SAAMA2019 CONFERENCE

Practical Application of OEE

Maretha Price

May 2019

Introduction

- To determine health and performance of assets / systems.
- To improve efficiency, utilisation and asset care.
- Evaluation of actual output against maximum potential output.
- Combination of Availability, Throughput Rate & Quality.
- Understanding the integrated meaning of the subset of OEE transforms it into a leading indicator.

OEE = Availability x Throughput Rate x Quality

Availability

- Always the first parameter in OEE - time that assets were available to produce output.
- Doesn’t measure if equipment efficiency – only if the equipment is operating at all.
- Definitions of downtime needs to be specified and standardised across operations.

Availability = Actual Running Time / Total Time

- Indication of asset life cycle and overall integrity.
- Identifies maintenance improvement areas.
- Refers back to actual asset condition, rather than operations aspects.
- Essential to review the operations trend and history as well.

Throughput Rate

- Second parameter - the rate at which output was produced.
- Difference between actual and intended rate – inability to produce desired output.
- MSR or MPR? Standardise and fixed annually for trending purposes.
- Only use actual output and actual achievable output (based on availability).

*Rate = Actual Output / (Actual Running Time * Maximum Rate)*

- Shortcomings in process performance such as SOP's.
- Reducing these losses will typically result in critical evaluation of operations parameters and operating plans.

Quality of Output

- Last parameter - measures the quality of output according to standards / specs.
- Any output outside of the specification limits is considered a loss.
- Only evaluate actual useable output against actual output.

Quality of Output = Actual Useable Output / Actual Output

- Losses likely related to process design parameters not adhered to.
- Also an indication of quality of feedstock received.
- Review process efficiency to rule out potential operations errors.

Calculation Example

MINIMUM PLANT REQUIREMENTS	
Total Runtime Required	24 hours
Maximum Design Rate	100 tons per hour
Maximum Proven Rate (MPR)	90 tons per hour
Minimum Quality Pass Rate	95% Standard Adherence

- For ~ 2 hrs operations was on recycle due to incorrect feed.
- No product was produced for this period.

Rate = Actual Output / (Running Time * Max. Rate)
= (Potential Output – Output Loss) / (Running Time * Max Rate)
= [(21 – 2 hrs) * 90 tons per hr] / (21 hrs * 90 tons per hr)
= 1 710 tons / 1 890 tons
= 90%

(In other words, 2 hrs losses translated to 180 tons lost out of possible 1 890 in theory.)

Rate Loss = Product Loss / Total Theoretical Product
= (2 hrs * 90 tons per hr) / (24 hrs * 90 tons per hr)
= 180 tons / 2 160 tons
= 8.3%

(In other words a total of 1 710 tons can still be produced in theory.)

*OEE = Availability * Rate * Quality*
*= 87.5% * 90% * 95%*
= 75.2%

- 2 hours were lost due to repair work on a breakdown.
- 1 hour downtime due to statutory inspections.

Availability = Actual Running Time / Total Time
= (24 hrs – 3 hrs) / 24 hrs
= 21 hrs / 24 hrs
= 87.5%

(In other words, 3 hrs losses translated to 270 tons lost out of 2 160 in theory.)

Availability Loss = Product Loss / Total Theoretical Product
= (3 hrs * 90 tons per hr) / (24 hrs * 90 tons per hr)
= 270 tons / 2 160 tons
= 12.5%

- Only 95% of product achieved min. acceptance criteria.

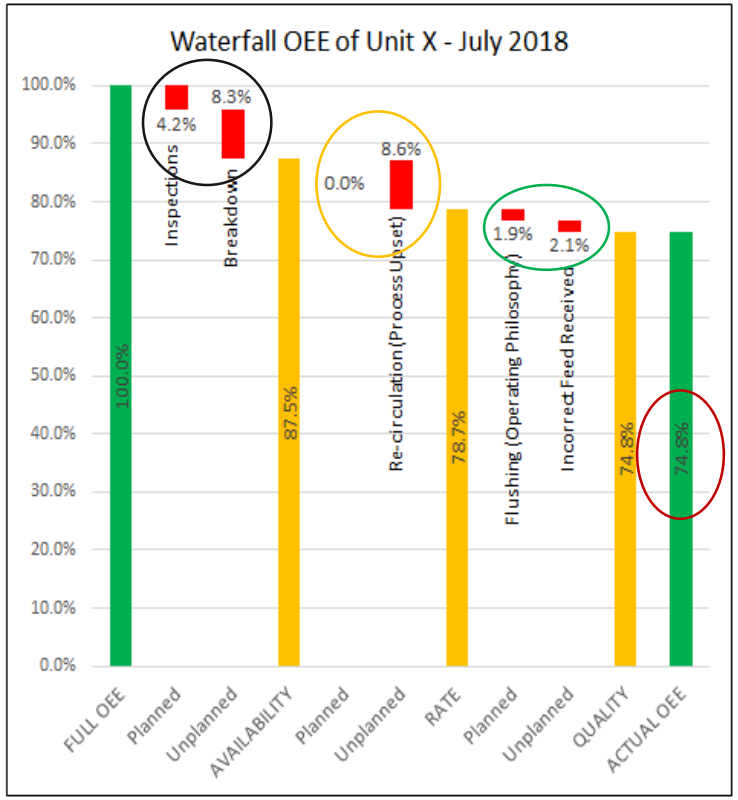
Quality = Actual Useable Output / Actual Output
= (95% * 1 710 tons) / 1 710 tons
= 1 624 tons / 1 710 tons
= 95%

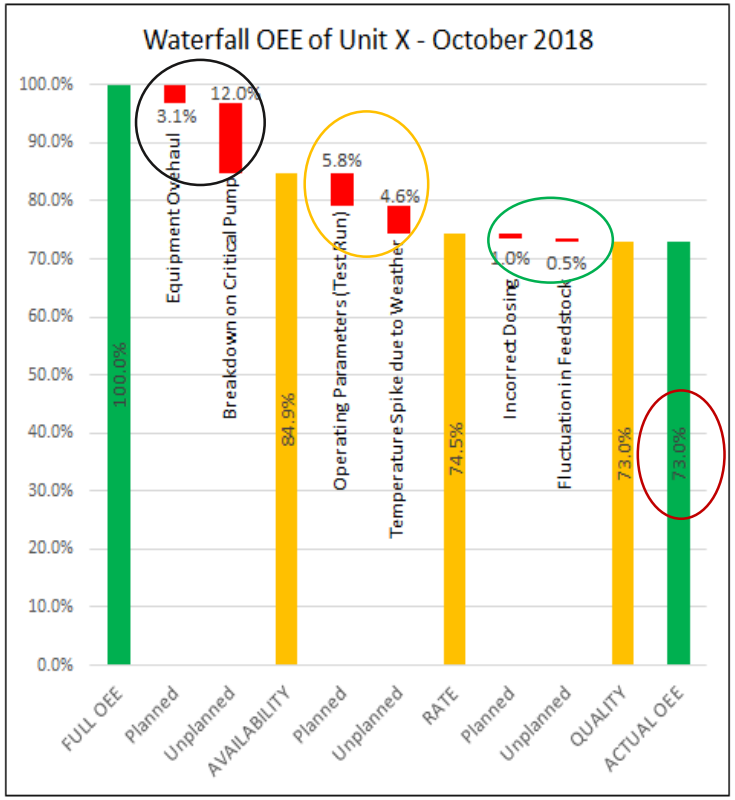
(In other words, 95% acceptance translated to 86 tons lost out of 1 710 tons in theory)

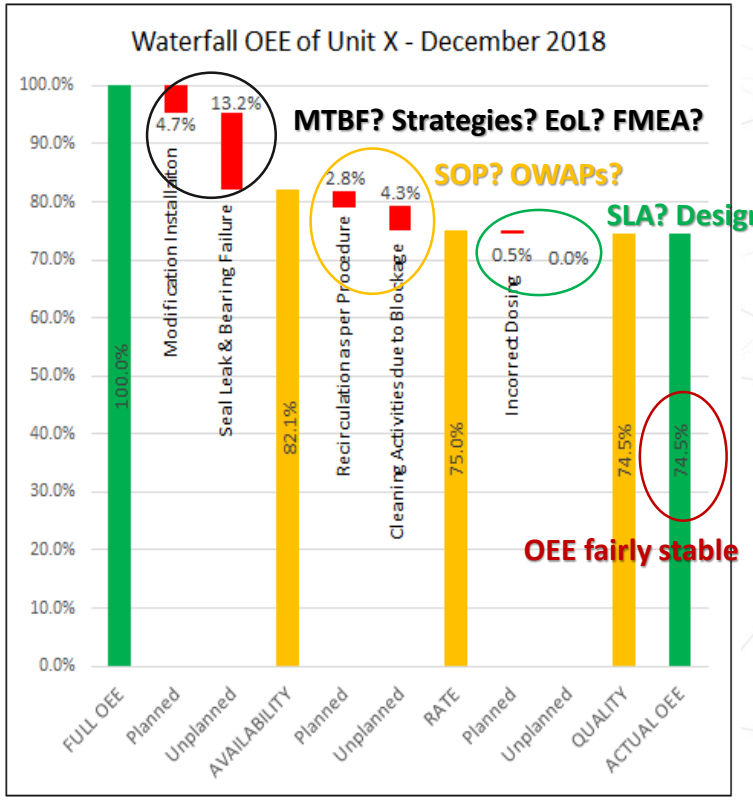
Quality Loss = Product Loss / Total Theoretical Product
= 86 tons / 2 160 tons
= 4%

OEE = 100% - Availability Loss - Rate Loss - Quality Loss
= 100% - 12.5% - 8.3% - 4%
= 75.2%

Trending Example







- A waterfall graph is a single snapshot of spectrum of parameters & losses.
- Distinguish amongst planned or unplanned and internal or external.
- Both the trend and instantaneous figures need to be understood.

SAAMA2019 CONFERENCE

Closing

- If used correctly, OEE is a valuable tool to guide focus both tactically and strategically with regards to decision-making and performance evaluation with the intent to minimise losses.
- Evaluating a holistic waterfall graph of OEE such over time can assist an organisation in becoming more pro-active if evaluated and interpreted correctly.
- Interpreting and understanding OEE correctly often elevate hidden failures across the organisation and enables operations to become more pro-active.
- It further aids in understanding the various consequences of failures, whether it is operational or non-operational.
- Understanding the detail behind these metrics are key critical and often requires deeper analysis, by means of data or root cause analyses.

“Stand up to your obstables and do something about them. You will find that they haven’t half the strength you think they have.” – Norman Vincent Peale