

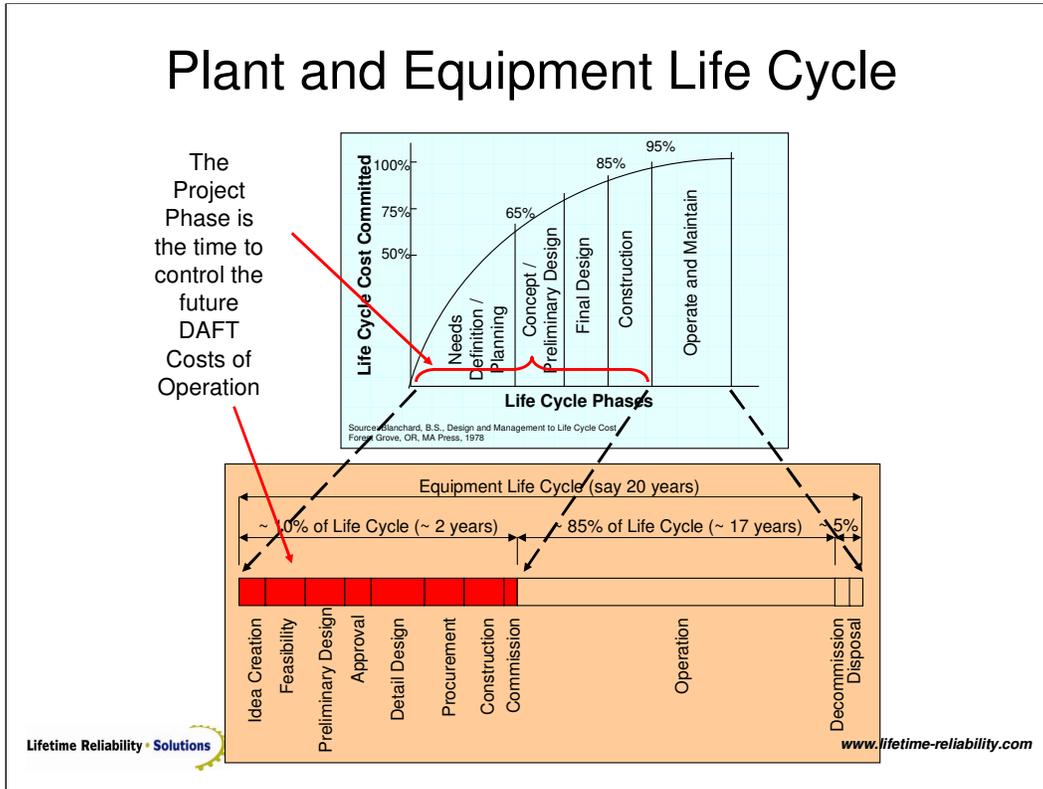
Enterprise Asset Management (*Plant Wellness*)

Welcome to Section 2 – **Implications**

See how the concepts impact your
business and decisions.

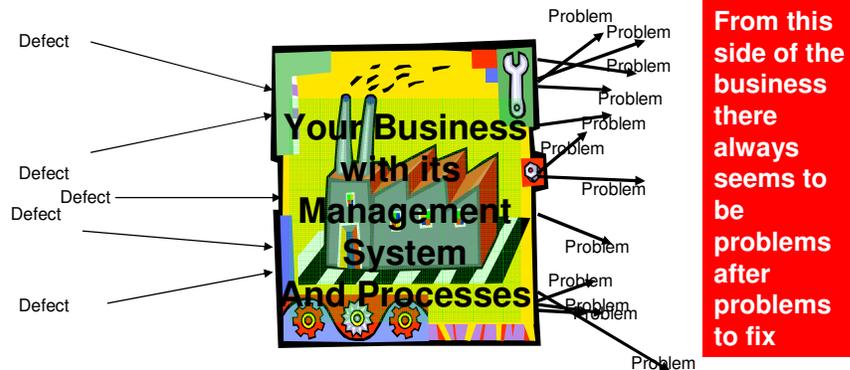
Presented by Mike Sondalini

Plant and Equipment Life Cycle



We return to the realisation that the work done on maximising reliability during the project phase is the most important in getting high plant and equipment availability during the rest of the life cycle.

Problems are Variations Caused by Defects



The problems in a business never seem to stop. Get one sorted-out and another one appears to take its place and absorb your effort and time. Along the way the problems cost the business time and money – the DAFT Costs. What can be done to stop the problems? You saw the answer in the defect elimination model. You first need to stop 'defects' from getting into the business, so they do not become the problems you have to fix. But how do you do that?

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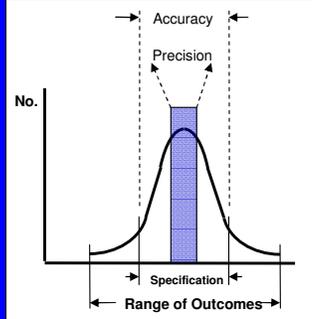
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The sense behind the idea of stopping defects entering your business is sound. The challenge is how do you do it, how do you change your business practices to focus on the inputs side of the business, and not the outputs side? Even if you use methods such as Root Cause Failure Analysis to tackle your problems, it is only one problem at a time. By the time you sort that one problem out after 6 – 10 weeks, there are dozens of other to replace it.

It's virtually impossible to fix your business by fixing one problem at a time. The one best way is to prevent all problems by putting an impregnable 'wall' at the front of all your business' activities to stop the defects. It means setting quality standards for everything that comes into your operation, and everything your operation does, and only accepting that which meets, or better, the standards.

Accuracy Controlled Expert Standard Operating Procedures

Control the quality of **each** task's outcome with a Target, a Tolerance, and a Test to confirm task achievement – these are the 3Ts of defect elimination and failure prevention!



Sam, a technique for controlling the outcome of human dependent processes, is to build feedback loops into the process that provide information to continually correct our actions. These are known as the **3T's of failure prevention** – **'Target, Tolerance, Test'**.

Precision: having a high degree of exactness

A certain thing and no other, strictly correct in amount

Accuracy: the degree of agreement between a measured value and the standard value for the measurement

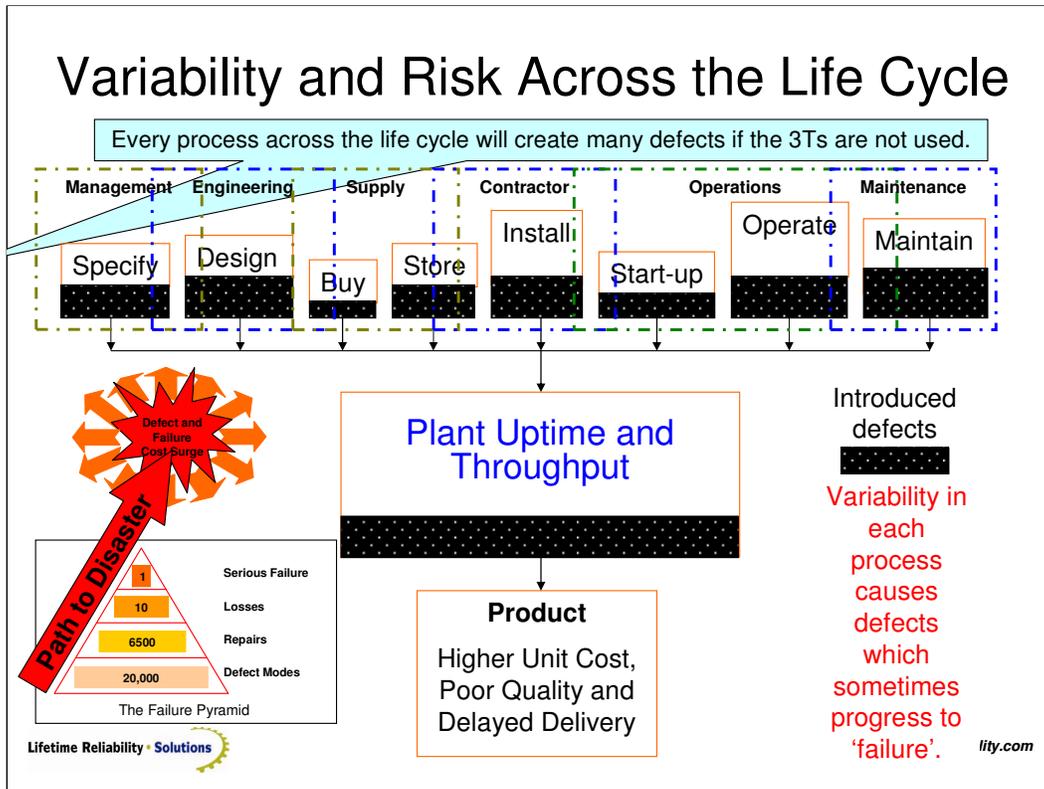
Right, truth, correct, close, without error, acceptable deviation



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A technique for controlling the outcome of human controlled processes, is to build feedback loops into a process that provide information to continually correct our actions. These are known as the '3T's of failure prevention' – Target, Tolerance, Test.

The archery target bullseye has a tolerance. It is not a small dot, rather it is a disk of some 100mm diameter. Hence the target is dead-centre, but anywhere inside the bullseye is full marks. We know we are in the bullseye because we have an edge to measure from. So it is when the 3T's are used to control failure in a process – we set a target, give a tolerance that is acceptable and provide a means to measure if we within tolerance. Once we confirm we are inside the tolerance we know we are right and can move to the next task.



Making and delivering a product/service is the output of many processes and numerous actions and decisions. We know that in every process, act and decision there is an opportunity for variation to arise. Extreme variations lead to the creation of defects and eventually failures. This was supported by the Failure Pyramid evidence where disaster will arise given enough chances.

Throughout the life cycle of a facility and its plant there will be times when chance, variability and opportunity for disaster align and a calamity happens. If we want to reduce the possibility of a calamity it is necessary to prevent the presence of defects which under the 'right' circumstances will progress to failure and in a few cases disaster.

The more defects present, the greater the number of problems they become. Problems show up as lost time, reduced production rates, poor quality product, workplace accidents and many other wastes and losses. These require removal and correction, which absorbs our time, resources and money. We see the end result as poor operating performance and poor profitability.

What Risks Are Out There?

Current application of CBM is typically on critical machines ... what of the rest?

CBM = Condition Based Maintenance = PdM = Predictive Maintenance

Machines by size

Machine Size	Percentage
300KW	10%
50-300KW	25%
0-50KW	65%

It's easy to focus on looking after the important equipment, while the lesser items are left to breakdown. But breakdowns cost 3 to 9 times planned maintenance. Unless you monitor all plant with low-cost methods and operator watch-keeping, you'll spend your money fixing breakdowns on unimportant equipment.

Stethoscope

Laser Thermometer

Touch Thermometer

Vibration Pen

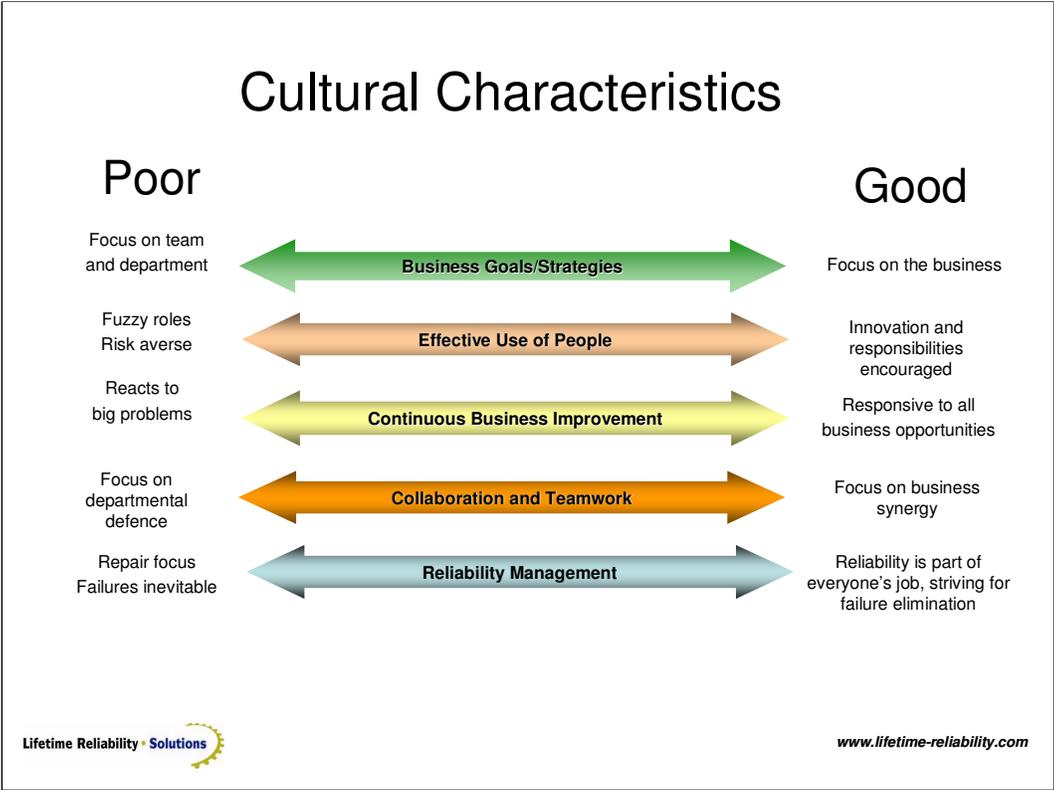
Operator & Checklist

First use low-tech options to monitor ... then hi-tech to investigate problems.

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The trap many operations fall into is to focus much condition monitoring effort on the critical plant and discount the importance of monitoring the remaining equipment. In reality the key equipment is naturally high in priority and people are well aware of the consequences of failure. This focus tends to help keep reliability and availability high by applying condition monitoring to detect impending failures. As a result it is possible that the rest of the plant will end up suffering more downtime from lack of attention.

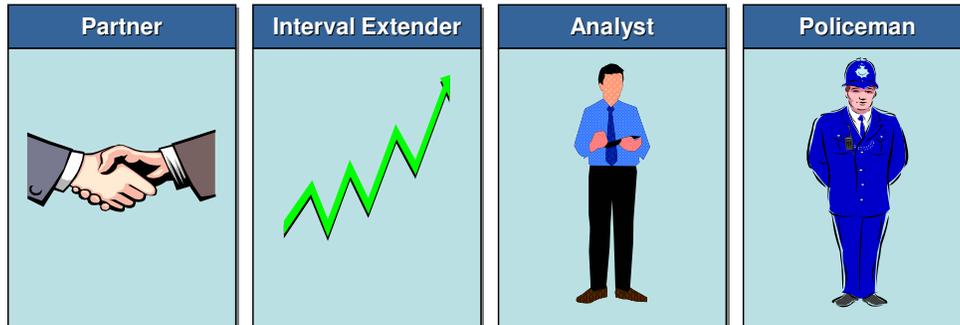
It becomes necessary to find methods to also condition monitor all the 'less important' items of plant and equipment. One method is to use the human senses of operators and maintainers and supplement them with simple monitoring tools to conduct regular inspections of all equipments' condition.



The cultural traits of top performers have also been well documented.

Keeping People Focused on Reliability

In a top performing organisation an Internal Auditor is used for analysing performance, policing practices, providing mentoring and guidance, encouraging greater performance. It is akin to the role of a 'Black Belt' in the Six Sigma Quality methodology.



This allows the Auditor to balance organisational safety, reliability and profitability.

Auditing your progress is a key requirement. It's part of performance measurement. It's part of continuous improvement. It's purpose is many fold – analysing performance, policing practices, providing mentoring and guidance, encouraging greater performance.

Committing to auditing operational performance sends a signal to everyone that the organisation wants improvement, it wants feedback, it wants to know its problems and what needs to be done to solve them. Auditing is visual evidence of your belief in the Vision. It also delivers practical worth.

The Auditor needs to flow easily from role to role. Yet not compromise when it's necessary to take a hard-stand in the circumstances.

Benchmark to Recognise Where You Are

Compared with best-of-the-best companies, DuPont employed:

- 23% more maintenance performing personnel;
- 55% less maintenance planning personnel; and
- 15% less maintenance support staff.

YEAR	Maintenance Cost as a Percent of ERV
76	3.20%
77	3.35%
78	3.45%
79	3.15%
80	3.35%
81	3.45%
82	3.20%
83	3.25%
84	3.30%
85	3.60%
86	3.35%
87	3.25%
88	2.95%
89	2.75%
90	2.45%
91	2.50%
92	2.50%
93	2.30%

DuPont did its maintenance as well as any of the leading companies but in doing so it:

- spent more money for maintenance
- planned and scheduled less often, and
- had less of a business focus.

DuPont benchmarked their operations against the best in the industry. They found maintenance cost as a percent of Equipment Replacement Value was too high. Using the benchmarks they 'set the bar higher' and put a plan into place, which took them to world class performance.

This case study examines closely the process that DuPont Chemicals went through in the early to mid-1990's to make their business world-class. They have become renown in the West as a leading pacesetter for Enterprise Asset Management Excellence.

In 1986 DuPont benchmarked sixteen of its USA chemicals and specialties plants with fifteen industry leaders. Benchmarking showed that DuPont did its maintenance job as well as any of the leading companies but that in doing so it:

- spent more money for maintenance
- planned and scheduled less often, and
- had less of a business focus

Numerically the study found that for DuPont, maintenance cost was 3.6% of the estimated plant replacement value. This was 10% to 30% higher than best - of - the - best comparison companies. In addition it was found that compared with best - of - the - best companies, DuPont employed:

- 23% more maintenance performing personnel;
- 55% less maintenance planning personnel; and
- 15% less maintenance support staff.

The study revealed that DuPont had the potential to reduce maintenance costs by US\$200 million annually if maintenance could be performed as well as the "best - of - the - best." This knowledge and the information provided by the benchmarking study allowed DuPont to set in place a strategic plan that not only achieved the target but went further, when the goal posts

changed, to reduce maintenance costs by an estimated US\$400 million per annum in 1993. The graph below shows the reduction in maintenance costs as a percent of estimated replacement value following the 1986 benchmarking study and the subsequent activities.

Sourced from: **Benchmarking Performance in the Mining Industry - Reliability and Maintenance as Strategy Components** by Edwin K. Jones PE, and William Holmes