Summary Of Process Reliability

Here are typical questions/comments on the Barringer Process Reliability technique.

The issue:

Do we have a maintenance problem or a process problem? Each side says the other party is responsible for lost production. We need a tool to decide what area to attack and set priorities for corrective action. The Barringer Process Reliability technique is a method for answering questions about losses in a quantitative manner.

How to resolve the issue:

Barringer's Weibull process plots give visual displays about the categories of losses and who is responsible for initiating corrective action. Process reliability plots provide, on one page, vital signs of how well the maintenance and production systems are functioning along with evidence of who is responsible for solving the problems along with establishing problem solving priority. Input data for the analysis is daily production output of prime product.

The revenue stream from any process is dependent upon daily production of prime product. Consistency of daily output is a precursor for how smoothly the money machine functions as a key business index.

We use daily production output of prime product and Weibull probability plots as a decision tool for identify the types of problems and where corrective action should occur.

When production is in a state of statistical control, the daily output makes a straight line on Weibull probability plots. Steep straight lines (small variability in output are synonymous with **steep line slopes** defined by the Weibull statistic beta, β) are desired. Steep trend lines illustrate good control of the process (***variability is due to common cause variation which are many in number and common cause variations are difficult identify and correct***). World class processes show small variations in output which generates a steep slope measured by the probability plots statistic called a shape factor beta. World class betas are equal to or greater than 100!

Beta shape factor values can be benchmarked for one-to-one comparisons of similar processes which avoids the "My process is better than your process and thus I don't need to make improvements—I'm happy, just leave me alone".

The characteristic output of the process (defined by a Weibull statistic value called eta, η) is also a benchmark value. Eta is the single point determination of the demonstrated maximum asset capability. The demonstrated maximum asset capability near the name plate (entitlement value) of the design point is desirably.

Loss of statistical process control shows production tending toward lower output with a cusp(s) on the Weibull plots. The cusps are due to things (***special cause variability is due to things you can see and understand***), which are often maintenance related. The first cusp toward lower production defines a point estimate of the **process reliability** (high values are desired).

The Barringer process reliability technique identifies/quantifies hidden factory costs for removal. The hidden factory is in stealth mode, you're paying both fixed and variable costs but you're not getting profitable results. Hidden factories are wasteful and paid for by the customer or the stockholder as they add no value for the customer or the stockholder. Stealth waste is under your nose, use the process reliability technique to:

1. Quantify the value of lost production in the hidden factory (how big is it, where is it, and what's it worth to correct), and
2. Set a strategy to recover the losses by taking corrective action on a Pareto priority basis to destroy the waste.

When was the first process reliability plot created?

In 1995, data for the first process reliability plots used feed data delivered to a refinery crude tower. The Weibull plots demonstrated desirable steep trend lines and desirable high reliability typical of a good process with few losses.

Cusps on the trend lines were directly related to known maintenance issues. Losses were quantifiable gaps between the demonstrated production line and the actual data points falling to the left (smaller output) of the demonstrated production trend lines. The gaps matched losses from the reliability issues. These problems are solved by maintenance engineers and reliability engineers.

In 1996, nameplate lines were applied to the process reliability plots. Gaps between the demonstrated production lines and the nameplate line quantified common causes losses between actual results and what could be achieved from the asset. Reasons for the gaps between the demonstrated production line and the nameplate line are due to efficiency and utilization issues. These problems are solved by management and six-sigma black belt experts.

Where have process reliability plots been used most effectively?

The process reliability technique provides a quick and qualitative assessment of production/maintenance problems and quantifies the size and cost of the hidden factory which detracts from profitability.

Management driven efforts to increase profitability by attacking the most important issues for reducing losses are most effective. The plots reflect before/after conditions to monitor progress. Consider what makes reliability programs success and unsuccessful.

Continuous processes have the largest opportunities for reducing losses using these non-traditional tools.

The process reliability plots are useful communication tools between management groups to explain and quantify problems.

Who has used the process reliability tool most effectively?

Major chemical plants and refineries have been most effective in motivating improvements because of their need to improve profits from a top down perspective.

The least effective users have been in industries where use of new tools and new approaches are discouraged, particularly when driven as a bottom-up engineering approach.

What's the greatest single improvement on record at a single plant using the process reliability technique?

$143,000,000/year is the largest single project audited savings from a chemical plant.

Removal of an older process and installation of a newer process resulted in doubling of the beta (line slope) which cut losses of the hidden factory in half. This project involved the Plant Manager pushing for the changes. The Plant Manager actually spent two days in the Process Reliability training classes to emphasize to his organization how important it was to use new tools to make new breakthroughs to improve profits by eliminating losses.

Geographically, where are process reliability plots in use?

USA, Canada, Mexico, Colombia, Brazil, United Kingdom, Netherlands, Germany, Italy, Sweden, Kuwait, Australia, Malaysia, China, and Japan are some of the major users.

How many people have completed the process reliability training classes?

Over 1500 engineers have been trained in Process Reliability to find the hidden factory along with assessment of the reliability of the process. Approximately 10% to 20% of the group (150 to 300 people) represents expert users of the technique, and about 1% to 4% of the group (15 to 60) represents super users of the technique.

For other Barringer process reliability articles and examples:

- Use Periods Of Low Production Output To Improve Process Reliability And Consistency
- Special Cause Variations, Common Cause Variations, and Process Reliability Plots
- Process Reliability Punch List
- Production Output/Problems
- Six Sigma
- Coefficient of Variation
- Production Reliability Example With Nameplate Ratings
- Key Performance Indicators From Weibull Production Plots
- Production Nameplate Rating
- Process Reliability Plots With Flat Line Slopes
- Process Reliability Line Segments
- Automating Monthly Weibull Production Plots From Excel Spreadsheets
- Papers On Process Reliability As PDF Files For No-charge Downloads
  - New Reliability Tool for the Millennium: Weibull Analysis of Production Data
  - Process Reliability and Six-Sigma
  - Process Reliability Concepts

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Comments:
Refer to the caveats on the **Problem of the Month Page** about the limitations of the following solution. Maybe you have a better idea on how to solve the problem. Maybe you find where I've screwed up the solution and you can point out my errors as you check my calculations. E-mail your comments, criticism, and corrections to: Paul Barringer by **clicking here**.

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