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Automotive core tool: PPAP

Everyone is muted.
We will start at 7pm EST.

Kush Shah, Chairman
ASQ Automotive Division

Call In: +1 (951) 266-6125
Code: 330-832-467

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Agenda

- Housekeeping Items
- About ASQ Automotive Division
- Our Vision
- Webinar Series
- Automotive core tool: PPAP
- Questions & Answers

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Housekeeping Items

Everyone is muted

Session is being recorded

Session will last about 90 minutes

ASQ Automotive members can download the slides and video at www.asq-auto.org

Participate thru chat and questions

Will answer questions at the end:

- **Q&A at the end of the presentation**
- **Please type your questions in the panel box**

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ASQ Automotive Chair

Kush Shah

- Manager, Global Electrification, General Motors, Michigan, U.S.
- Leadership positions in Engineering, R&D, Manufacturing, Quality
- 20+ years of quality experience
- Six Sigma Master Black Belt, Shainin Red X Master, ASQ CQA, CMQ/OE,CQE, CSSBB
- Speaker at International Quality Symposiums / Conferences
- Trainer for Six Sigma and Quality Management

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Global Automobile Outlook – 2020

>1 billion vehicles - Circle the earth **125 times**

15% ownership

~3% annual growth worldwide

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American Society for Quality (ASQ):

ASQ is the world's leading professional association and authority on quality

ASQ Automotive Division Mission:

To be the recognized global network of automotive quality professionals that is helping individuals and organizations to achieve personal and organizational excellence

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Key Objectives of ASQ Automotive Division:

Increase Member Value – Webinars, symposium and Automotive Excellence magazine

Develop Core Tools Competency –On-site training - PPAP, APQP, FMEA, SPC and MSA

Global Outreach – Participate in conferences and deliver training globally

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Key Objectives of ASQ Automotive Division:

U.S. Outreach - Engage all automotive OEMs and Tier 1 & 2 suppliers

Student Outreach – Collaborate with universities

Collaborate With Other Professional Societies – Engage with other societies and professional organizations

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Core Quality Tools for Automotive Industry:

Advanced Product Quality Planning (APQP)
Failure Mode and Effects Analysis (FMEA)
Production Part Approval Process (PPAP)
Measurement Systems Analysis (MSA)
Statistical Process Control (SPC)

ASQ Automotive Division provides on-site training by certified instructors.

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The ASQ Automotive Division is pleased to present a regular series of free webinars featuring leading international experts, practitioners, academics, and consultants. The goal is to provide a forum for the continuing education of automotive professionals.

ASQ Automotive members can download the presentation slides on our website www.asq-auto.org. Recorded webinars are also available for viewing after the events for members.

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Group: ASQ Automotive Division Group

twitter.com/ASQautomotive

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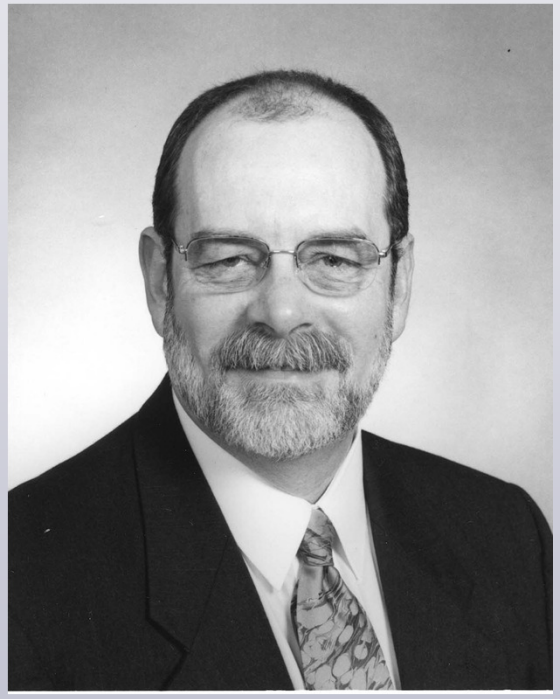
Mark A. Morris



Mark A. Morris has more than 30 years experience in tooling and manufacturing as a skilled machinist, toolmaker, college instructor, technical writer, and quality professional in roles from Quality Engineer to Director of Continuous Improvement. His expertise lies in dimensional issues, reliability, maintainability, and quality systems. Mr. Morris' credentials include undergraduate degrees focused on manufacturing engineering, industrial education, and metalworking; Master of Education degree from the College of Technology at Bowling Green State University; CQE, CRE, and CQA certifications from the American Society for Quality; and Senior Level Geometric Dimensioning and Tolerancing Professional (GDTP) certification from the American Society of Mechanical Engineers. Mr. Morris is also the Immediate Past Chair for the Ann Arbor section of ASQ, and for the past five years, has trained candidates to become ASQ Certified Quality Engineers. He presently serves as Education Chair on the Leadership Team of the Ann Arbor section of ASQ..

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Production Part Approval Process based on *PPAP 4th Edition*

Mark A. Morris

ASQ Automotive Division Webinar

November 16, 2011

M and M Consulting

mark@MandMconsulting.com
www.MandMconsulting.com

My Strategy for Tonight

- A Brief History
- Course Development Process
- Sample Presentations of PPAP Content
- Instructor's Manual
- Instructor Validation
- Simple Words

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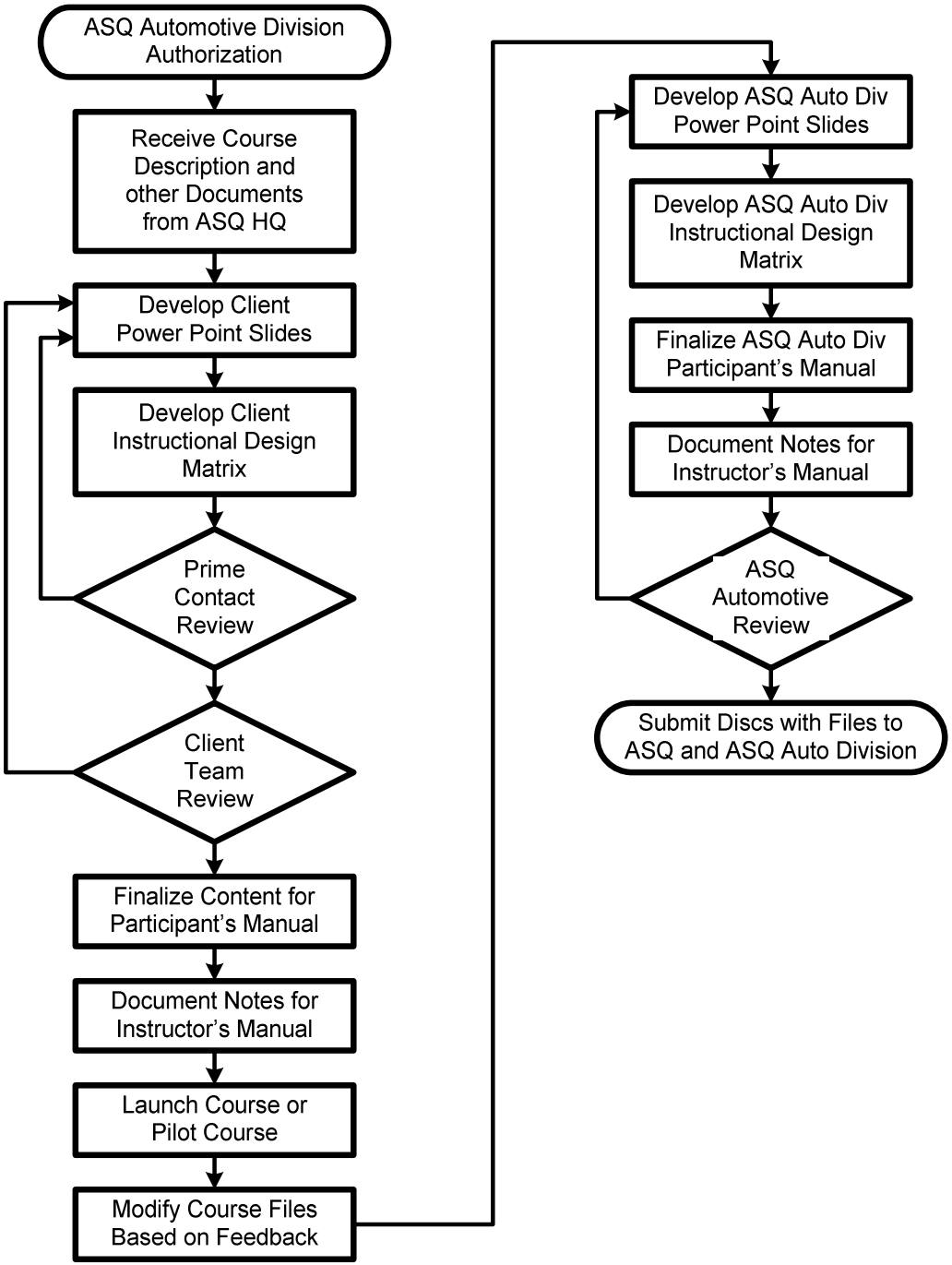
Course Development and Approval



PPAP 4th Edition – Table of Contents

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PPAP Course Design

- Introduction
  - Agenda, Objectives, and Effective Implementation
- PPAP Process Requirements
  - Review PPAP Manual
- Exercise 1
  - Consider PPAP Situations and Strategies
- PPAP Content Requirements
  - Review PPAP Manual
- Exercise 2
  - Evaluate 18 PPAP Content Requirements
- Summary and Closure

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Course Goals

1. To provide a fundamental understanding of the PPAP evidence vital to producing conforming product.

2. To ensure that all process, product, and customer requirements are understood.

3. To ensure that the production processes can meet all requirements.

PPAP Documentation Requirements

2.2.1 Design Record	2.2.2 Authorized Engineering Changes	2.2.3 Customer Engineering Approval	2.2.4 Design FMEA	2.2.5 Process Flow Diagrams	2.2.6 Process FMEA
2.2.7 Control Plan	2.2.8 MSA Studies	2.2.9 Dimensional Results	2.2.10 Material and Test Results	2.2.11 Initial Process Studies	2.2.12 Qualified Laboratory Documentation
2.2.13 Appearance Approval Report	2.2.14 Sample Production Parts	2.2.15 Master Sample	2.2.16 Checking Aids	2.2.17 Customer Specified Requirements	2.2.18 Part Submission Warrant

The focus of PPAP is Risk Reduction!

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PPAP Process Requirements

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PPAP Changes – 3rd to 4th Edition

- Align PPAP to ISO/TS 16949 process approach.
- Customer specific instructions moved to appropriate web sites (OEM and IAOB, www.iatfglobaloversight.org).
- Truck OEM requirements moved to Appendix H.
- Parts Submission Warrant (PSW) revised.
- Material reporting and polymeric identification requirements in the design record.
- Use of process capability indices (Cpk and Ppk).

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Purpose of PPAP

- PPAP defines generic requirements for production part approval.
- The purpose of PPAP is two-fold:
  1. To determine if all customer engineering design records and specification requirements are properly understood.
  2. To determine whether the manufacturing process has the potential to produce product consistently meeting these requirements at the quoted production rate.

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2.1 Significant Production Run

- For production parts, product for PPAP should be taken from a significant production run.

- This significant production run shall consist of from one hour to eight hours of production, and with the specific production quantity to total a minimum of 300 consecutive parts, unless otherwise specified.

2.1 Significant Production Run

- This significant production run shall be:
  - conducted at the production site,
  - at specified production rates,
  - using the production tooling,
  - production gaging,
  - production process,
  - production materials,
  - and production operators.

- Parts from each unique production process shall be measured and tested.

4.1 Submission Levels

Level 1	Warrant and Appearance Approval Report (if designated appearance items exist) submitted to the customer.
Level 2	Warrant with product samples and limited supporting data submitted to the customer.
Level 3	Warrant with product samples and complete supporting data submitted to the customer.
Level 4	Warrant and other requirements as defined by the customer.
Level 5	Warrant with product samples and complete supporting data reviewed at the organization's manufacturing facility.

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Retention/Submission Requirements

Requirement	Level 1	Level 2	Level 3	Level 4	Level 5
2.2.1 Design Record	R	S	S	*	R
2.2.2 Authorized Engineering Changes	R	S	S	*	R
2.2.3 Customer Engineering Approval	R	R	S	*	R
2.2.4 Design FMEA	R	R	S	*	R
2.2.5 Process Flow Diagrams	R	R	S	*	R
2.2.6 Process FMEA	R	R	S	*	R
2.2.7 Control Plan	R	R	S	*	R
2.2.8 MSA Studies	R	R	S	*	R
2.2.9 Dimensional Requirements	R	S	S	*	R
2.2.10 Material and Test Results	R	S	S	*	R
2.2.11 Initial Process Studies	R	R	S	*	R
2.2.12 Qualified Laboratory Documentation	R	S	S	*	R
2.2.13 Appearance Approval Report	S	S	S	*	R
2.2.14 Sample Production Parts	R	S	S	*	R
2.2.15 Master Sample	R	R	R	*	R
2.2.16 Checking Aids	R	R	R	*	R
2.2.17 Customer Specified Requirements	R	R	S	*	R
2.2.18 Part Submission Warrant	S	S	S	S	R

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5.1 Part Submission Status

- Upon approval of the submission, the organization shall assure that future production continues to meet all customer requirements.

- Customer PPAP Status:
  1. Approved
  2. Interim Approval
  3. Rejected

List of Appendices

A. Completion of PSW

B. Completion of AAR

C. Dimensional Results

D. Material Test Results

E. Performance Test Results

F. Bulk Material – Specific Requirements

G. Tires – Specific Requirements

H. Truck OEM – Specific Requirements

Exercise 1

PPAP Situations and Strategies

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Exercise 1 – Question 1

400 consecutive parts are required in a significant production run.

- ❑ True
- ❑ False

Exercise 1 – Question 4

You are to produce a high risk part or assembly, and your customer authorized representative wanted to be present for the significant production run. What level PPAP would you expect to be specified?

- ❑ Level 1
- ❑ Level 2
- ❑ Level 3
- ❑ Level 4
- ❑ Level 5

Exercise 1 – Question 5

If you were to produce a part, and your customer wanted to specify exactly which elements of the PPAP were to be submitted to, what level PPAP would you expect to be specified?

- ❑ Level 1
- ❑ Level 2
- ❑ Level 3
- ❑ Level 4
- ❑ Level 5

Exercise 1 – Question 6

Under what conditions would it be appropriate to request an interim PPAP approval, rather than just fixing existing deficiencies and applying for a full PPAP approval?

PPAP Content Requirements

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PPAP Documentation Requirements

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The focus of PPAP is Risk Reduction!

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2.2.11 Initial Process Studies

2.2.11.1 General

2.2.11.2 Quality Indices

2.2.11.3 Acceptance Criteria for Initial Study

2.2.11.4 Unstable Processes

2.2.11.5 One-Sided Specifications and Non-Normal distributions

2.2.11.6 Actions to be Taken When Acceptance Criteria are not Met

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The Genius of Dr. Hans J. Bajaria

Dr. Hans Bajaria synthesized the work of the masters into a practical, effective structure to identify and resolve problems.

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Three Questions to be Taken in Order

Dr. Hans Bajaria claimed that these three questions could identify three unique sets of causes.

1. Is the process stable?

2. Is there too much variation?

3. Is the process off-target?

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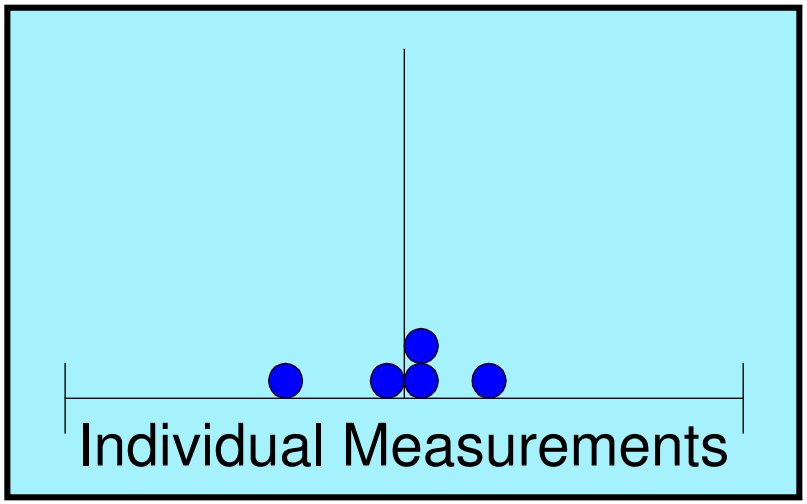
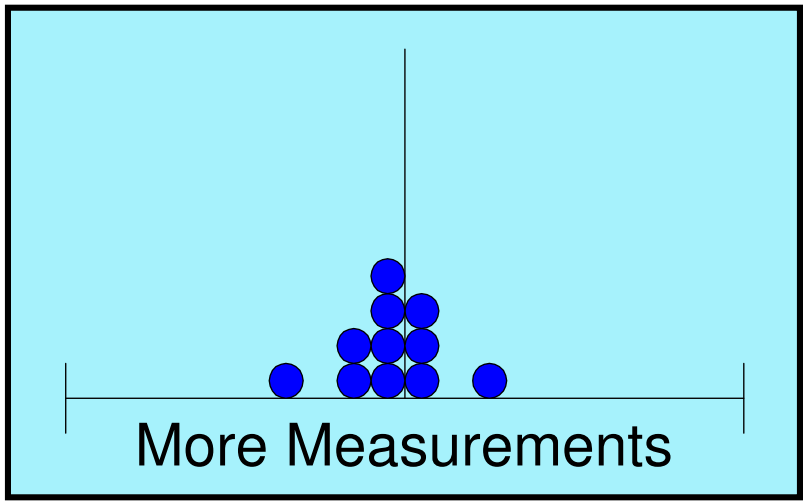
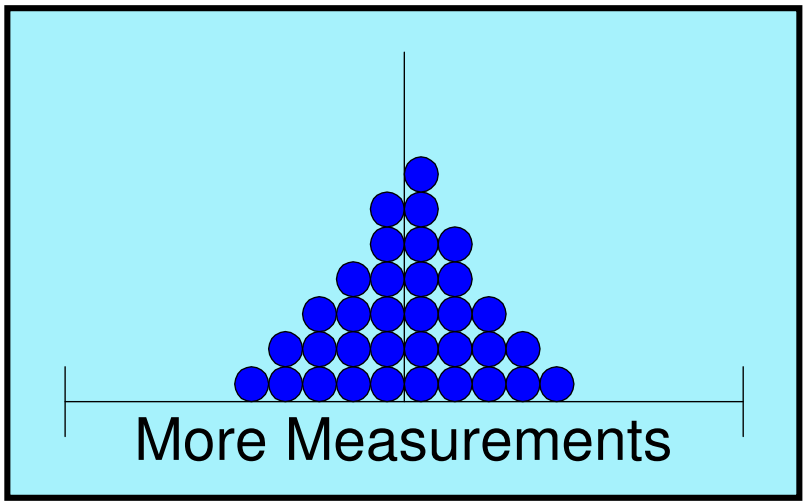
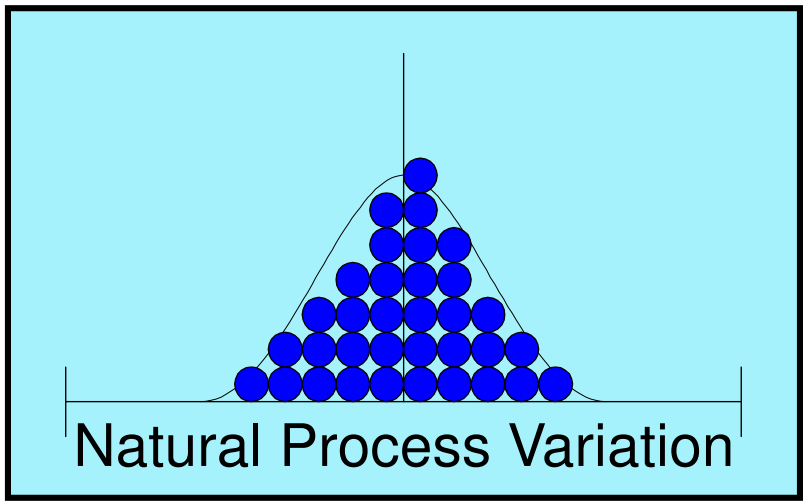
Variation in All Things









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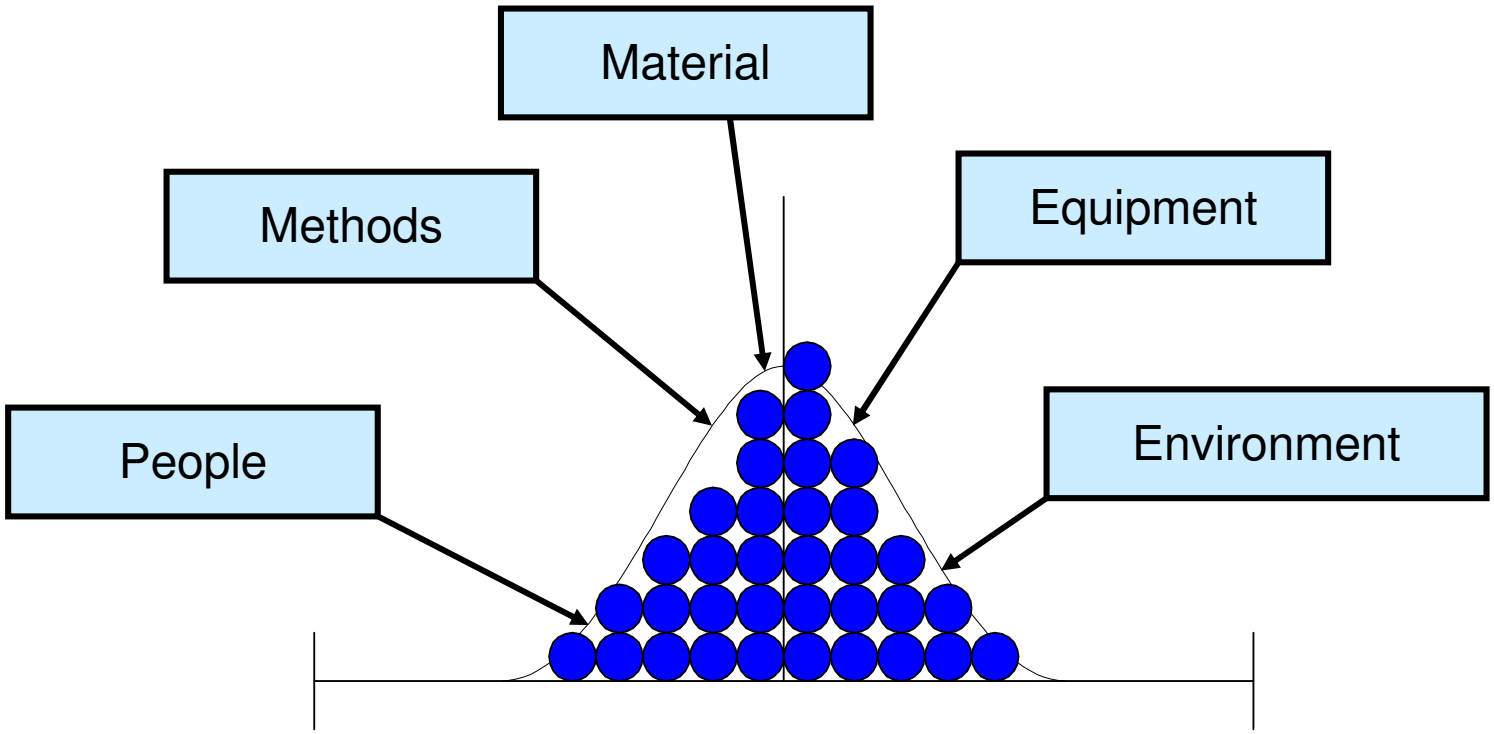
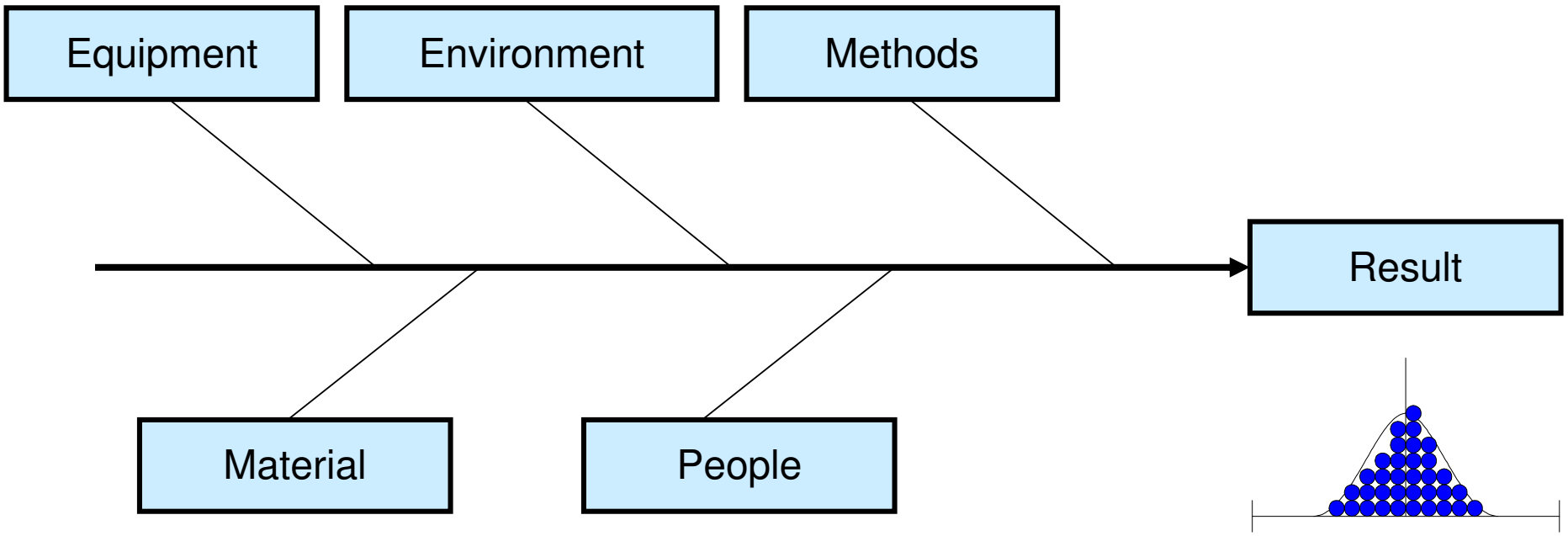
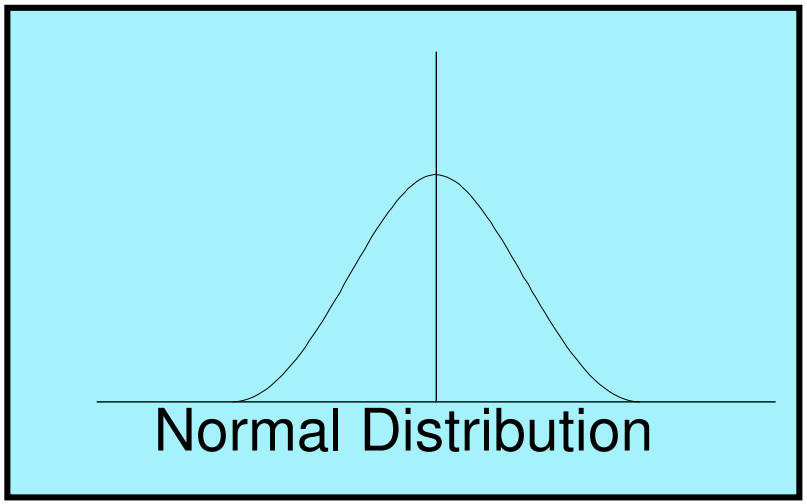
Natural Variation Inherent in the Process

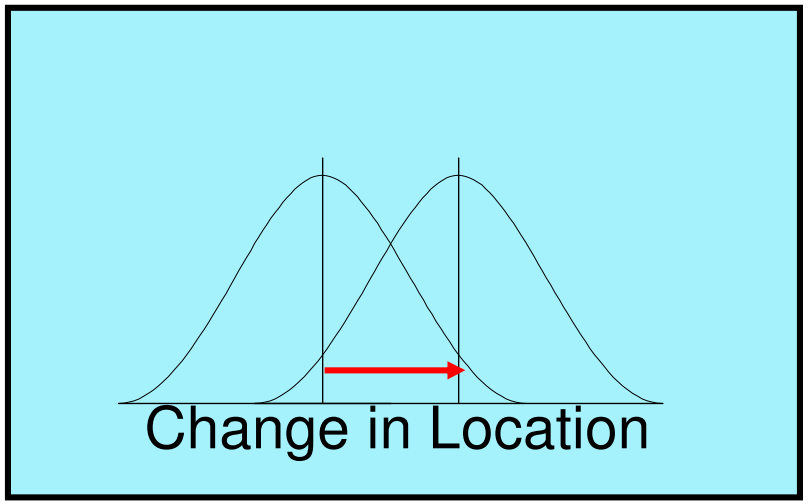


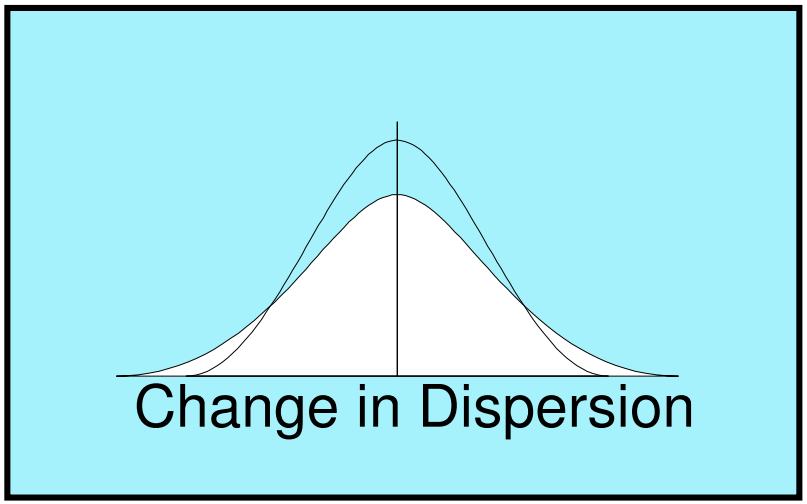
Causes and Effects

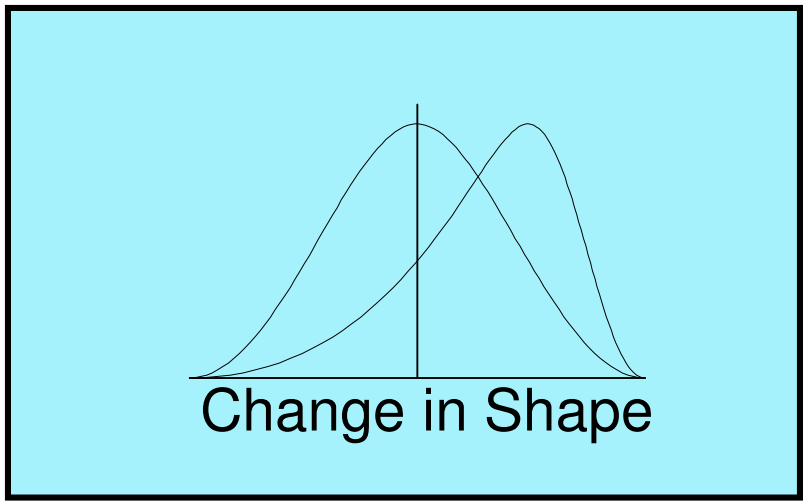


Changes in Behavior









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The Genius of Dr. Walter A. Shewhart

Invented tools that give us a rational basis to know whether data is random or is affected by assignable causes.

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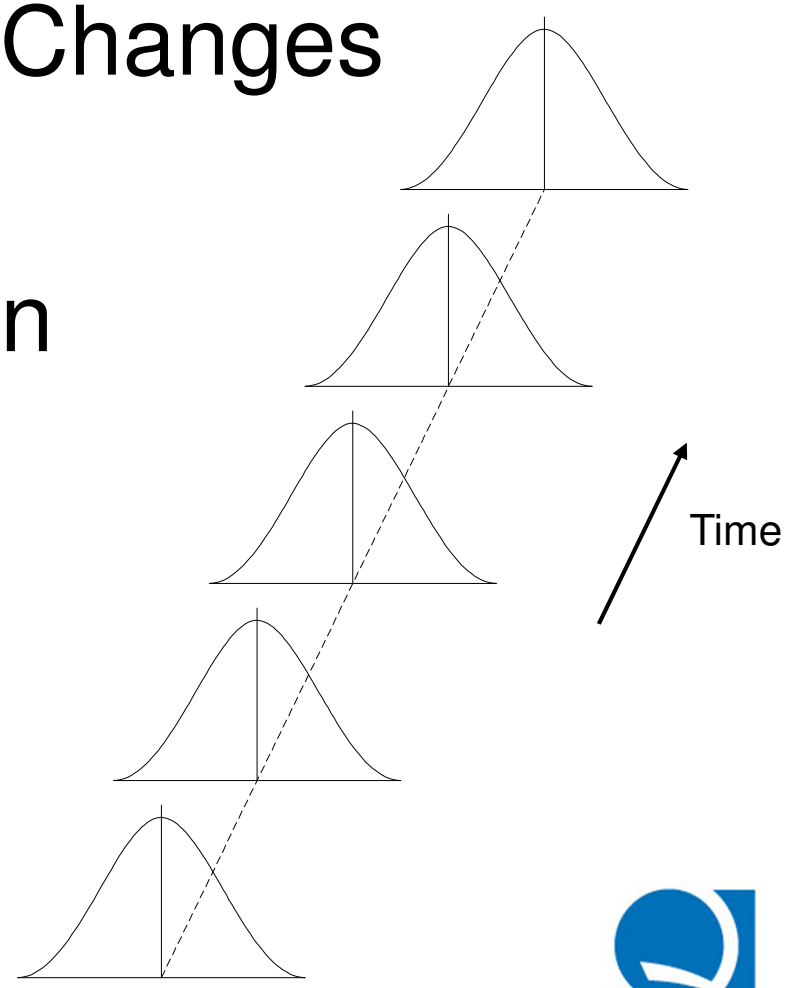
Some Processes are Predictable

- Absence of Unexpected Changes
- Common Cause Variation
- In Statistical Control
- Process is Stable



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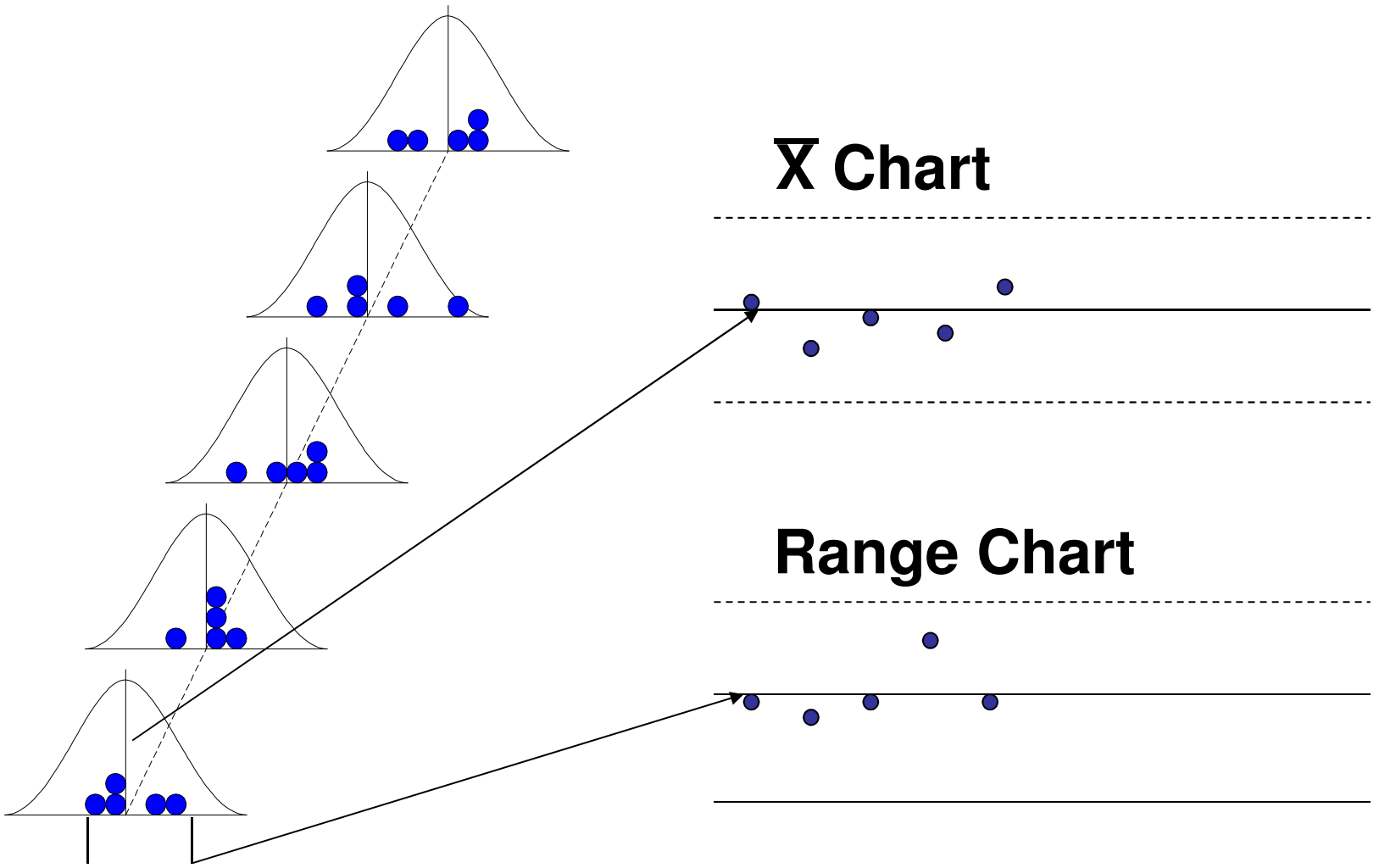
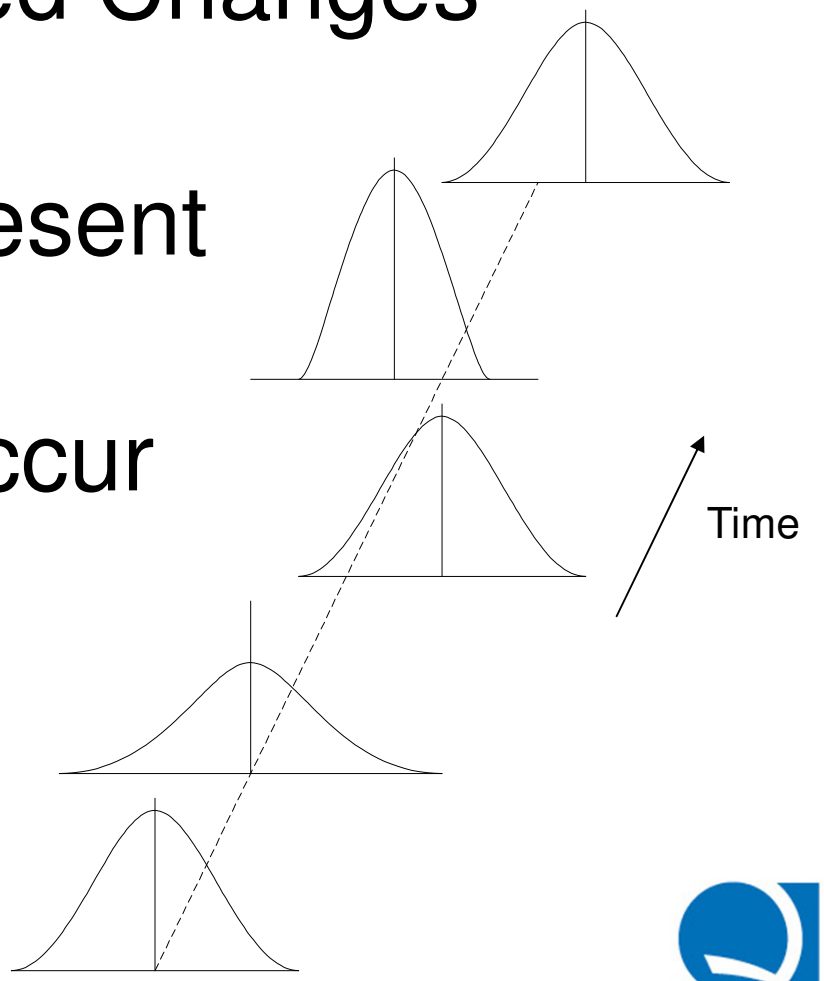
Control Charts Assess Stability



Other Processes Lack Stability

- Presence of Unexpected Changes
- Special Causes are Present
- Significant Changes Occur
- Process Out of Control
- Unstable



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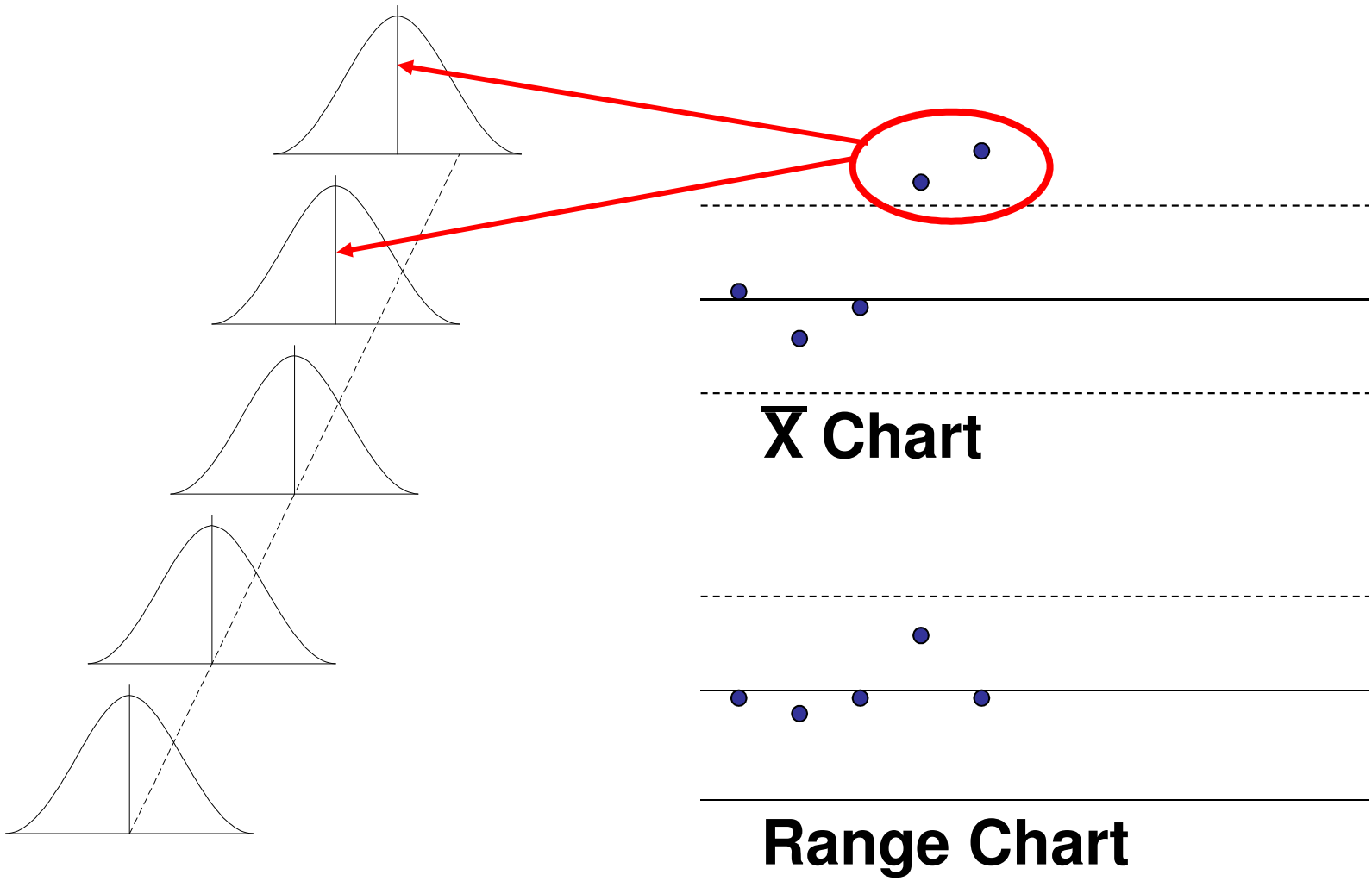
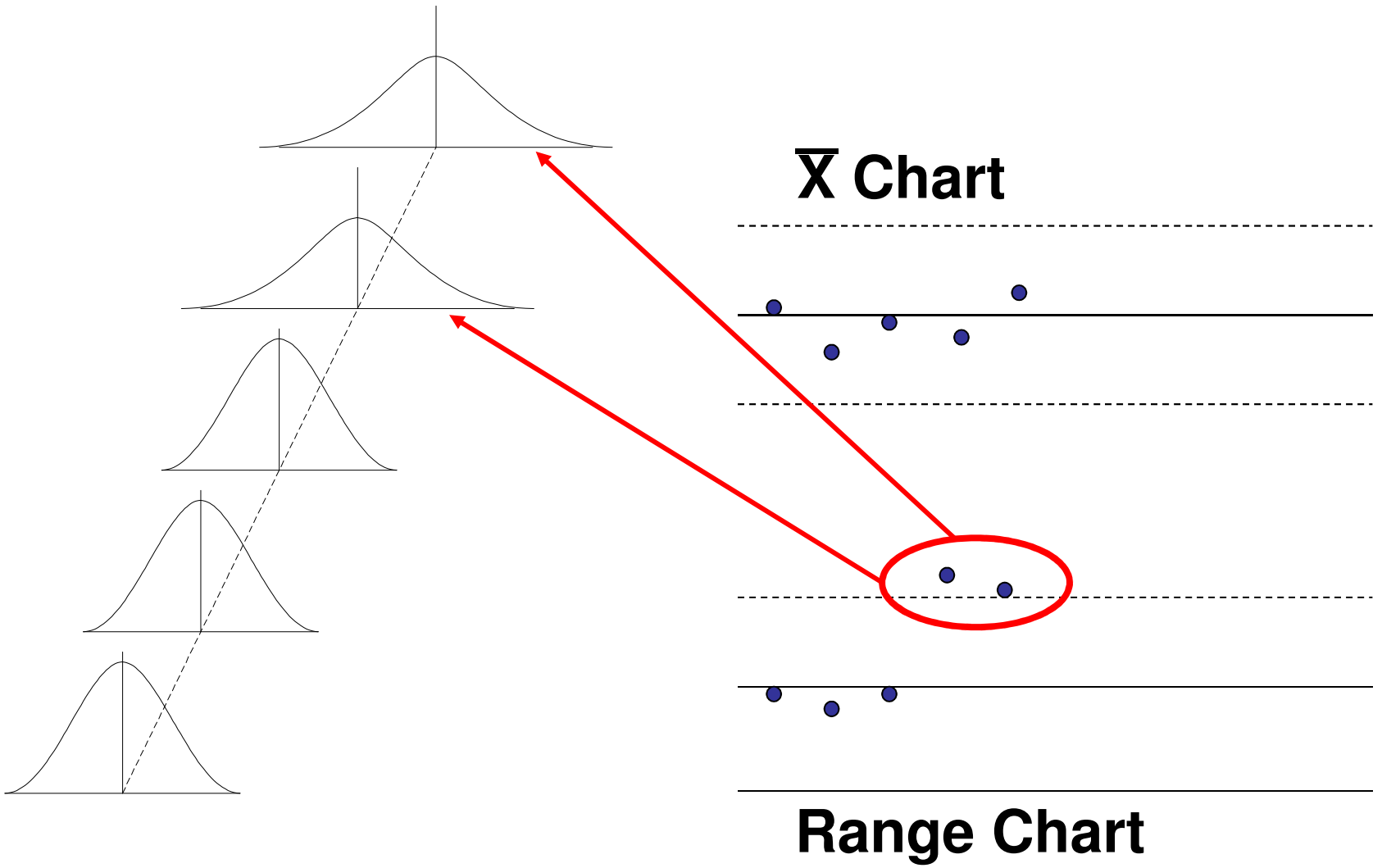
Drifting Off Target



Increasing Variation



Three Questions to be Taken in Order

Dr. Hans Bajaria claimed that these three questions could identify unique sets of causes.

1. Is the process stable?

   Method to know:

2. Is there too much variation?

3. Is the process off-target?

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Process Potential

- **Process Potential** is simply the ratio between the tolerance and the natural variation of the process. Location of the distribution has no impact on the figure of merit, Cp.

$$Cp = \frac{Tolerance}{6\sigma}$$

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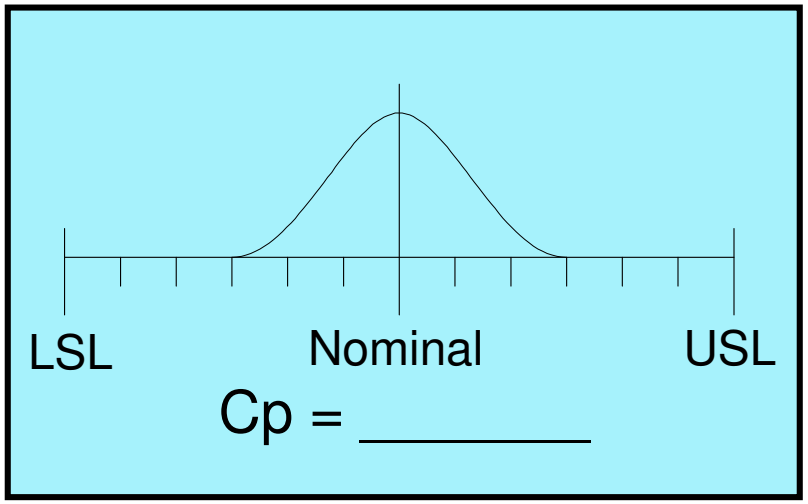
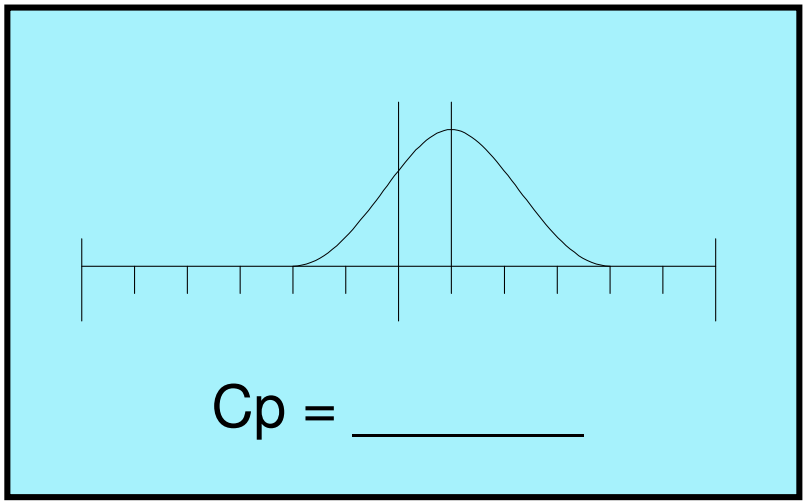
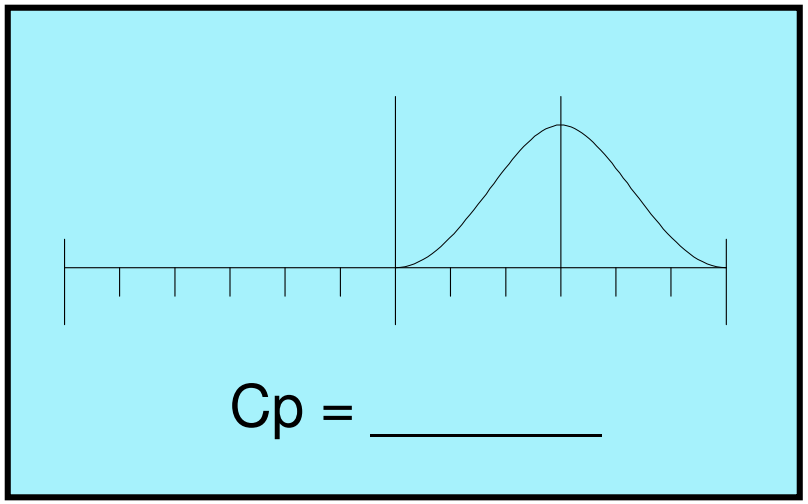
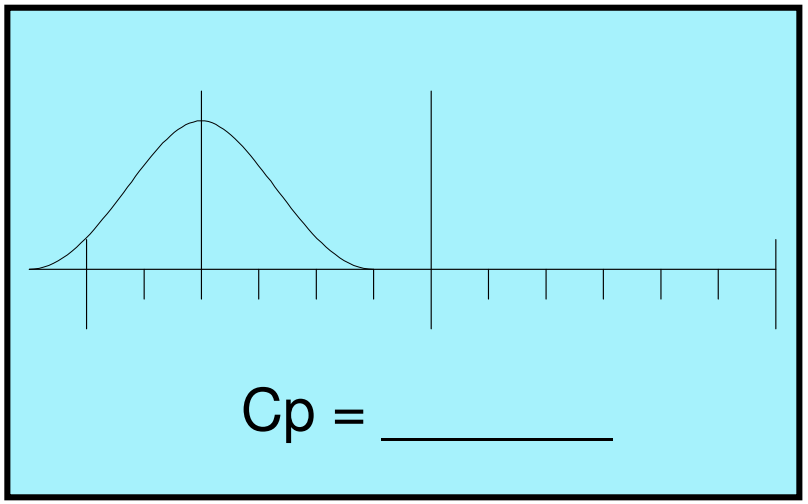
Process Potential









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Three Questions to be Taken in Order

Dr. Hans Bajaria claimed that these three questions could identify unique sets of causes.

1. Is the process stable?

   Method to know: **Control Chart**

2. Is there too much variation?

   Method to know:

3. Is the process off-target?

Process Capability

- **Process Capability** is based on the number of standard deviations between the worst case tail of the curve and its corresponding specification limit.

$$Cpk = \text{minimum of } \frac{\overline{X} - LSL}{3\sigma} \text{ or } \frac{USL - \overline{X}}{3\sigma}$$

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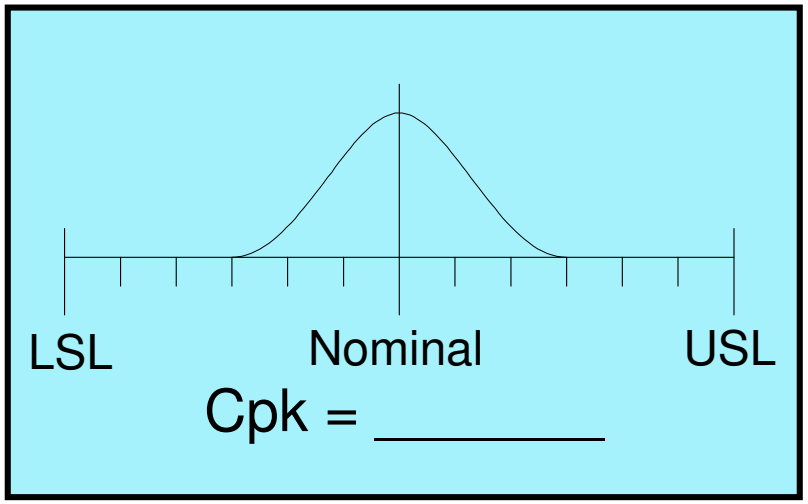
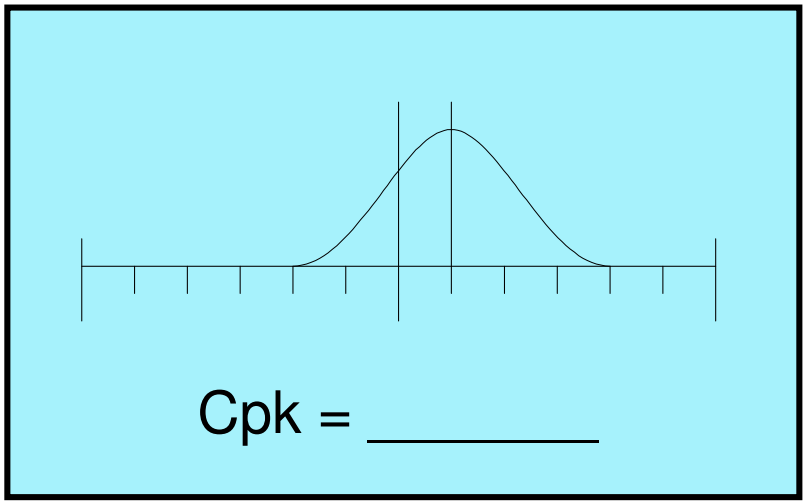
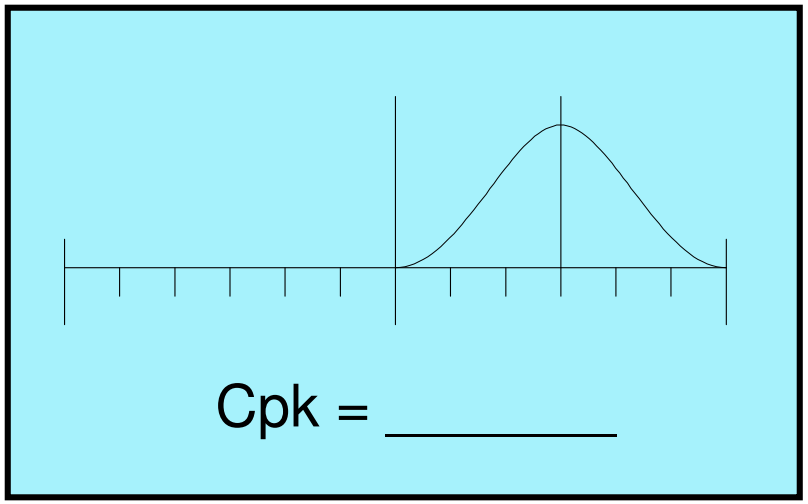
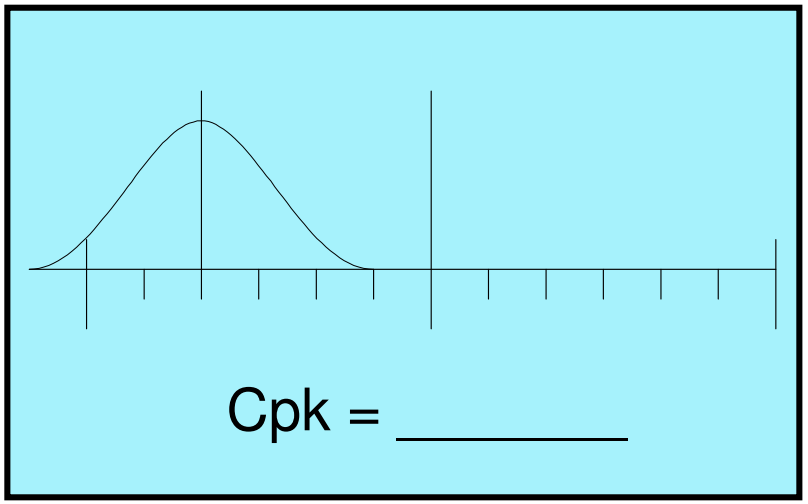
Process Capability









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Cp and Cpk vs. Pp and Ppk

- Pp and Ppk are sometimes used to assess preliminary process potential and capability.
- They are calculated using the same formulae as Cp and Cpk.
- The difference is in how the standard deviation is calculated.

$$\text{For Cp and Cpk, } \sigma = \frac{\overline{R}}{d_2}$$

$$\text{For Pp and Ppk, } \sigma = \sqrt{\frac{\sum \left(X - \overline{X}\right)^2}{n-1}}$$

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Three Questions to be Taken in Order

Dr. Hans Bajaria claimed that these three questions could identify unique sets of causes.

1. Is the process stable?

   Method to know: **Control Chart**

2. Is there too much variation?

   Method to know: **Cp or Pp**

3. Is the process off-target?

   Method to know:

Instructor Validation

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Exercise 2

Evaluate 18 PPAP Content Requirements

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Simple Words for PPAP Requirements

2.2.1 Design Record	2.2.2 Authorized Engineering Changes	2.2.3 Customer Engineering Approval	2.2.4 Design FMEA	2.2.5 Process Flow Diagrams	2.2.6 Process FMEA
2.2.7 Control Plan	2.2.8 MSA Studies	2.2.9 Dimensional Results	2.2.10 Material and Test Results	2.2.11 Initial Process Studies	2.2.12 Qualified Laboratory Documentation
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Match the simple words below with the 18 PPAP elements, 2.2.1 through 2.2.18.

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Summary and Closure

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Questions and Answers

Please type your questions in the panel box

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Thank You For Attending

Please visit our website www.asq-auto.org for future webinar dates and topics.