

# ***Streamlining the Determine Combo Production Using Lean Sigma Methodology***

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**Sponsor: Dr. Fred Samuels**

**October 2015**

**Define**

**Measure**

**Analyze**

**Improve**

**Control**

# *Project Goals & Objectives*

- 1. Reduce total scrap by at least 20% (about 25k\$).**
- 2. Implementation of OEE on critical equipment.**
- 3. Improve OEE at main production machines.**
- 4. Expanding the drying capacity of the coater (scale up)- Ability to produce 3 times more in the coater (scale-up)**

# *List of High Priority Issues*

- Changing the three main processes according to the value added mapping and streamlining the process:
  - Eliminate unnecessary IPC.
  - Change/simplify necessary non value added steps.
- Establish the MT (Matching Testing) procedure to increase the success rate of the BME stage.
- Expanding the drying conditions in the coater in order to enable scale up of the SP&CP production.

# *OEE Data: Starting Point (December 2014)*

- Plotted NC Average OEE= 48.7%
- Assembled Card Average OEE = 51.5%
- Perforated Card Average OEE =61.5%

$$\%OEE = Q * A * P$$

$$\%Quality (Q) = \frac{Processed\ Amount - Defective\ Amount}{Processed\ Amount} * 100$$

$$\%Performance (P) = \frac{Machine\ Run\ Rate * Processed\ Amount}{Operating\ Time} * 100$$

$$\%Availability (A) = \frac{Machine\ Run\ Rate * Processed\ Amount}{Operating\ Time} * 100$$



# Plotted NC Value Added Mapping: Starting Point

Company: Organics      Process: NC Dispensing      Mapping Team: Fred, Hadas, Lena, Sieta, Moti

Date: 30.11.14

#	Step Description	"As it actually is..."										"As it should be..."							
		Operation	Injection	Transport	Storage	Delay	Quantity	Time	Value Add	Non Value Added Necessary	Non-Value Added Unnecessary	Maintain	Eliminate	Simplify	Rearrange	Integrate	Automate	Human Resource	Change
	Prepare storage containers											X							
	FRM-308 reconciliation											X							
	FRM-P-06-07B open work station																		
	Empty lines- 4 cycles													X	X				כיוונים
	Washing with hot water- 20 cycles																		X
	Washing with jet wash: 5 cycles																		X
	Hold 10 min						10												X
	Empty lines- 4 cycles																		X
	Wash with Milli-Q: 40 cycles																		X
	Hold with Milli-Q till receiving the dispensing materials																		X
	- Only for lines 1+3																		X
	Wash with NaOH+HCl																		X
	pH test																		X
	Calibration																		X
	Set Up with Jig											X							X
	Location testing with ruler												X						
	Location testing with Jig											X							
	Scratches testing/ Splashing											X							
	Dropping process																		
	Drying process						30												
	Graph printing																		בדיקת סדר סגירת אטומה
	Storage											X							
	5 membranes to retention											X							X
	Washing with hot water- 20 cycles																		X
	Draining- cycles																		X
	Washing with jet wash: 5 cycles																		X
	Holding time with Jet-Wash						10												X
	Empty lines- 4 cycles						10												X
	Washing with Milli-Q - 40 cycles						10												X
	Fill FRM-P-06-07C+B						10												

4 Non unnecessary value added steps (~13%) were identified.

- The FRM filling is obligatory, therefore changed to “necessary”.
- Two unnecessary steps were omitted and some necessary steps were changed (ex: the washing procedure).

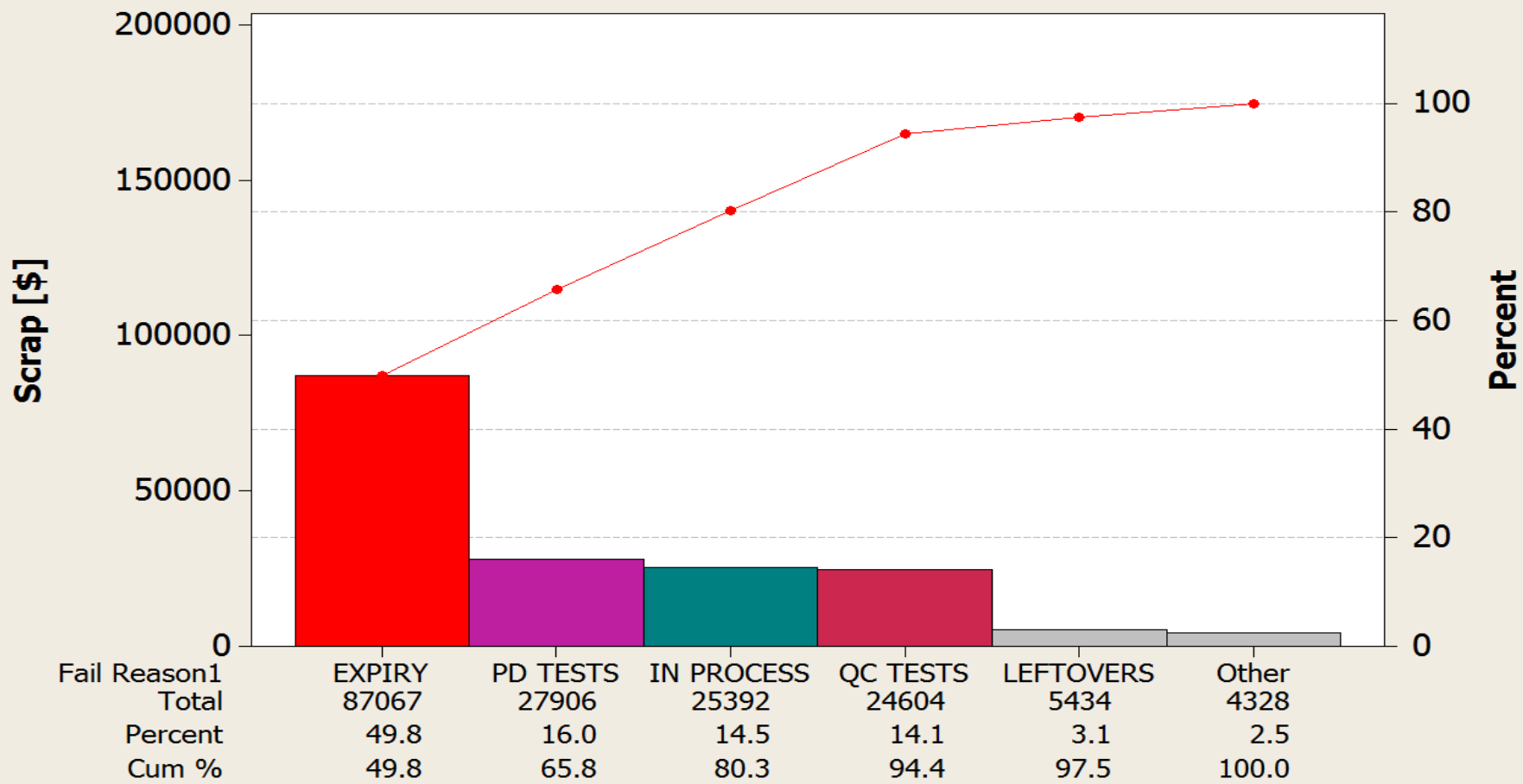
# Plotted NC Value Added Mapping: Improve Stage

#	Step Description	New State					Value Add	Non Value Added Necessary	Non-Value Added Unnecessary
		Operation	Inspection	Transport	Storage	Delay			
	Prepare storage containers	□	○	⇒	▽	∩			
	FRM-P-06-07B open work station					∩			
	Empty lines- 4 cycles	□							
	Washing with hot water- 20 cycles	□							
	Washing with jet wash: 5 cycles	□							
	Hold 10 min					∩			
	Empty lines- 4 cycles	□							
	Wash with Milli-Q: 40 cycles	□							
	Hold with Milli-Q till receiving the dispensing materials.					∩			
	- Only for lines 1+3								
	Wash with NaOH+HCl	□							
	pH test		○						
	Calibration	□							
	Set Up with jig	□							
	Scratches testing/ Splashing	□							
	Dropping process	□							
	Drying process	□		⇒			■		
	Graph printing	□							
	Storage			⇒	▽				
	5 membranes to retention				▽				
	Washing with hot water- 20 cycles	□							
	Draining- cycles	□							
	Washing with jet wash: 5 cycles	□							
	Holding time with Jet-Wash	□							
	Empty lines- 4 cycles	□							
	Washing with Milli-Q - 40 cycles	□							
	Fill FRM-P-06-07C+B					∩			

**No unnecessary non value added steps left in this process.**

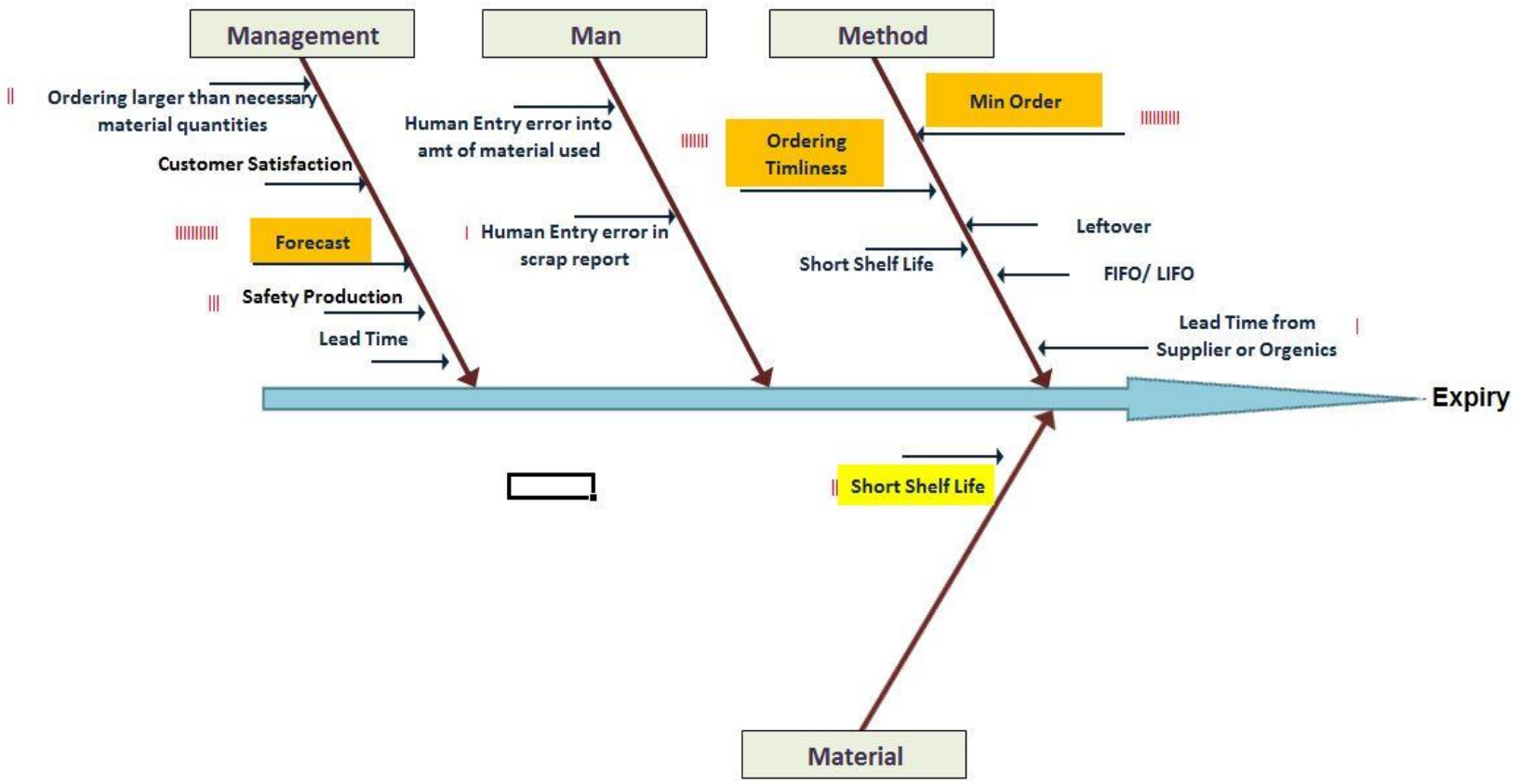
# Scrap Data from ERP 2014 - After the Finansit List Changed

**Pareto Chart of Fail Reason Combo 2014**



# Scrap (Expiry)- Root Cause Analysis

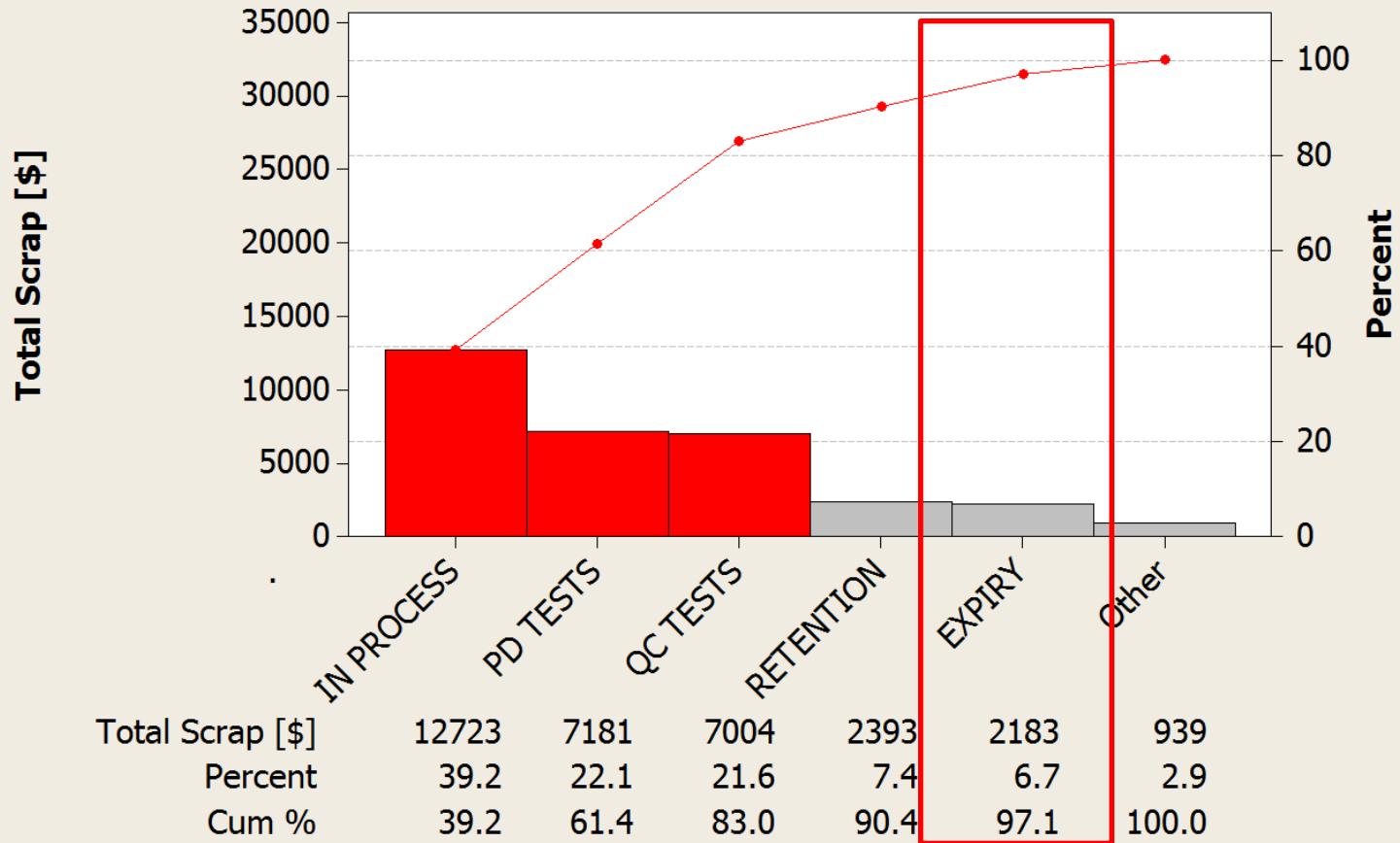
## Scrap Reason: Expiry





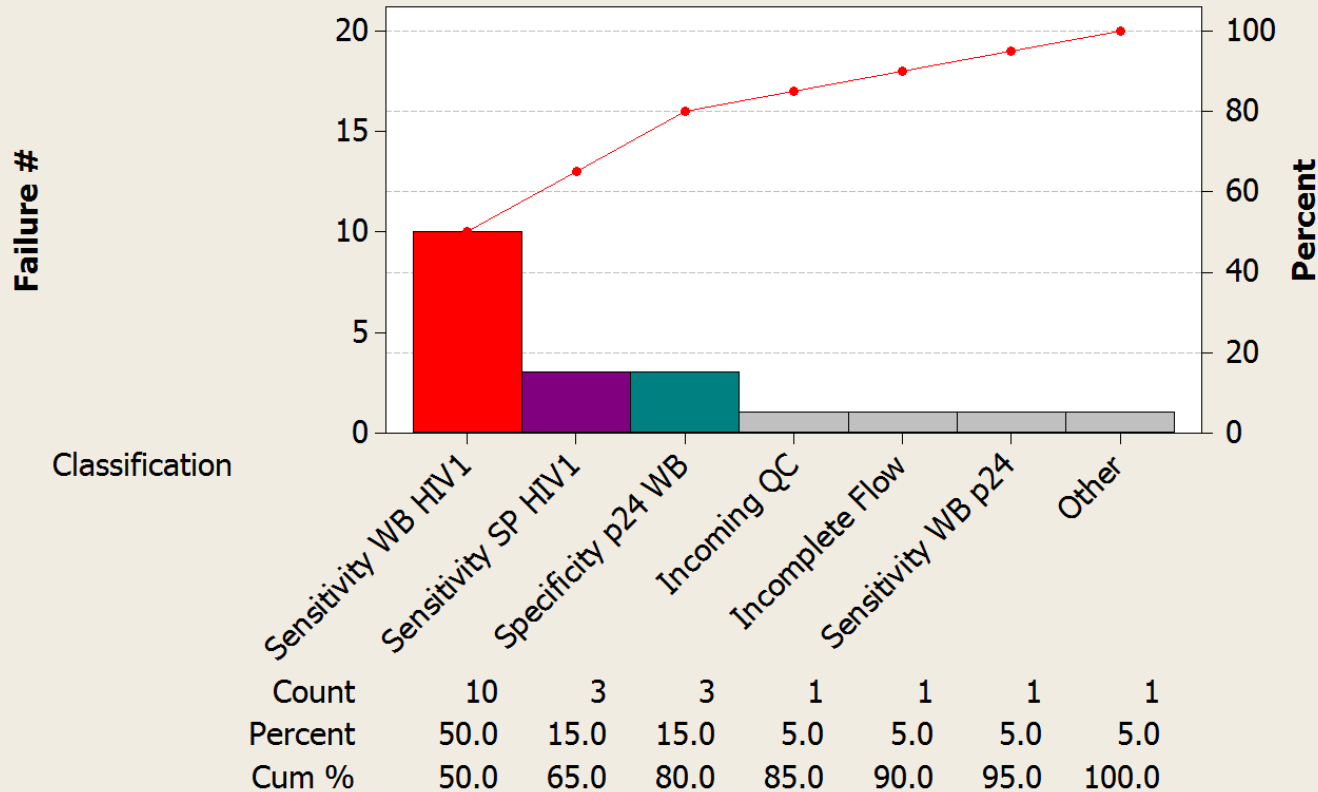
# Scrap Analysis: Improve Stage January-March 2015

**Pareto Chart of Determine Combo by Failure Reason Jan-March 2015**



# BME – Failure Analysis (2013-2015)

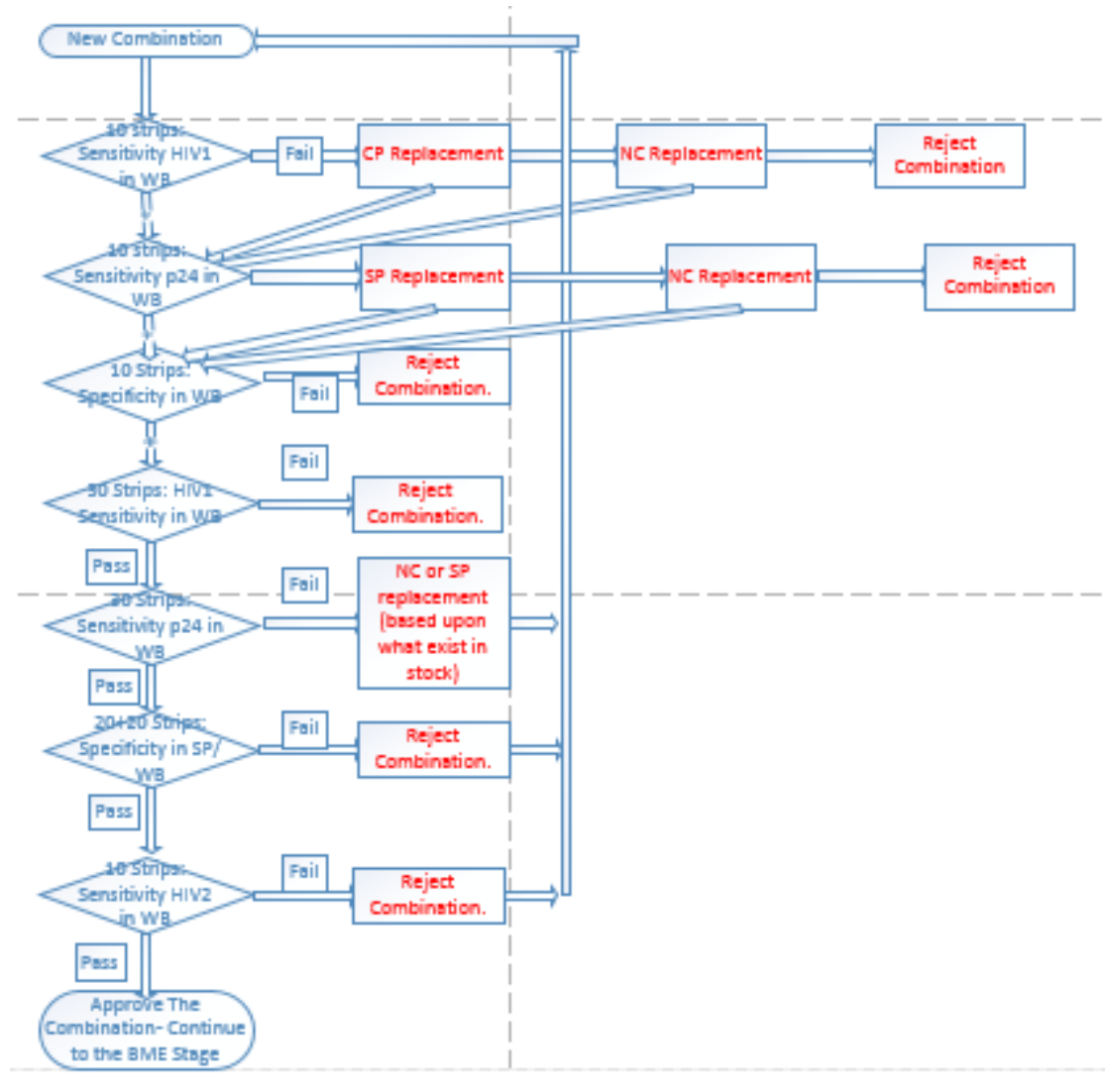
**Pareto Chart of Classification (2013-2015)**



Year	Fail Number BME	Total	%Failure
2013	7	40	18%
2014	9	32	28%
2015	3	20	15%
<b>Total (2013-2014)</b>	<b>16</b>	<b>72</b>	<b>22%</b>



# Matching Testing



# Coater SP DOE- Plan

Experiment Number	Temperature [°C]	Speed [in/min]
1	58	18
2	58	22
3	58	20
4	65	20
5	72	20
6	72	18
7	72	22

**Define****Measure****Analyze****Improve****Control**

# Coater SP DOE- Results

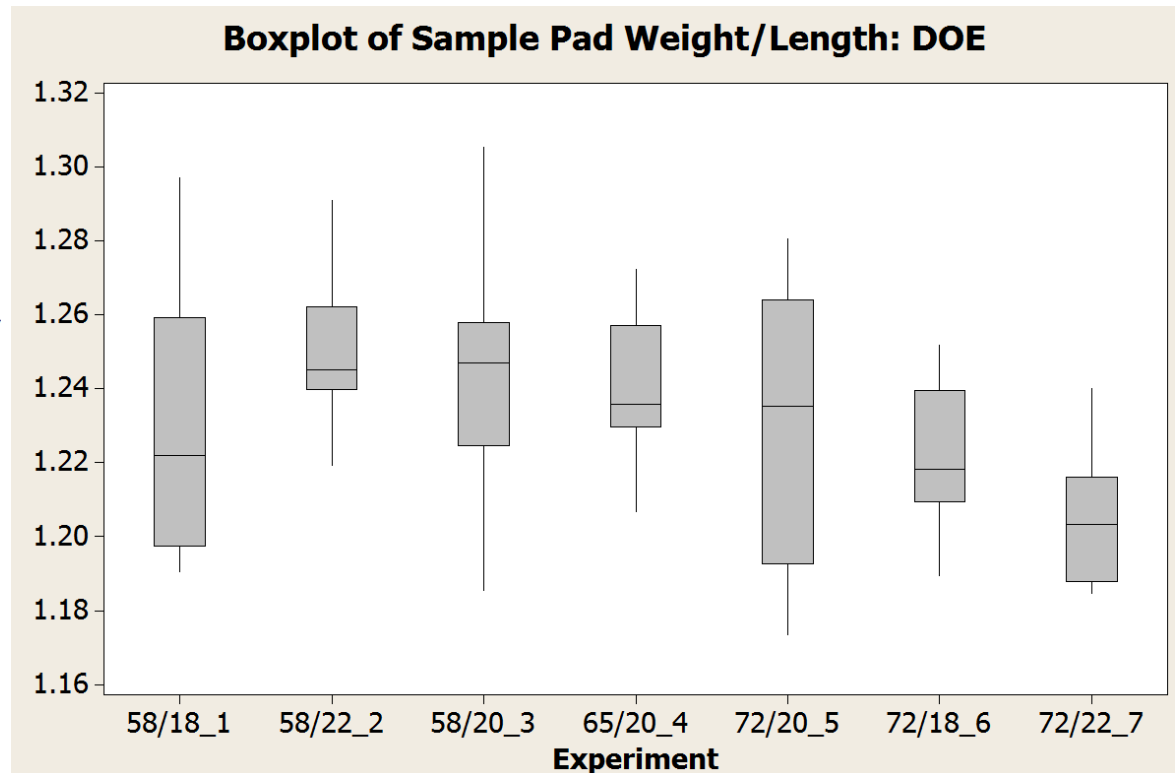
## One-way ANOVA: LW versus Test Number

Source	DF	SS	MS	F	P
Test Number	14	0.001798	0.000128	0.33	0.988
Error	90	0.034800	0.000387		
Total	104	0.036598			

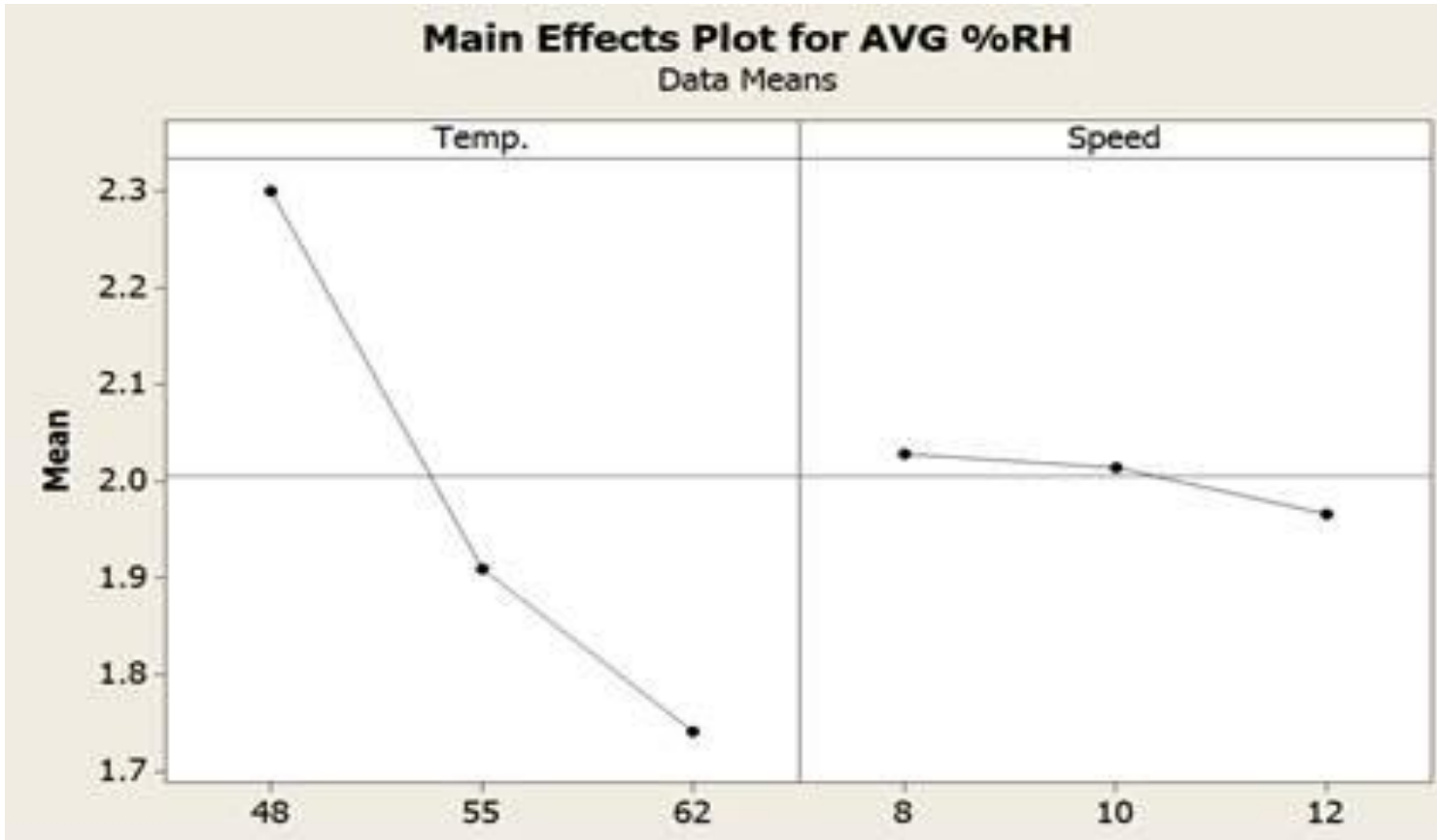
S = 0.01966 R-Sq = 4.91% R-Sq(adj) = 0.00%

Level	N	Mean	StDev	Individual 95% CIs For Mean Based on Pooled StDev
1	7	0.81388	0.02271	(-----*-----)
2	7	0.81371	0.01618	(-----*-----)
3	7	0.80931	0.01759	(-----*-----)
4	7	0.81807	0.01958	(-----*-----)
5	7	0.80833	0.02036	(-----*-----)
6	7	0.80643	0.02374	(-----*-----)
7	7	0.81508	0.02127	(-----*-----)
8	7	0.80835	0.02526	(-----*-----)
9	7	0.81126	0.01983	(-----*-----)
10	7	0.81377	0.02042	(-----*-----)
11	7	0.81135	0.01625	(-----*-----)
12	7	0.82227	0.01738	(-----*-----)
13	7	0.80792	0.02057	(-----*-----)
14	7	0.80936	0.01397	(-----*-----)
15	7	0.81461	0.01634	(-----*-----)

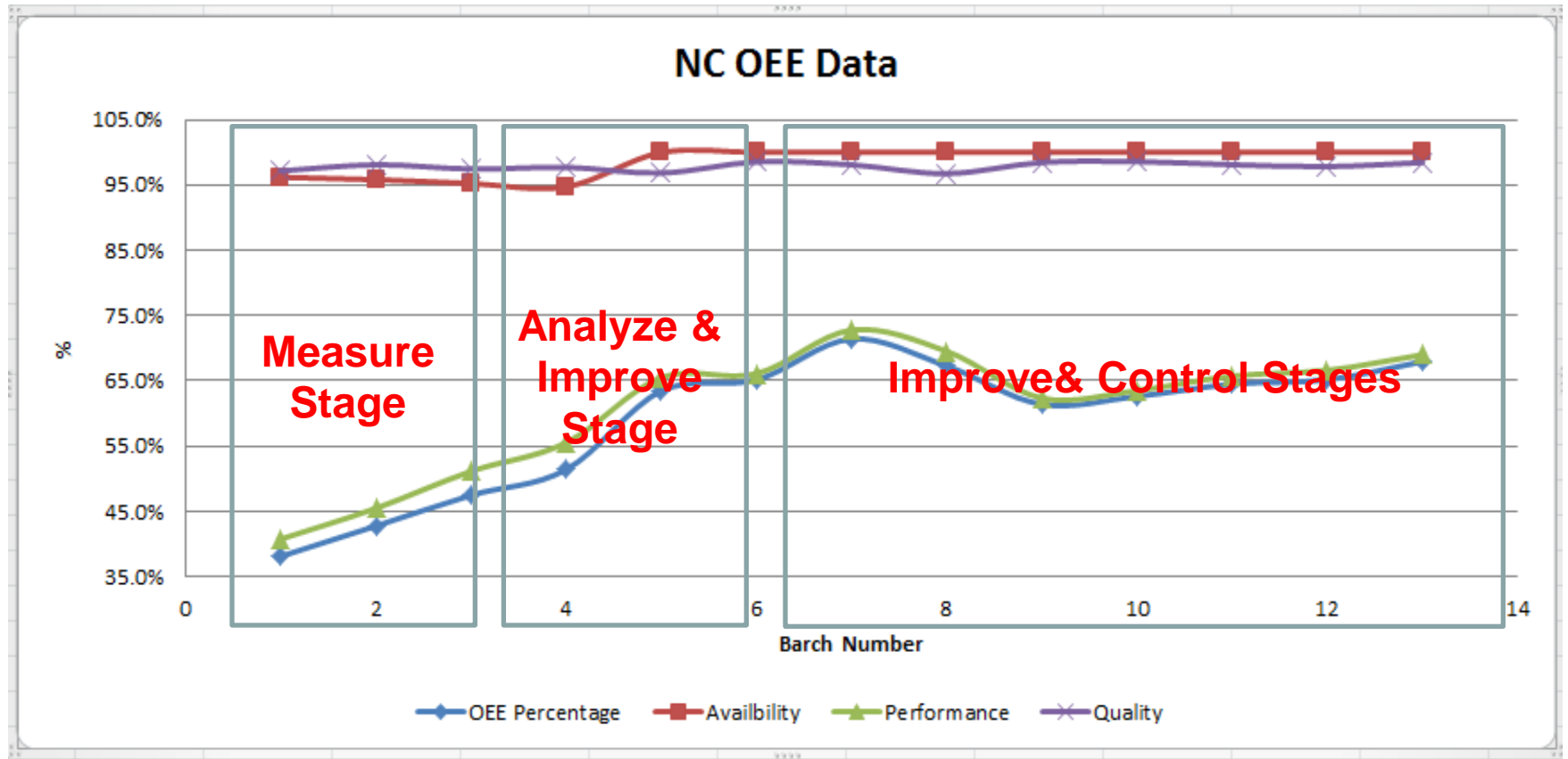
Pooled StDev = 0.01966



# Coater SP DOE- Results



# Plotted NC OEE



# *'Improve' Summary*

#	High Priority Issue	Chosen 'Improve' Solutions
1	Scrap reduction	Matching procedure; build a new assembly jig (according to DOE results); Build new ERP list in order to identify root causes
2	OEE	Value Added Steps Assessment
3	Expand the coating conditions	DOE Experiments





# *Project Summary and Benefits*

- Scrap reduction the scrap by ~40% (From 340k\$/ year to 200k\$/ year)
- OEE measurements & analysis have been implemented and the Determine Combo production was streamlined.
- NC OEE significant improvement: from 48.7% at project start to 67% at project finish
- Optimizing the coater drying conditions and the ability to scale up the Determine Combo production.

# The End!

