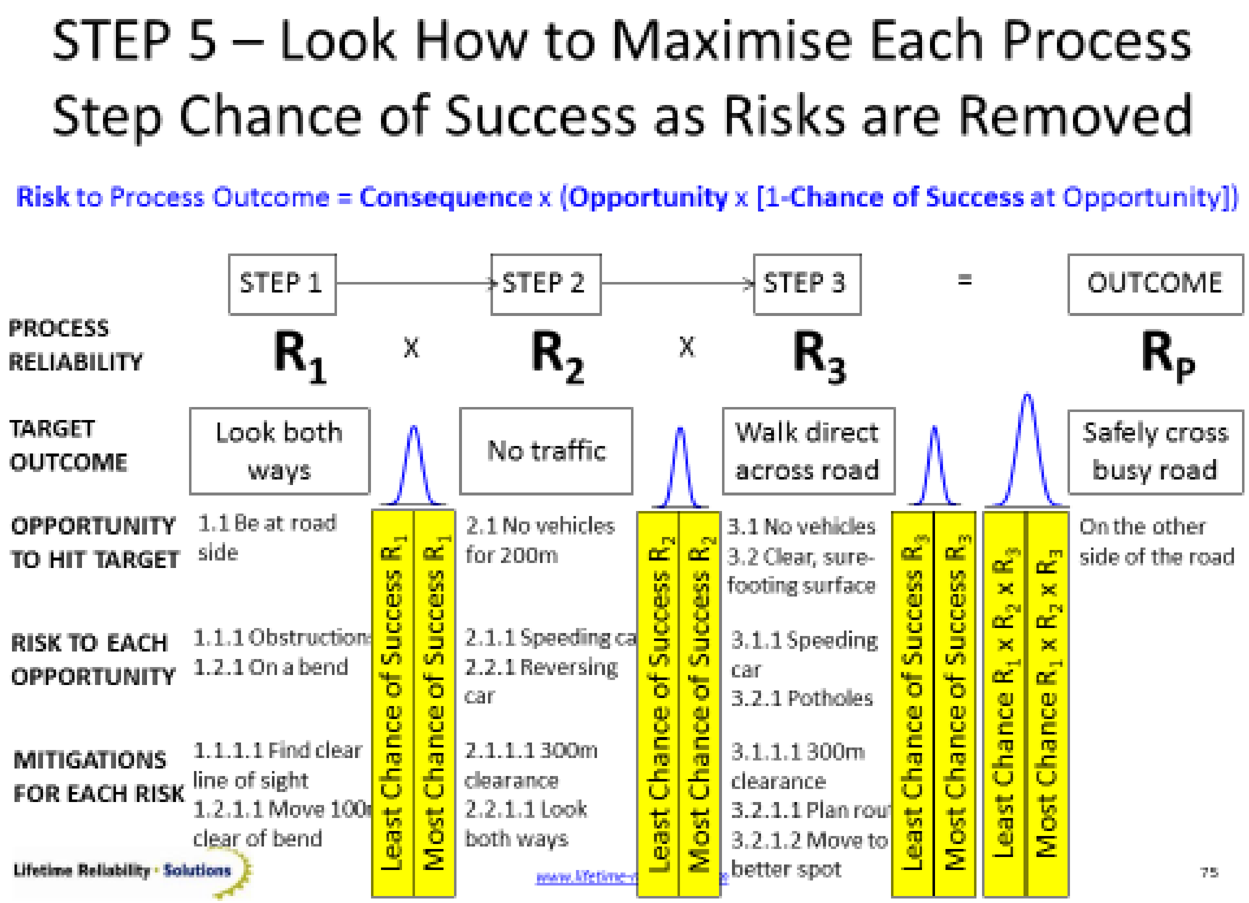


15. Chance of Success Analysis for Processes

Once a process is designed we can test and simulate how often it will work correctly, i.e. we can check its 'capability' to work correctly every time. A business process has risks of failure at each process step. We identify what can prevent a process step being completed correctly. Possible problems that arise in each process step are recorded and a value of the chance of a problem's occurrence is determined from historical data. Processes that have an unacceptably high chance of not working as designed are weak processes and need to be redesigned so as to be much more effective. Processes with weak process steps many be improved by a better process step design.

Develop flow chart for each process or procedure in a separate spread sheet showing all its sequential steps.

- Explain and define the purpose of each step
    - Describe the procedure to do the step
    - Specify the correct step inputs using 3T (Target-Tolerance-Test) format
    - Specify the correct step output using 3T (Target-Tolerance-Test) format
- Identify problems and weaknesses in each process step
    - This can be through the use of risk analysis
- Make probability estimates of each existing process step's chance of success
    - High,
    - Most likely
    - Low
- Calculate the whole current process' chance of success
    - High,
    - Most likely
    - Low
- Propose how to resolve unacceptably weak process steps
    - Introduce 3T (Target-Tolerance-Test) controls
    - Introduce redundancies
    - Introduce effective technology
    - Redesign the step with a more effective procedure
- Make probability estimates of each redesigned process step's chance of success
    - High,
    - Most likely
    - Low
- Apply Bayes' Theorem to determine revised estimate of future chance of success
- Calculate the redesigned process chance of success
    - High,
    - Most likely
    - Low
- Continue developing solutions for weak processes until the chance of success for the whole process is adequately high


STEP 5 – Look How to Maximise Each Process Step Chance of Success as Risks are Removed
Risk to Process Outcome = Consequence x (Opportunity x [1-Chance of Success at Opportunity])
STEP 1
STEP 2
STEP 3
=
OUTCOME
PROCESS RELIABILITY
R1
x
R2
x
R3
RP
TARGET OUTCOME
Look both ways
No traffic
Walk direct across road
Safely cross busy road
OPPORTUNITY TO HIT TARGET
1.1 Be at road side
2.1 No vehicles for 200m
3.1 No vehicles
3.2 Clear, sure-footing surface
On the other side of the road
RISK TO EACH OPPORTUNITY
1.1.1 Obstruction
1.2.1 On a bend
2.1.1 Speeding ca
2.2.1 Reversing car
3.1.1 Speeding car
3.2.1 Potholes
MITIGATIONS FOR EACH RISK
1.1.1.1 Find clear line of sight
1.2.1.1 Move 100
clear of bend
2.1.1.1 300m clearance
2.2.1.1 Look both ways
3.1.1.1 300m clearance
3.2.1.1 Plan rou
3.2.1.2 Move to better spot
Least Chance of Success R1
Most Chance of Success R1
Least Chance of Success R2
Most Chance of Success R2
Least Chance of Success R3
Most Chance of Success R3
Least Chance R1 x R2 x R3
Most Chance R1 x R2 x R3
Lifetime Reliability · Solutions
75

16. Performance Indicators

- Establish process step KPI’s for self-monitoring by ‘owner’ and ‘buddy(ies)’
  - Monitor inputs
  - Monitor outputs
  - Establish frequency distribution curves of step monitoring KPIs
- Establish process outcome KPI’s for regular Senior Management monitoring
- Establish frequency distribution curves of Senior Management KPIs

17. Pilot Test Trials

So far the process is designed to what seems a suitable degree of outcome certainty. Before changing an entire business to the new process the design needs to be tested.

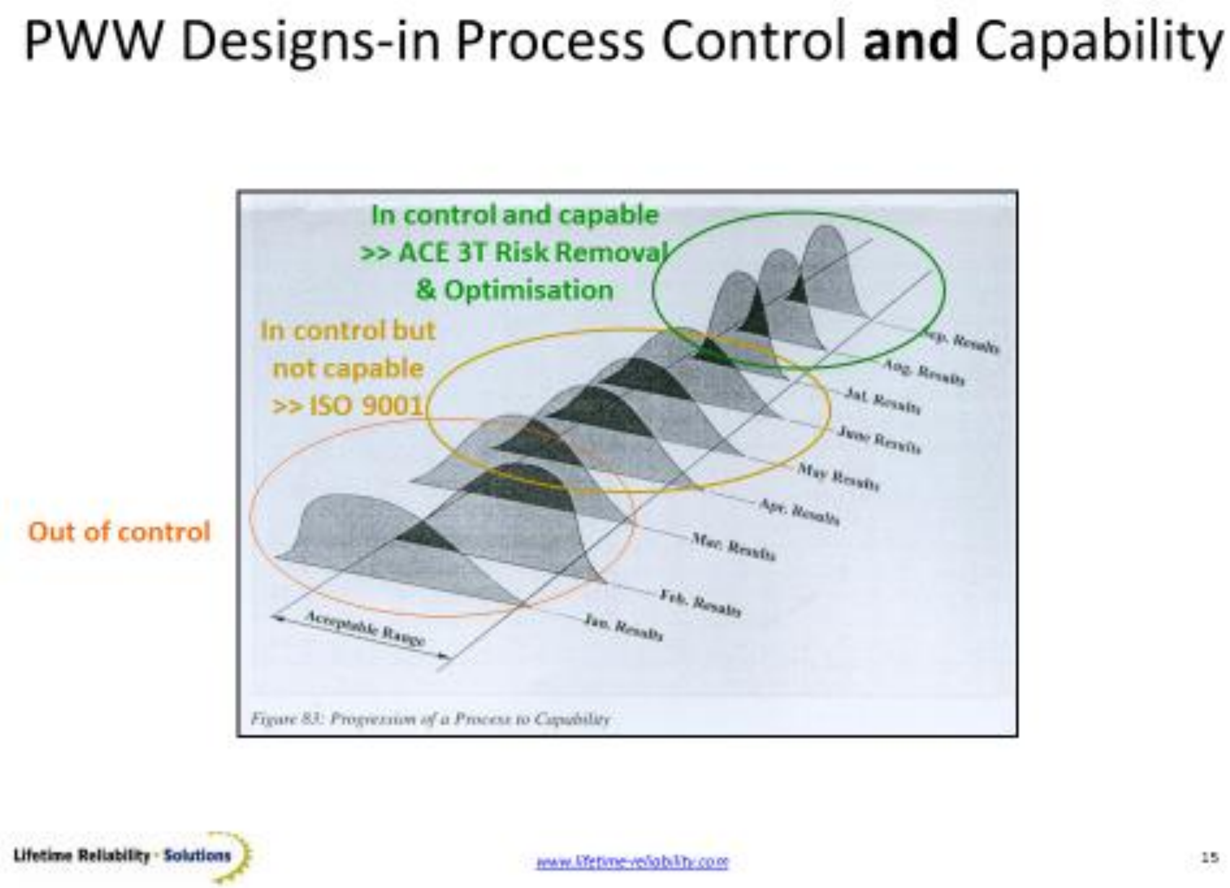
18. Document Final Process Design

Specify and define the complete process in sufficient detail to ensure process control and capability.

For each process:

- Flow chart each level, from top overview down to as detailed as needed to get desired success rate
- Establish procedures, including detailed instructions when risks in process steps justify the need to be meticulous.
- Incorporate 3T (Target-Tolerance-Test) quality assurance
- Identify each process step ‘owner’ who has ultimate responsibility to do the step correctly
- Identify each process step ‘buddy(ies)’ where persons are put in parallel for better process reliability

Continuous Improvement



19. Imbed Final Processes

Plant Wellness Way EAM
Operational Excellence Strategy….

- Creating one single **holistic business system**, to
- Address the **life cycle cost** issues and **reduce variation**, that
- Produces **lowest operating equipment risk profile**, and
- Results in the **least operating costs**, with
- Maximum **life cycle profit** from
- Markedly **reduced human error**, and
- Greatly increased **work quality results**, to
- Deliver the **least maintenance commitment**, while
- Producing the **world class reliability**, that
- Brings **Operational Excellence** performance, forevermore.

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