

Use of Modern Analytical Tools for Variability Analysis



Agenda

- High level view of plant operations and importance of reducing variability
- Tradition analysis of variability
- Methods used for more extensive analysis of variation
 - Protective layers
 - Operator performance and alarms
 - Improved controls and procedures
 - KPIs
- Leveraging the study to ensure on-going management of variation



Effective Operation of Manufacturing Plants



* Health, Safety and Environment



Manage Variability from Plan/ Goals – A Systems View



Further optimize performance. Typically complex decisions

Manage typical disturbances using closed loop algorithms and push to optimum

Manage disturbances when control actions are insufficient

Make the plant safe



Traditional Investment Justification



Notes

- 1. Discussions with planners, operations team, engineers
- 2. Remove data that will give high std dev procedures/ upsets



Traditional Investment Justification



Notes

3. Typically assume 25-50% reduction (shown to be achievable by project post audits). Mean shift = 1.65* change in std dev

4. Estimate relationship on (eg) production/ energy use using regression, simulation or experience



Assuming a Normal Distribution

- Assume that 5% of operations can continue outside the expected operating limit
- Mean shifts by 1.65 times the standard deviation reduction





Issues

- Traditional analysis tool = Excel
- OK for simple problems but as analysis gets more complex, Excel becomes too inefficient
- Consequence analyses traditionally have been limited to improved control
 - Don't get total picture
- More modern process analysis tools
 - Reduce time needed (ease of use)
 - Enable broader analysis in available time/ cost
 - Support deeper analysis
 - Enable better collaboration
 - Provide a better basis for future solutions
- Next few slides review analysis done on some projects. In some cases, methodology is still being developed



- Protective layers
- Alarms and operator UI
- Controls and procedures
- KPIs



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Analysis of Excursions/Upsets





Analysis of Excursions/Upsets



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Analysis of Excursions/Upsets





Analysis of Control Improvements

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Analysis of Control Improvements



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Analysis when Multiple Constraints Active





Analysis of Procedure Automation Opportunities





Analysis of Procedure Automation Opportunities





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Improved Mgmt of KPIs

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Summary



Traditionally estimates very high level Opportunity to provide more insight but need to consider impact of modes and improved controls

Traditional methods accepted. Opportunities to improve analysis (by grade/ mode/ shift) Easy to analyse impact of better procedures

Can gain more insight into performance during excursions Key issue is economic value

Can easily analyse frequency and costs Can consider relationship of frequency with protective layer design basis



Leveraging Analysis Results

For Project Justification



Breakdown of savings (Example)



On-Going Performance

Area	Based on study	Extending the study	
MES	Extend KPI monitoring to analyse KPI variability on a routine basis.	Implement decision support (equipment, process, production) based on modern analytics.	
Procedures	Monitor performance of key procedures and key steps.	Monitor use of automation	
Control performance	Monitor variation of critical process variables.	Monitor use and performance of controllers/ advanced controllers	
Operator performance and alarms	Monitor excursions and excursion metrics for key variables	Analyse alarm metrics (to understand cognitive load).	
Protective layers	Monitor frequency of trips.	Monitor health, maintenance and performance of protective layers (dynamic process risk)	

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Summary

- Modern process analysis tools radically reduce time for analysis
 - Allows broader/deeper analysis
- Tools can then be leveraged to introduce analytics into day-today operations