

Measurement for Improvement

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The traditions of measurement

Research

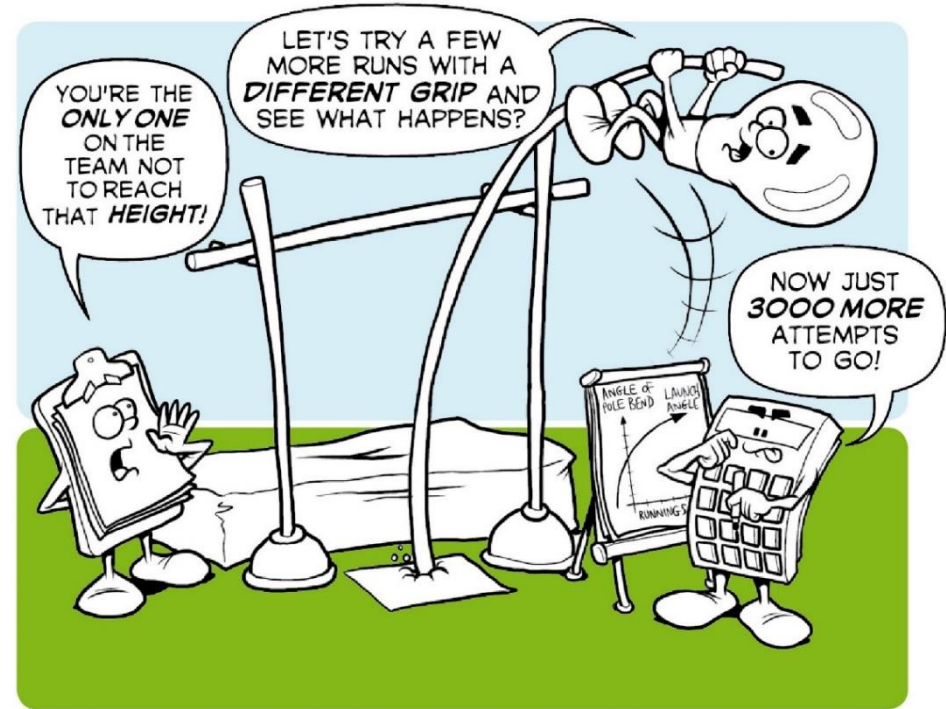
- eg A-B comparison, average, huge dataset

Judgement

- eg one-to-many benchmarking comparison, average, large dataset

Improvement

- eg continual analysis of single changing process over time

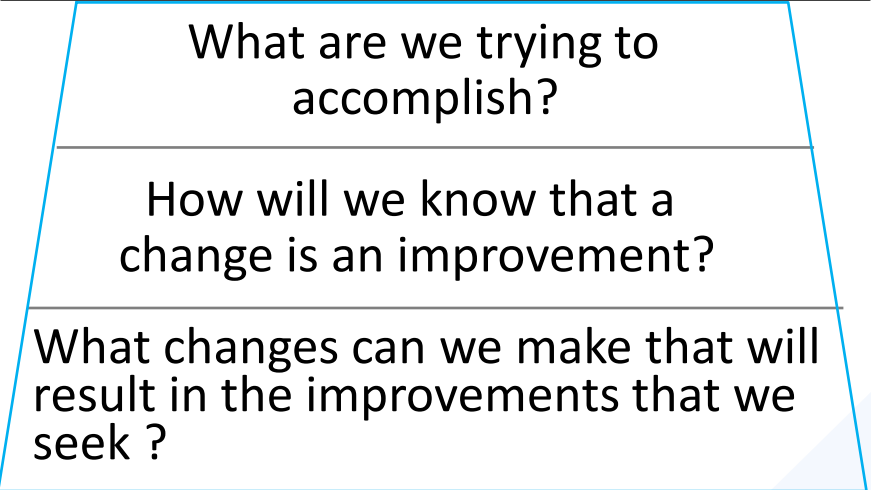


Measurement mindsets

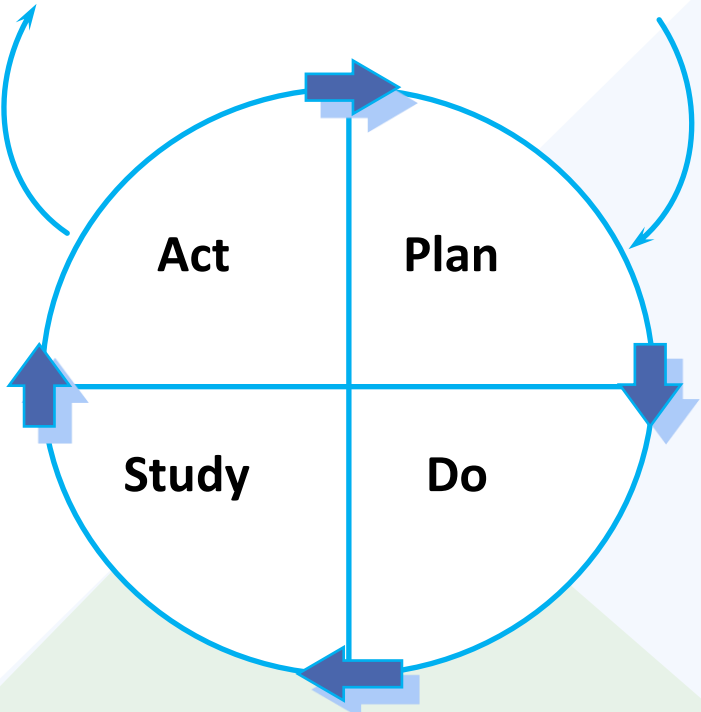
	Research	Judgement	Improvement
Goal	New knowledge (not its applicability)	Comparison Reward / punishment Spur for change	Process understanding Evaluating a change
Hypothesis	Fixed	None	Multiple and flexible
Measures	Many	Very few	Few
Time period	Long, past	Long/medium, past	Short, current
Sample	Large	Large	Small
Confounders	Measure or control	Describe and try to measure	Consider but rarely measured
Risks in improvement settings	Ignores time based variation Over-engineers data collection	Ignores time based variation Over-reaction to natural variation	Incorrectly perceived as 'inferior statistics'

Based on L. Solberg, G Mosser and S McDonald (1997) The Three Faces of Performance Measurement: Improvement, Accountability and Research, Journal on Quality Improvement, 23 (3): 135 - 147.

Model for Improvement

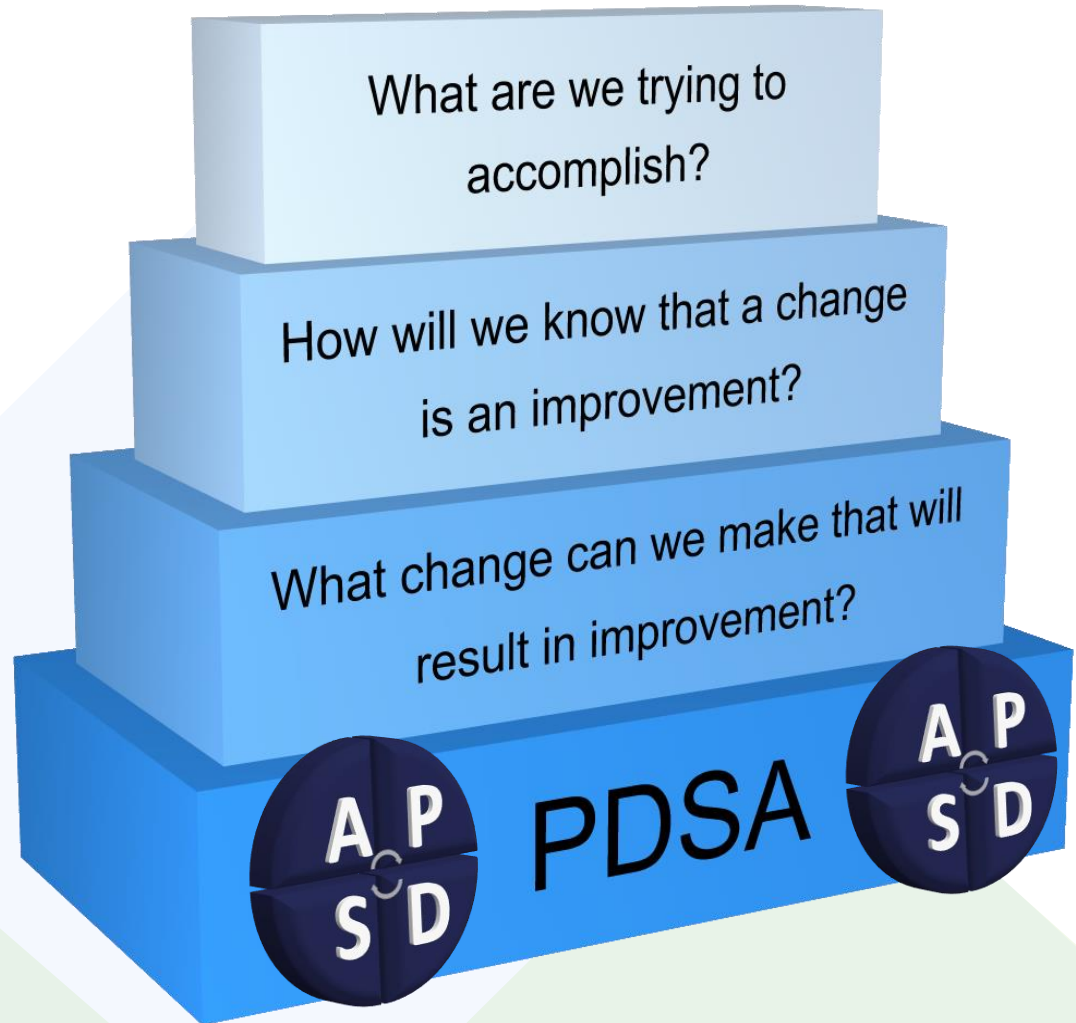


- ← Aims
- ← measurements
- ← change ideas



← testing ideas before implementing changes

Model for improvement



1 Decide
Aim

2 Choose
Measures

3 Define
Measures

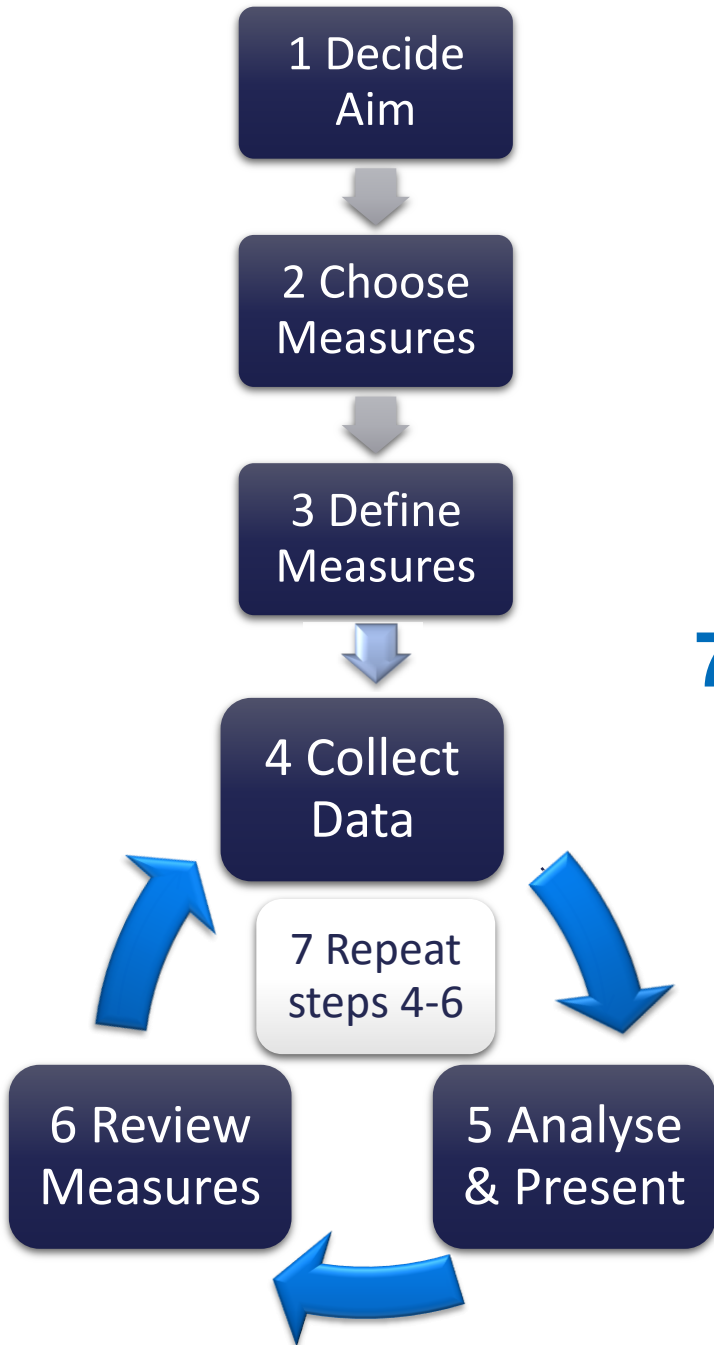
4 Collect
Data

7 Repeat
steps 4-6

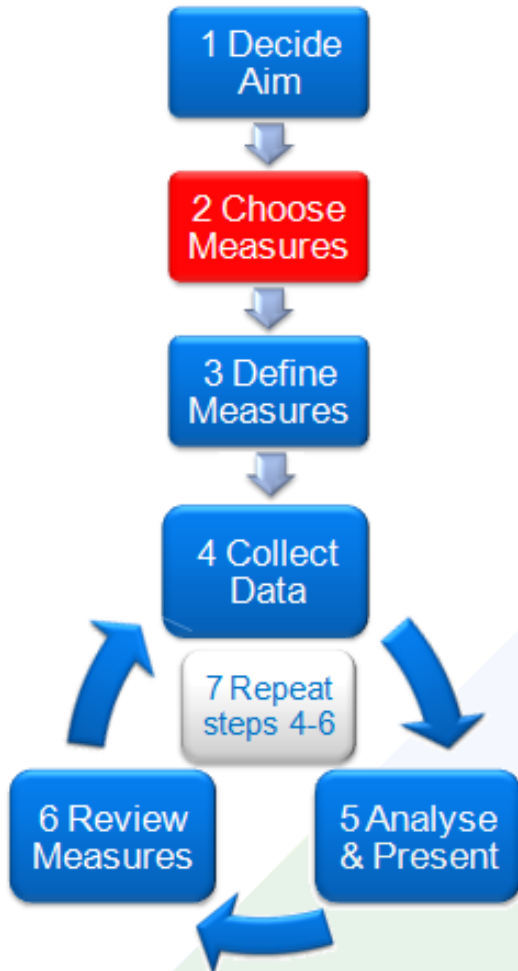
6 Review
Measures

5 Analyse
& Present

7 Steps to measurement



Step 2 – Choose Measures



There are two tools to help you choose measures

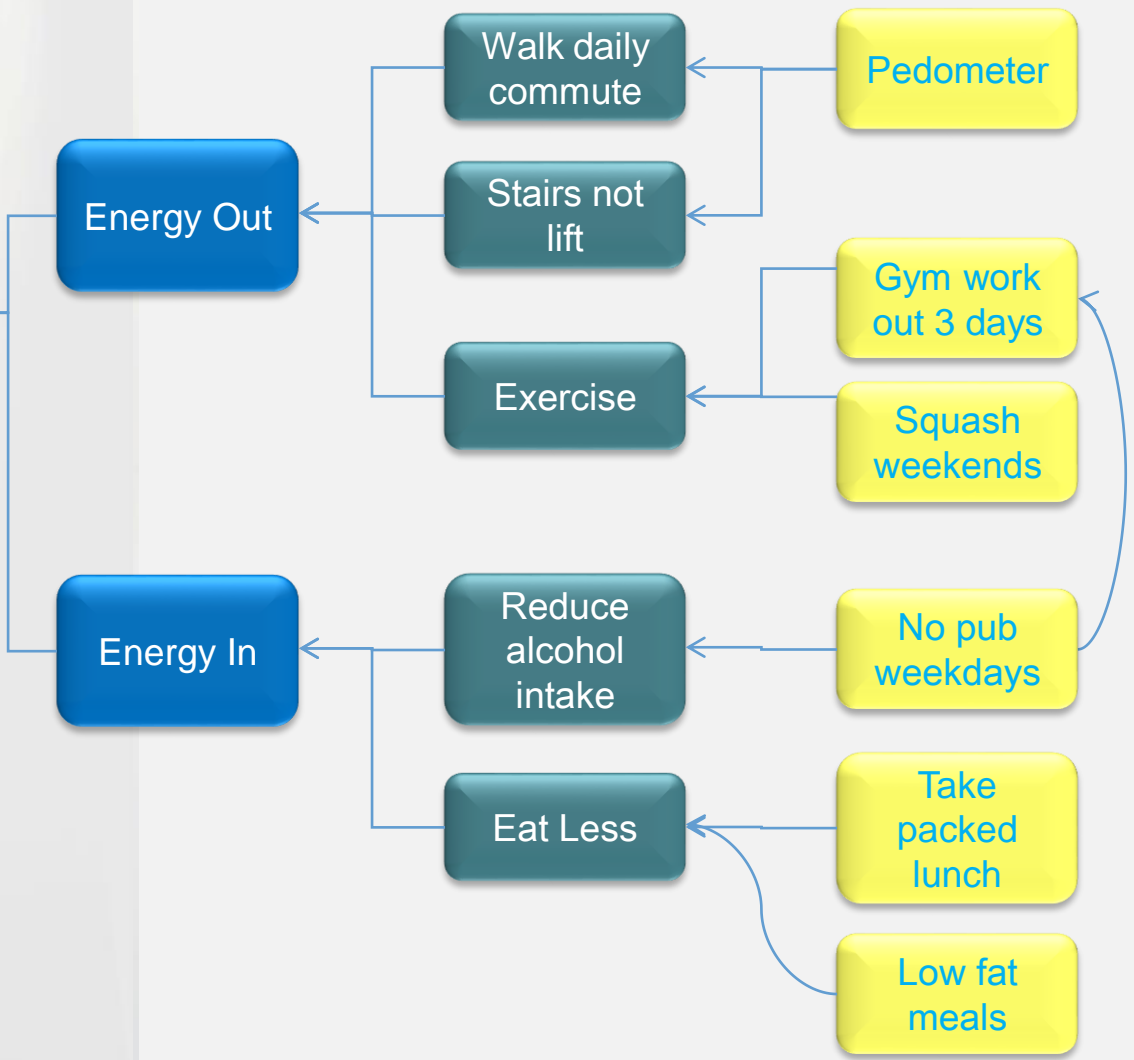
1. Process Mapping
2. Driver Diagrams



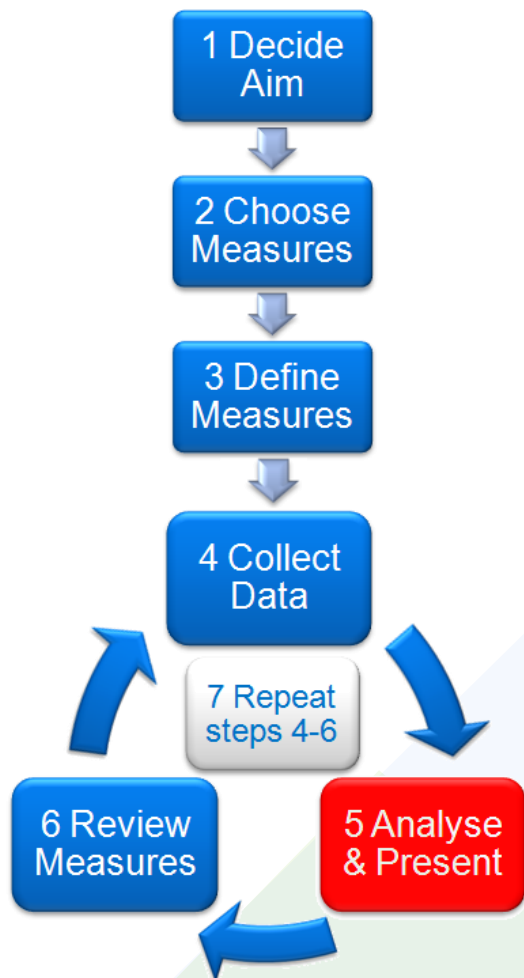
Driver Diagrams – weight loss example



**Aim:
2 stones
lighter!**



Step 5 – Analyse & Present

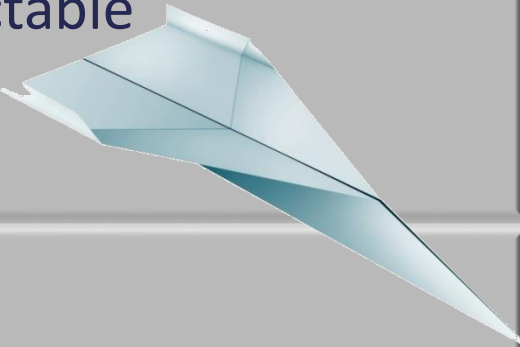


We will now focus in more detail on methods of presenting and analysing our chosen measures....



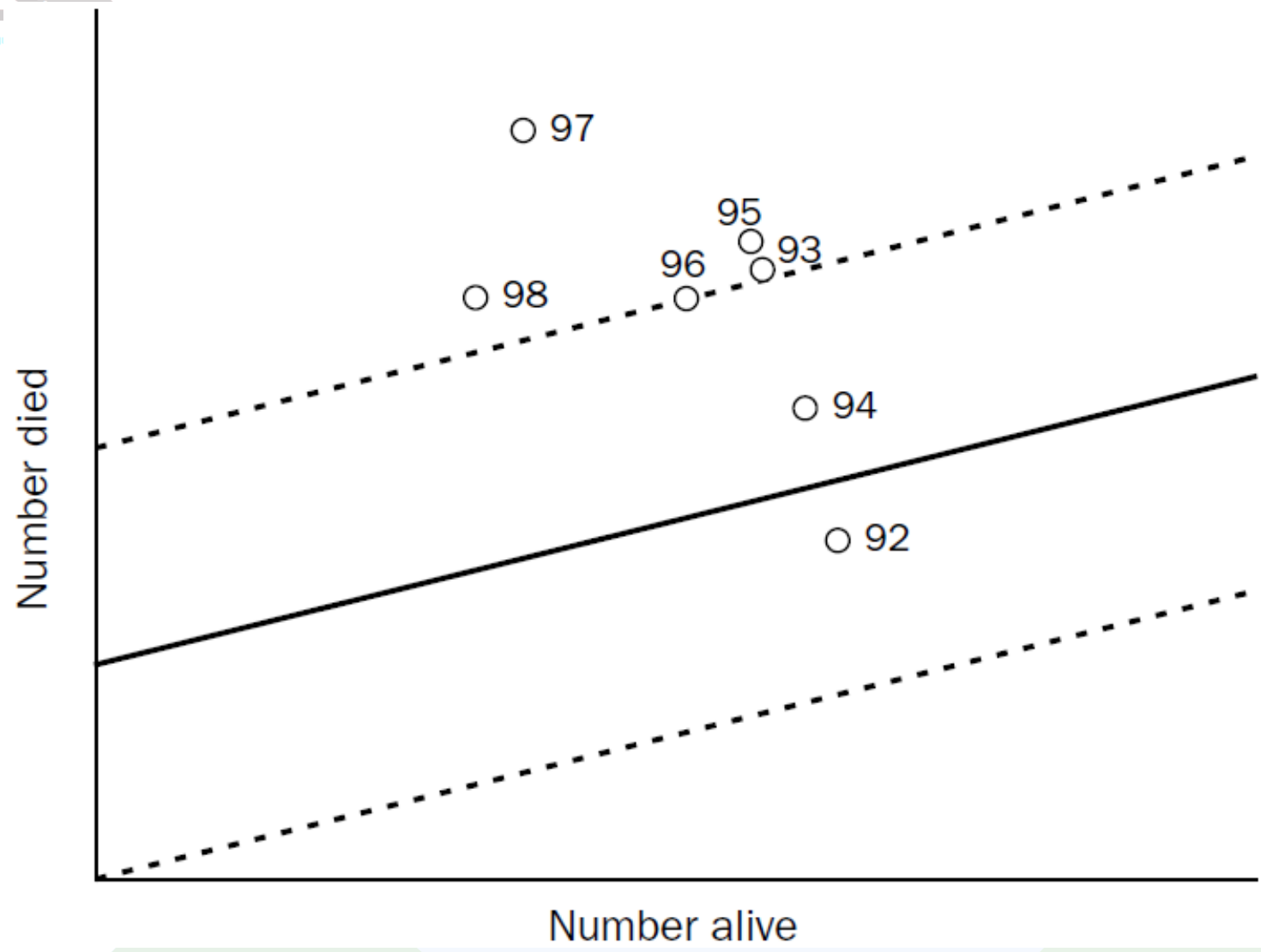
Can we classify variation?

Common Cause	Stable in time and therefore relatively predictable	Paper selection
		Persons technique
		Design of the plane
Special Cause	Irregular in time and therefore unpredictable	Water spill
		Fire





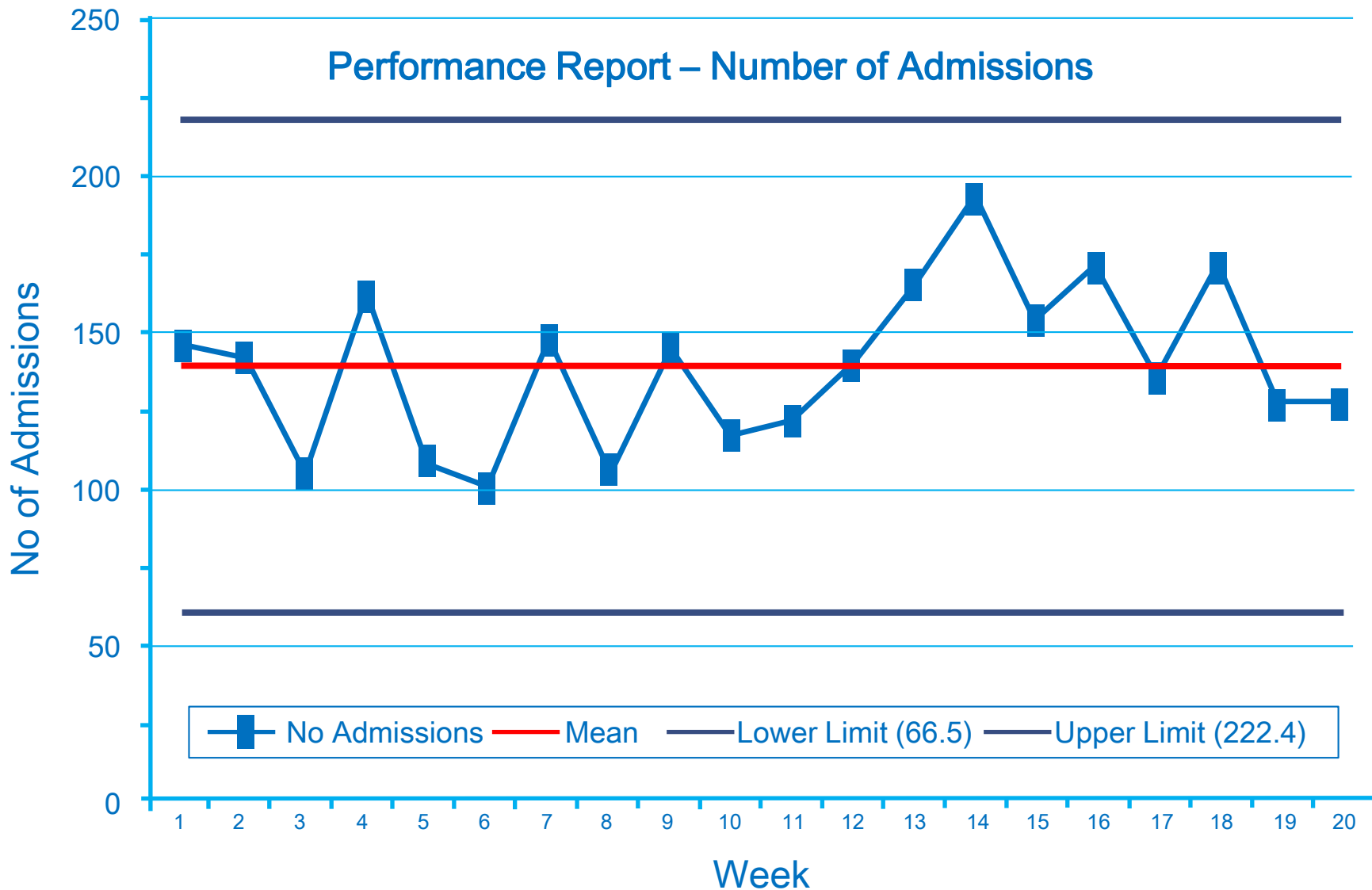
What is SPC?



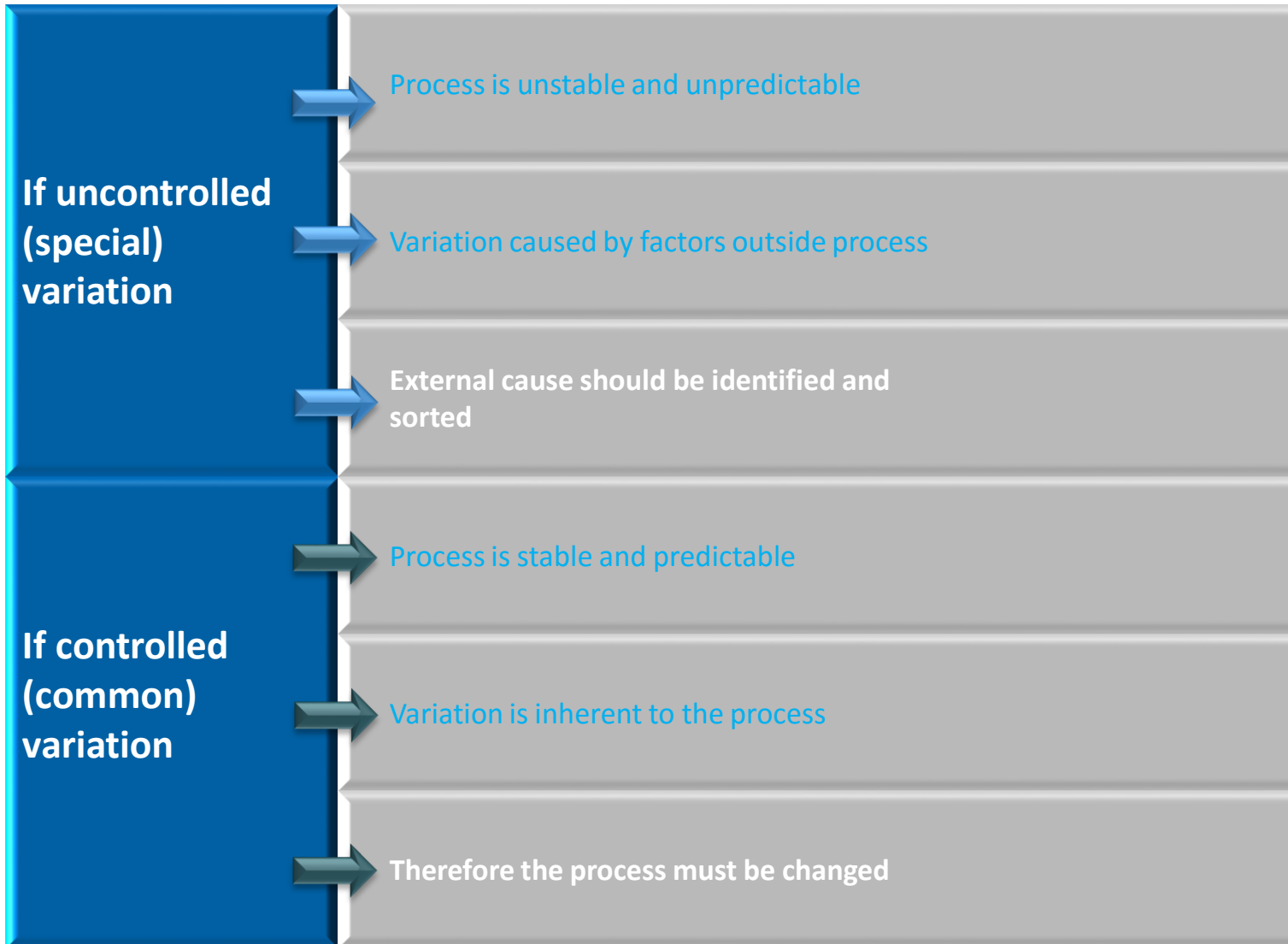
Statistical Process Control (SPC) charts...

- ...use the pattern of events in the past to predict with some degree of certainty where future events should fall
- ...distinguish between the natural/common cause variation and special cause variation
- ...enable you to look for problems when they are there, not when they are not
- ...can motivate staff to improve practice thereby reducing adverse events and minimising variation

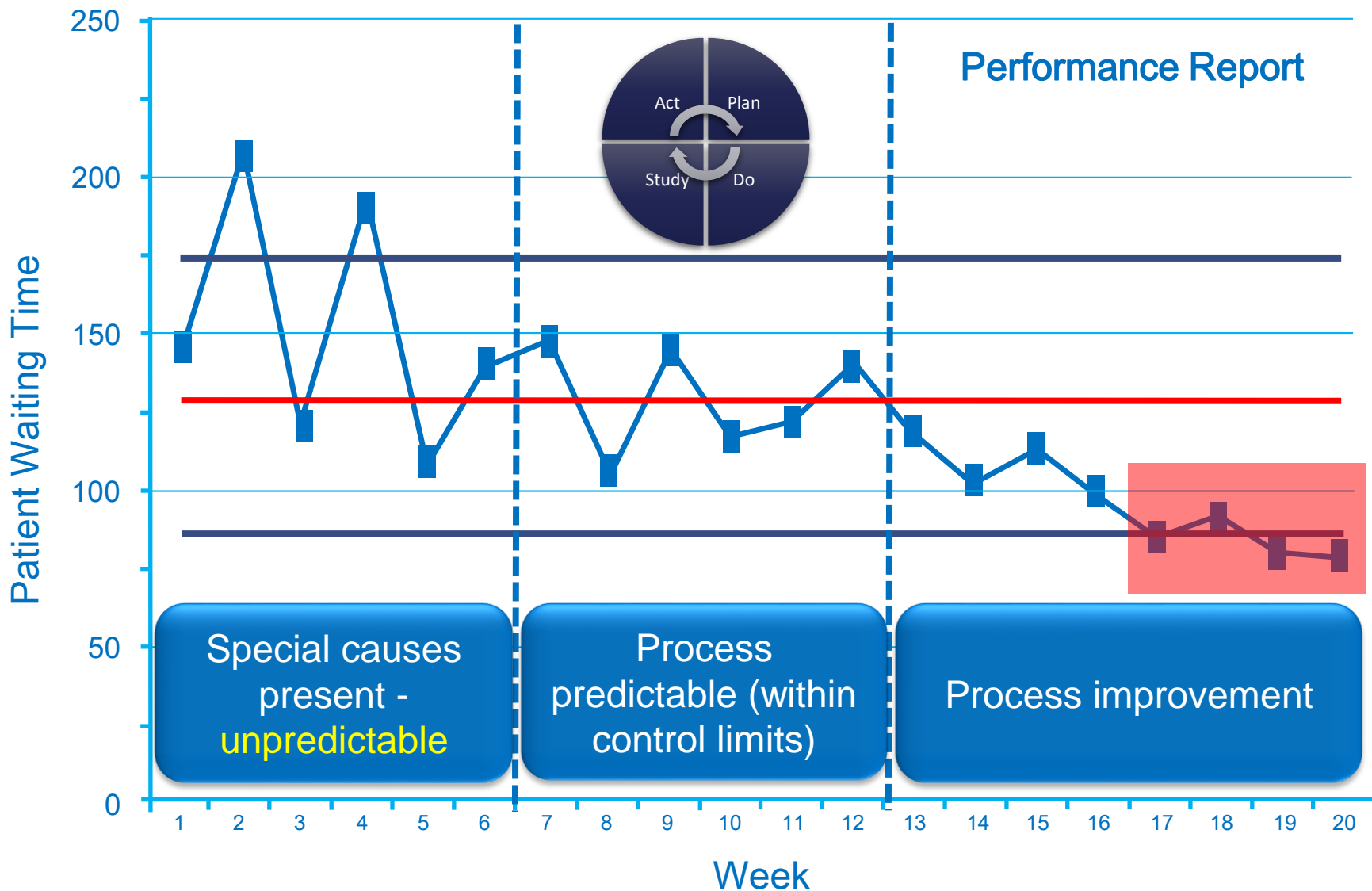
Statistical Process Control (SPC) Charts:



2 Ways to improve a process



The improvement process



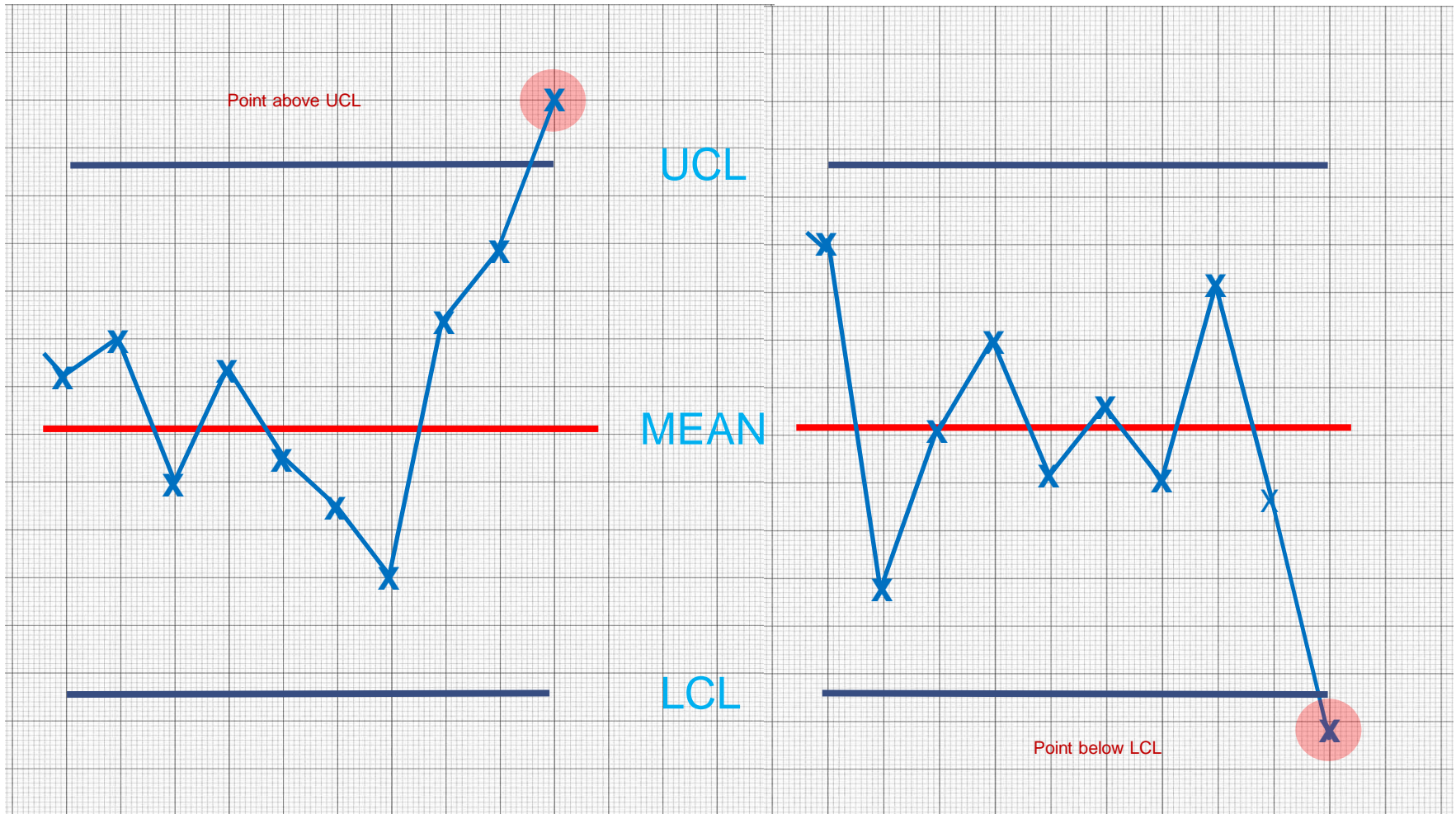


Interpreting Charts

Special causes



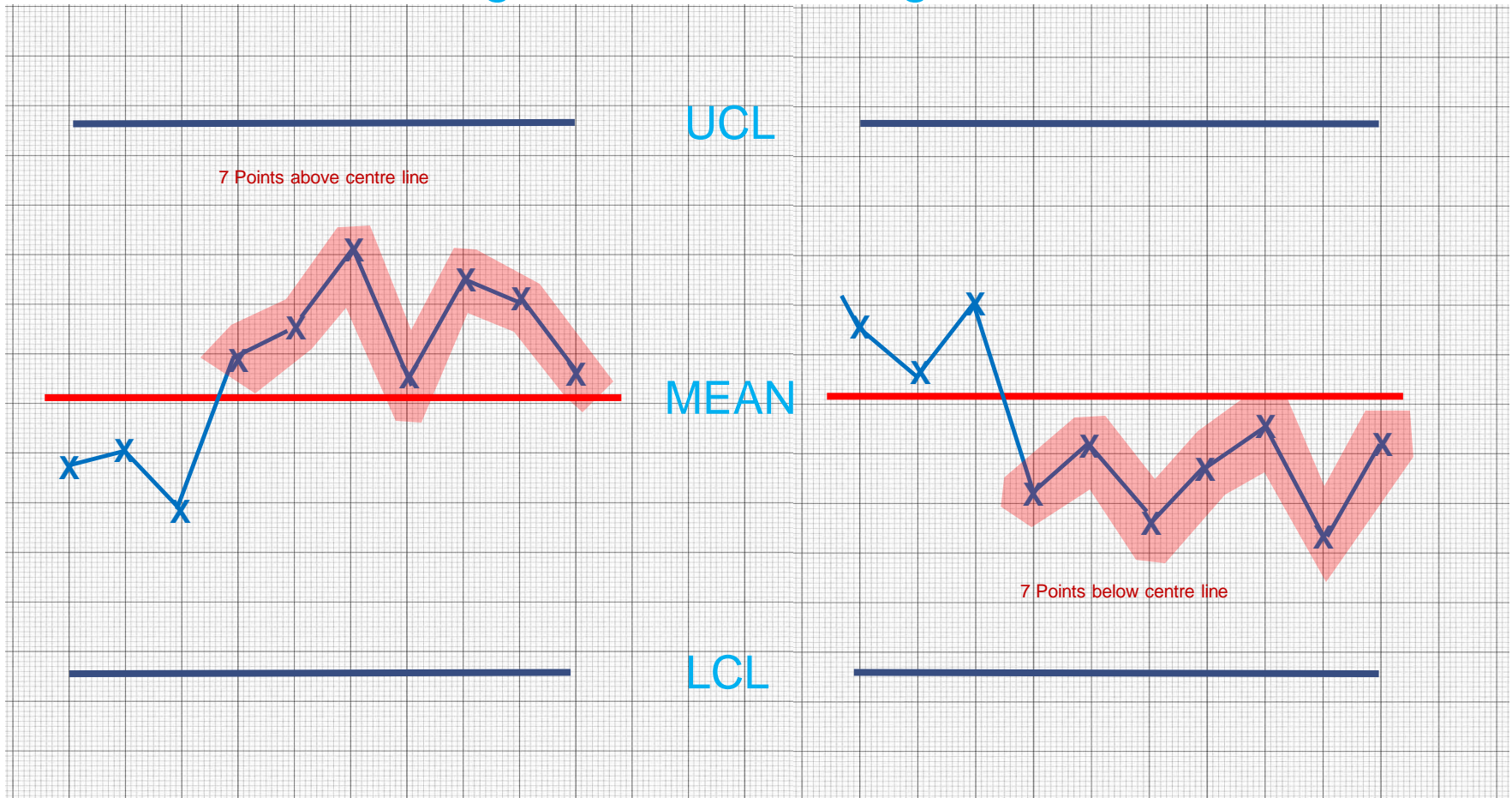
Rule 1 - Any point outside one of the control limits



Special causes



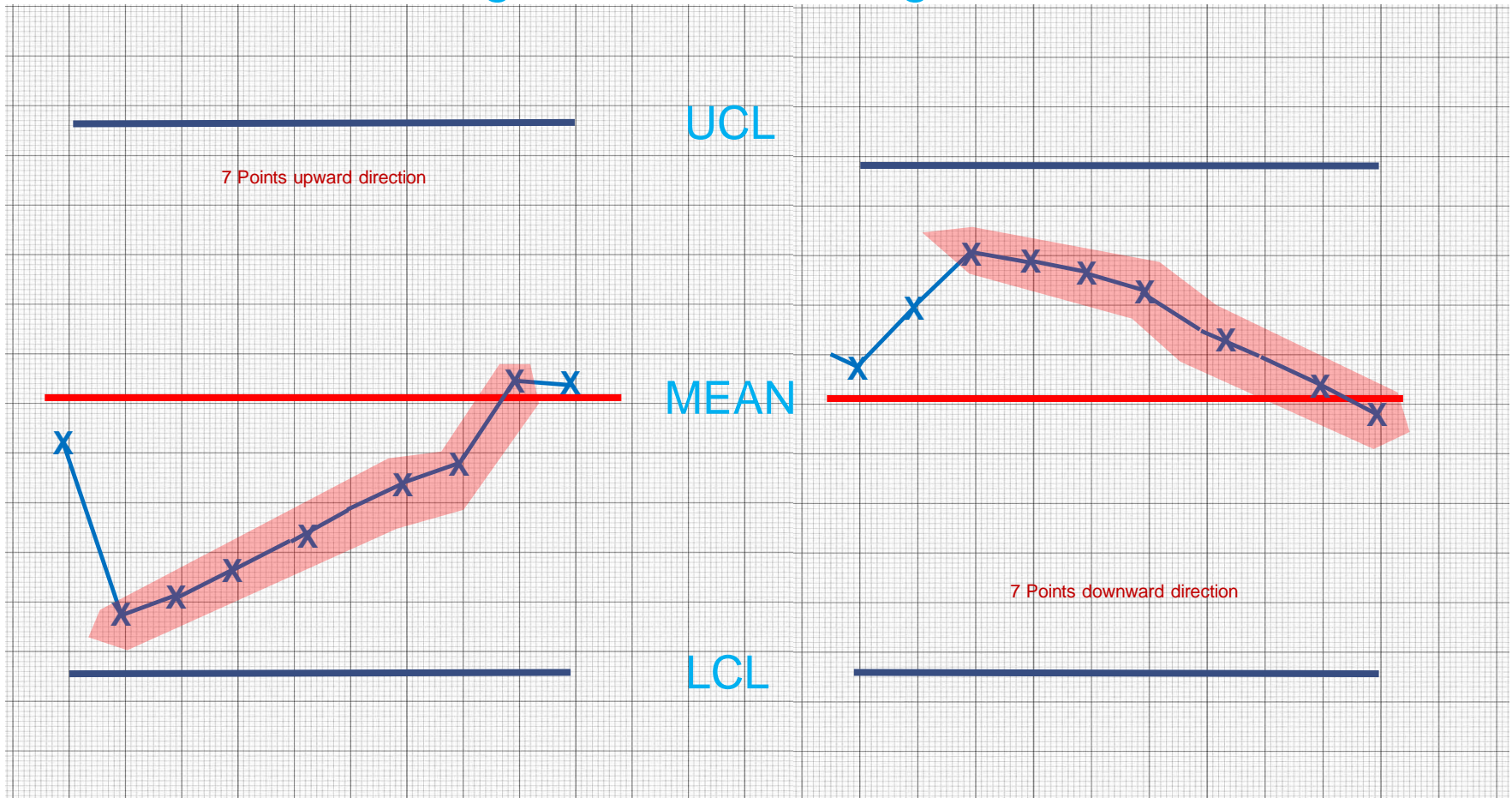
Rule 2 - A run of seven points all above or all below the centre line, or all increasing or all decreasing



Special causes



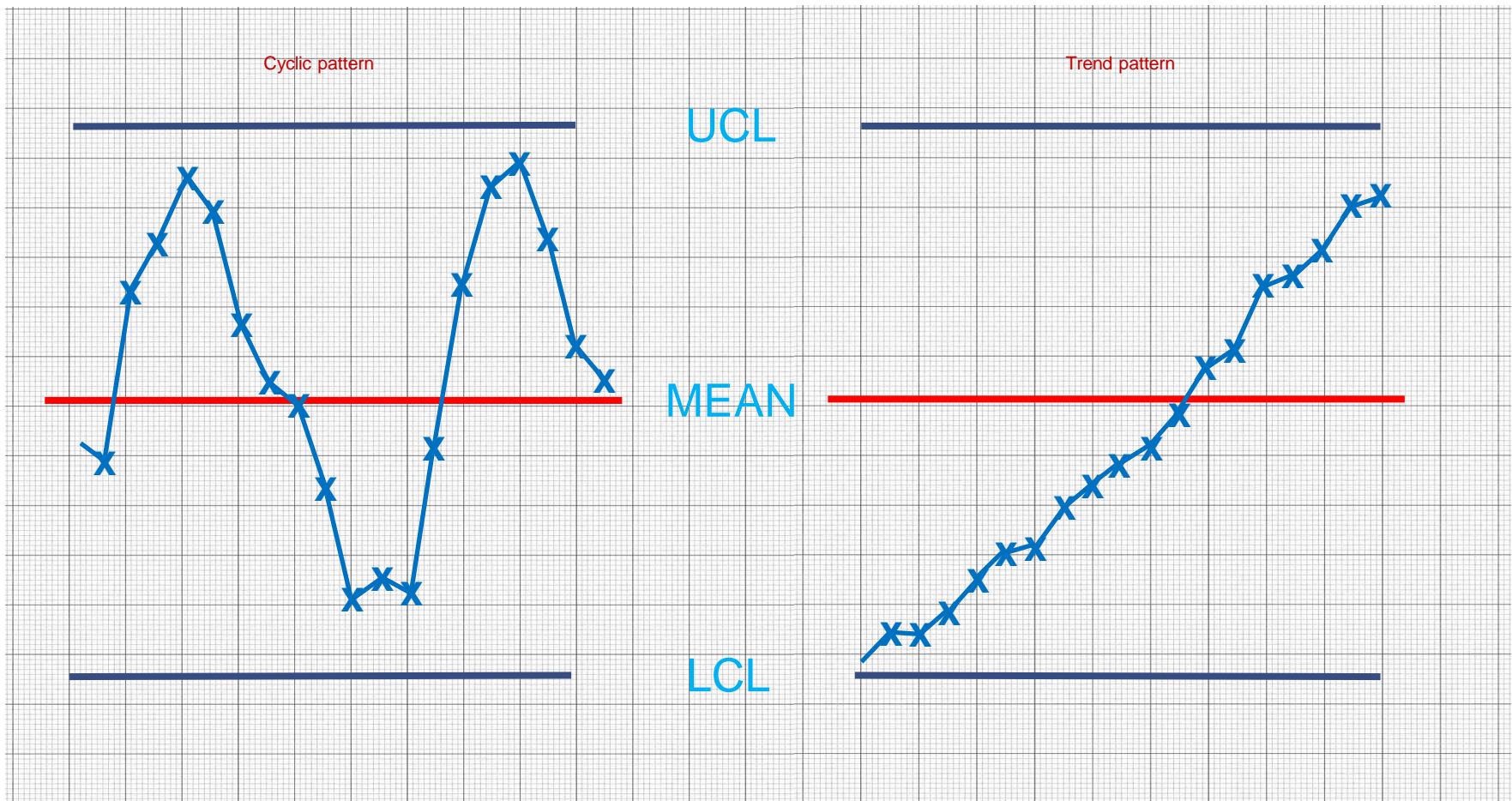
Rule 2 - A run of seven points all above or all below the centre line, or all increasing or all decreasing



Special causes



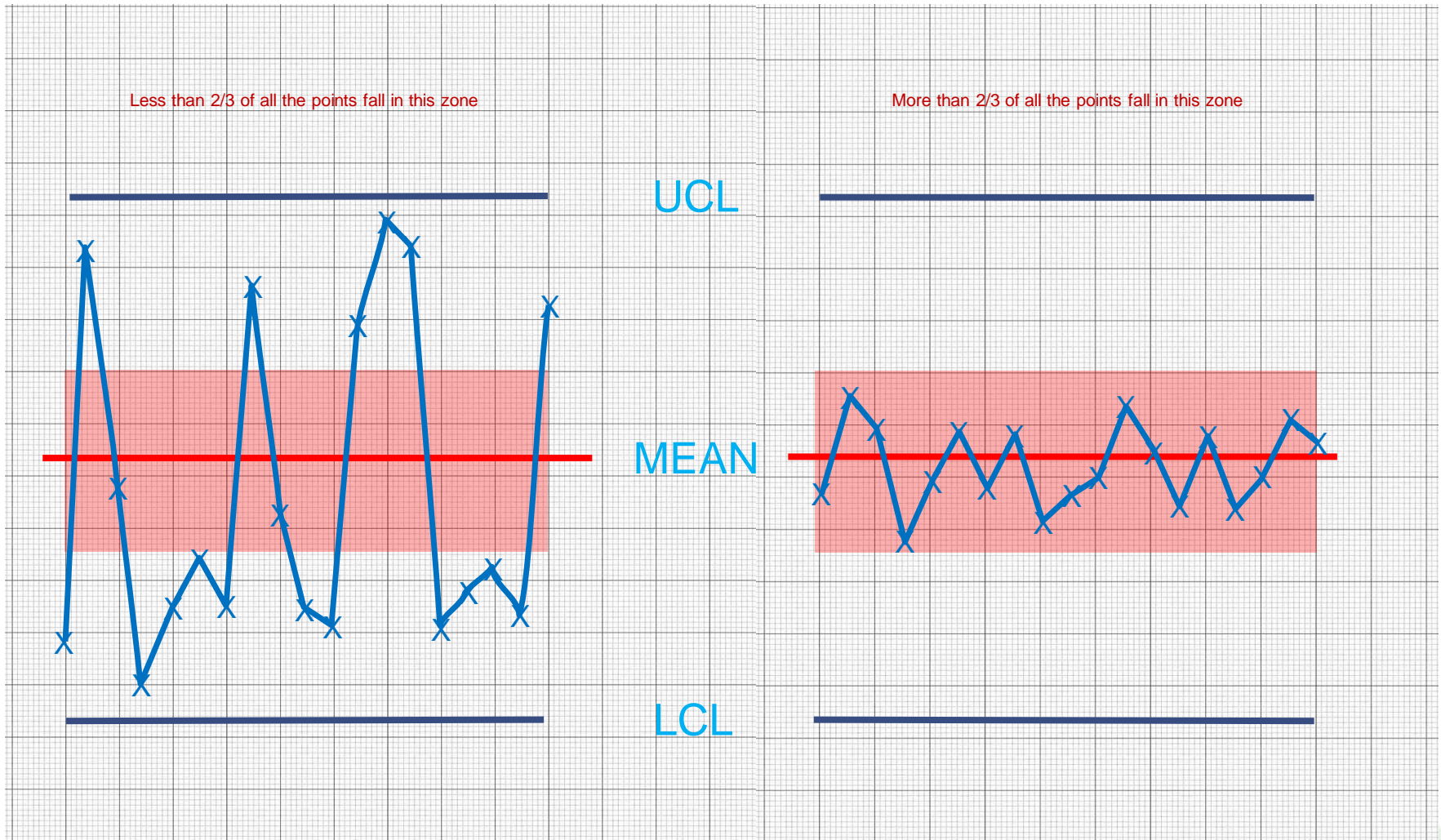
Rule 3 - Any “unusual” pattern or trends within the control limits



Special causes



Rule 4



Process out of control



- These rules are important!
- They tell us if the process is **stable** or **unstable**
- They tell us if **common** or **special** cause variation is present

Remember the rules!

- **Outside control limits**
- **Run of 7 or more consecutive points**
- **Patterns**
- **Rule of thirds**

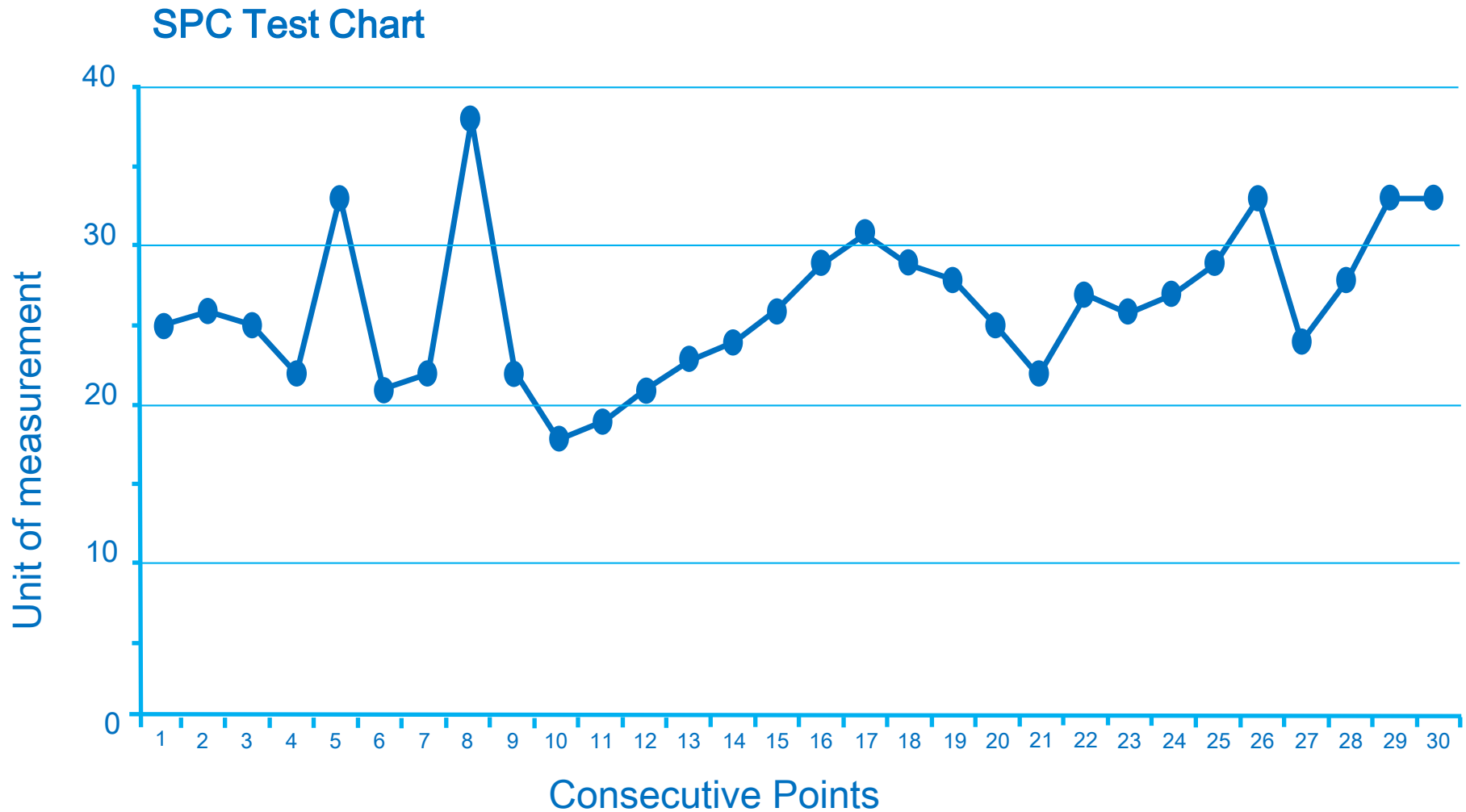


Constructing the chart

- There are 5 steps to constructing your chart:
 1. Plot the individual values
 2. Derive the moving range values
 3. Calculate the mean (\bar{X}) and plot it
 4. Calculate the average moving range (\bar{R})
 5. Derive upper and lower limits from this and plot them



1. Plot individual values



2: Derive moving range

These are required to calculate the control limits

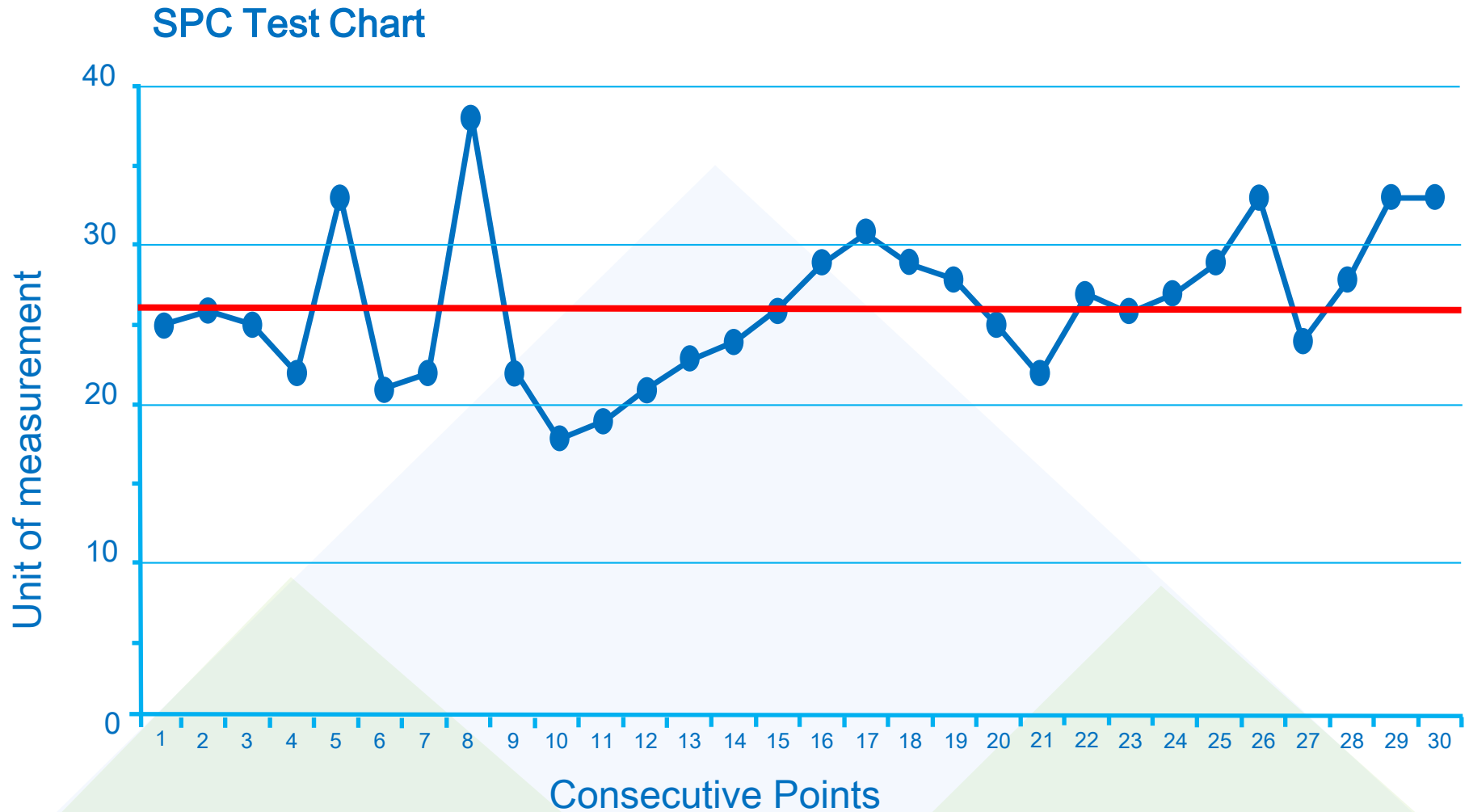
The first row contains the chart data

Use the second row to record the difference between successive data values

The difference is always recorded as a positive value

X Data	0	0	5	4	8	9
Moving Range		0	5	1	4	1

3. Calculate Mean & plot it



4: Calculate Average Moving Range

R ₁	R ₂	R ₃	R ₄	R ₅	R ₆	R ₇	R ₈	R ₂₃	R ₂₄
60	165	75	30	150	320	155	15	155	60

Average Moving Range	\bar{mR}
$= \frac{60+165+75+30+150+320+155+15 \dots\dots\dots+60}{24}$	
Sum of the R's Number of readings	$= \frac{1960}{24}$

5: Derive process limits

Derive measure of variation
(1 sigma) as:

Average moving range
1.128

19.3
1.128

Calculate upper limit as:

Mean + 3 sigma

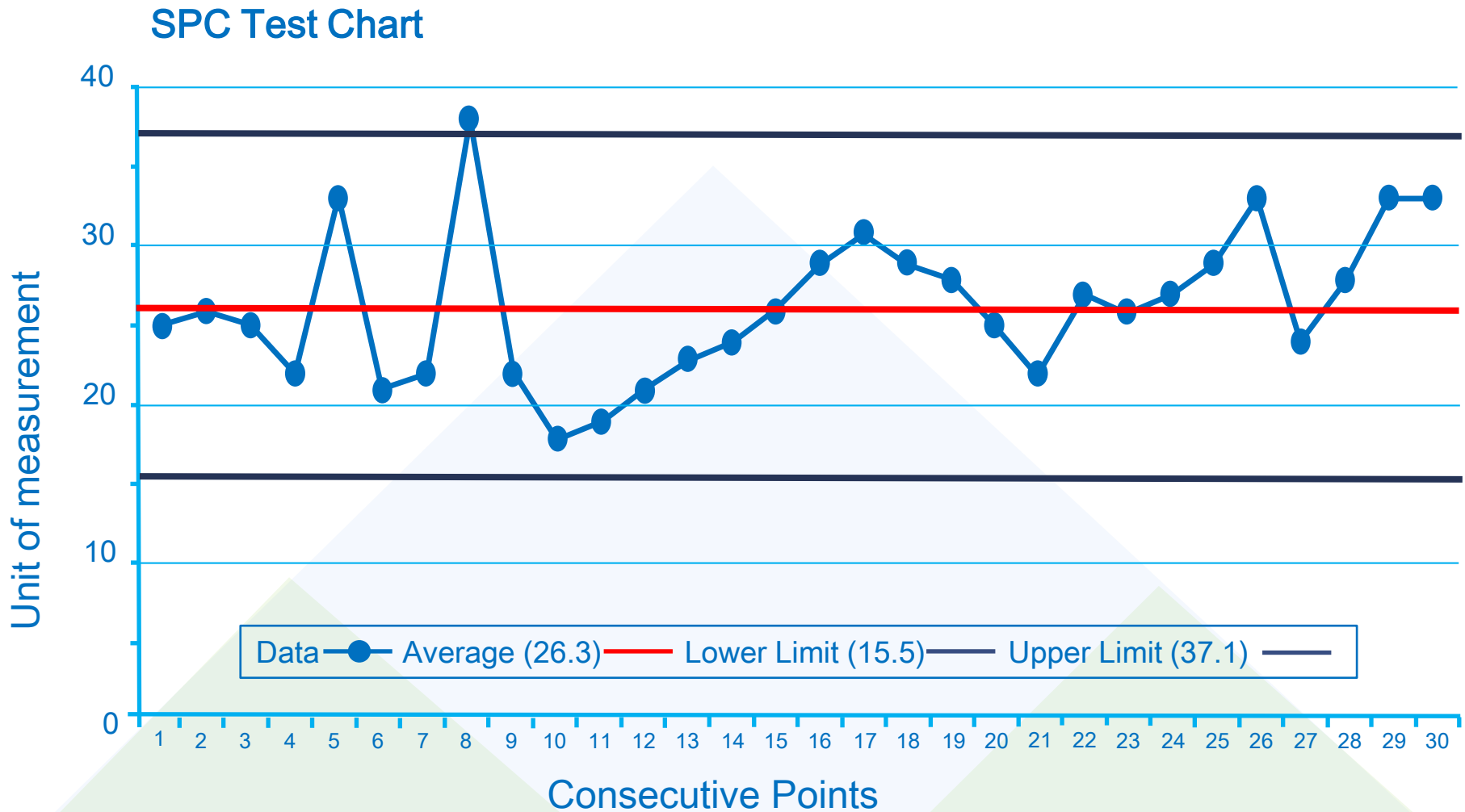
$= 58 + (3 * (19.3 / 1.128))$

Calculate lower limit as:

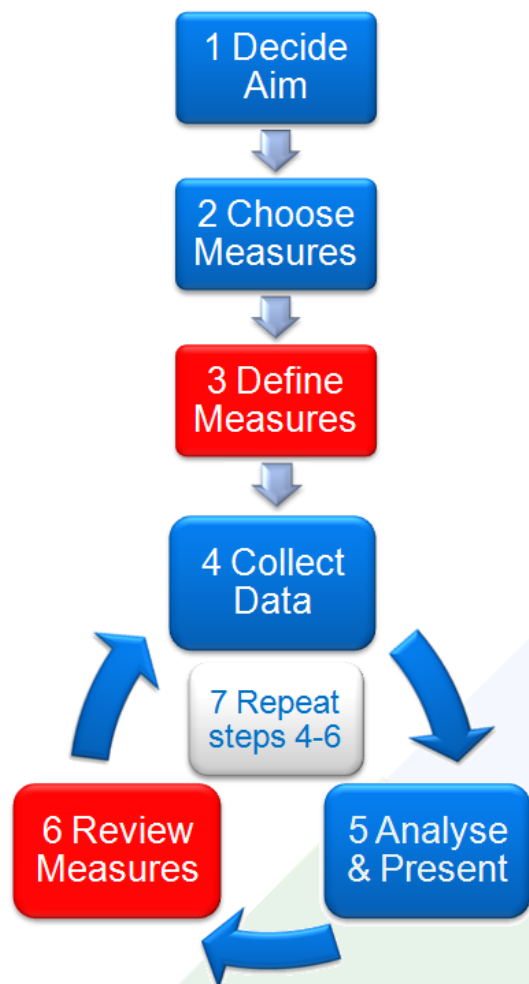
Mean - 3 sigma

$= 58 - (3 * (19.3 / 1.128))$

5. Plot process limits



Step 6 – Review Measures



*"It is a waste of time collecting and analysing your data if you don't **take action** on the results"*



Measurement recap



1. Remember variation exists
2. Define what you are collecting clearly
3. Only interpret data using statistically significant measures
4. Use SPC for all stages of your project