

# Fundamentals of **T**otal **Q**uality **L**eadership

## Module 3

System of Profound Knowledge

## Lesson 3

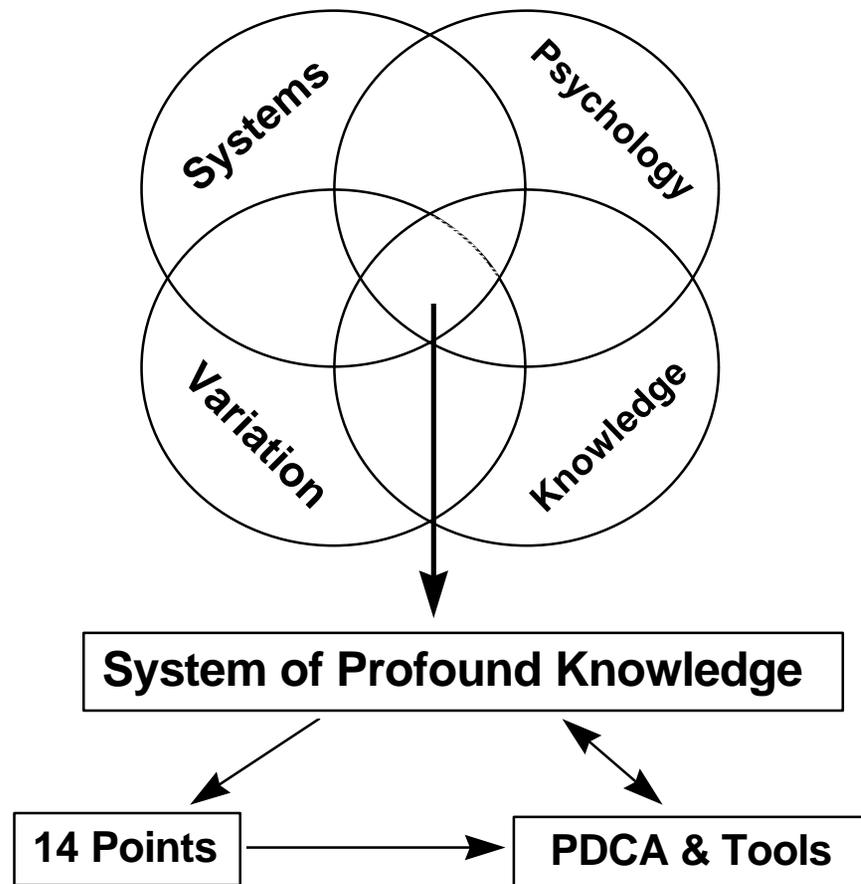
Variation

# Learning Objectives

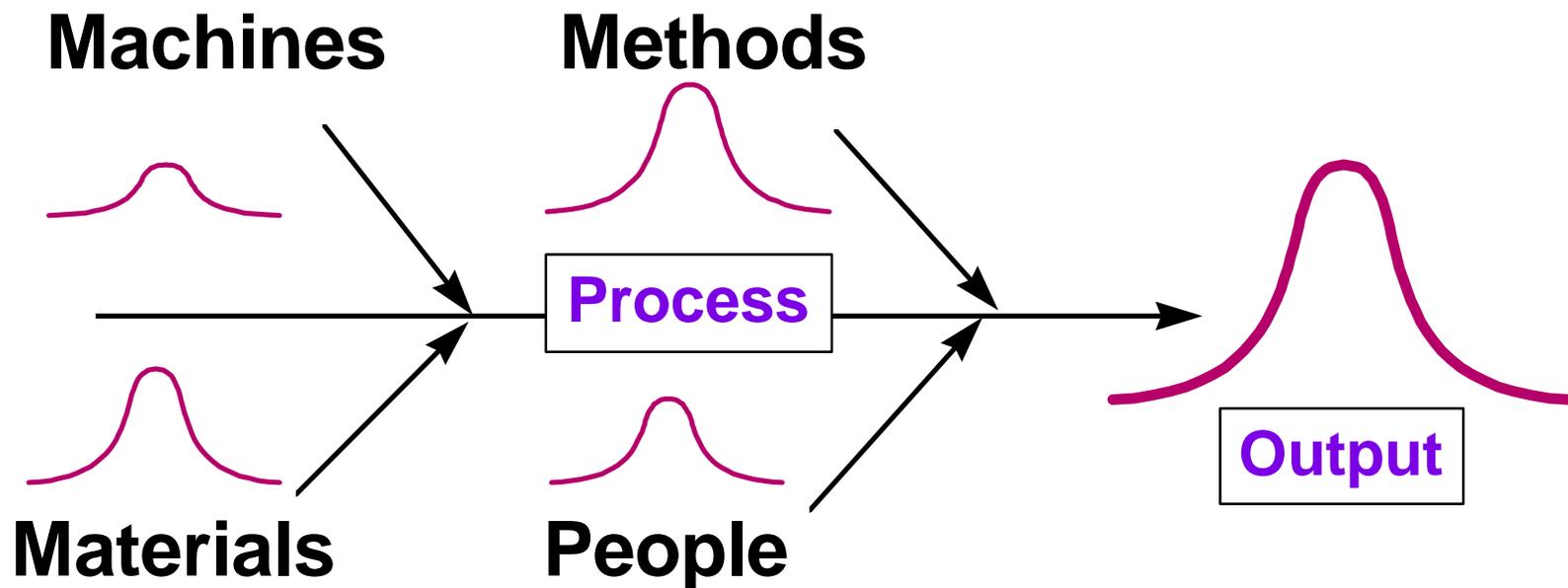
**At the end of this lesson the student will be able to:**

- ◆ Describe the concept of variation
- ◆ Explain the significance of the quality loss function
- ◆ Explain the importance of continuous process improvement for reducing variation
- ◆ Describe the difference between common cause and special cause variation
- ◆ Describe the difference between specification limits and control limits
- ◆ Describe the difference between stable and capable processes
- ◆ Explain who is responsible for taking action on common and special cause variation

# DON Approach to Quality Management

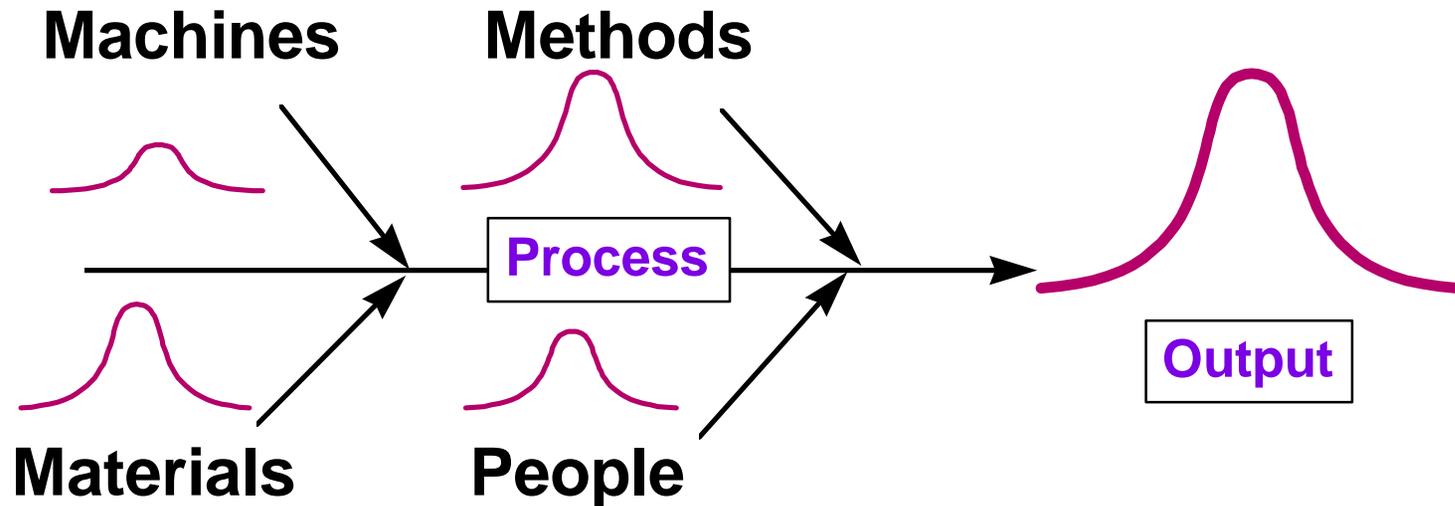


# Why Variation Occurs



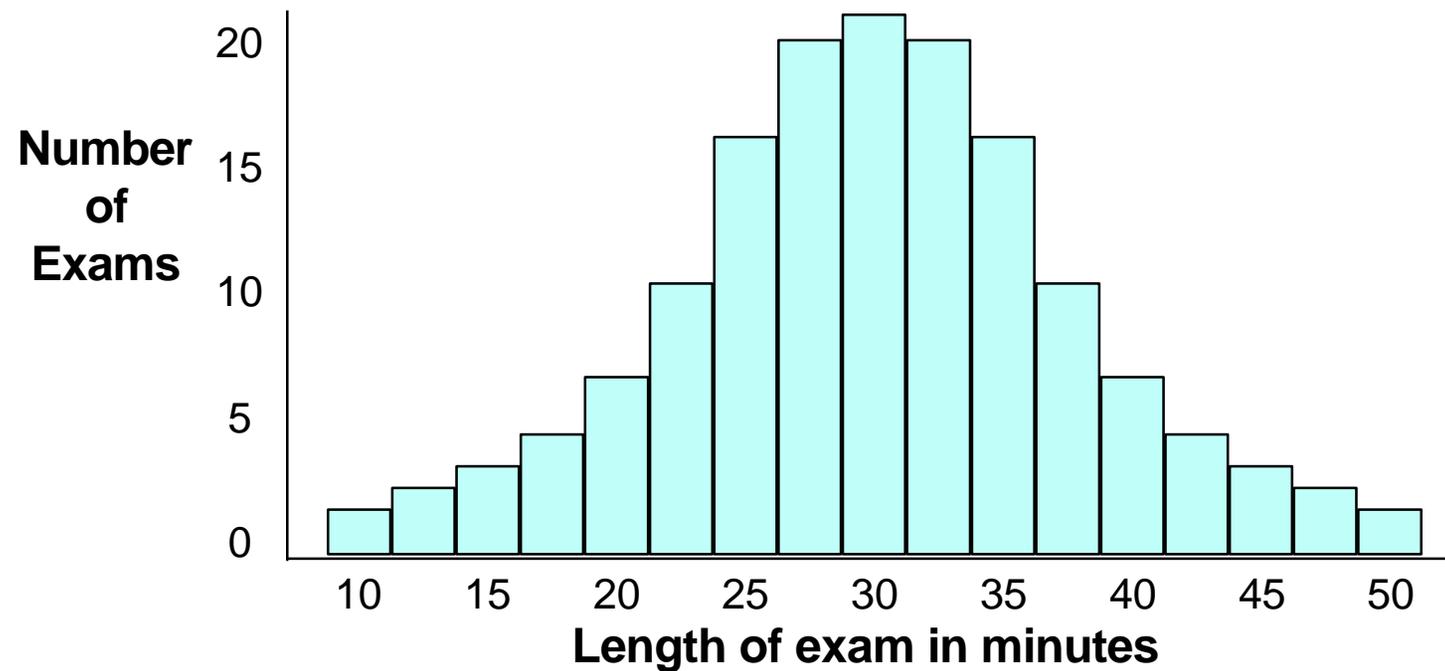
- ◆ Variation in the process leads to variation in the output

# Shewhart's Discovery



- ◆ Variation is inherent in all processes
- ◆ Process causes can be identified, measured, and analyzed
- ◆ Deliberate action is required to reduce variation

# Understanding Variation



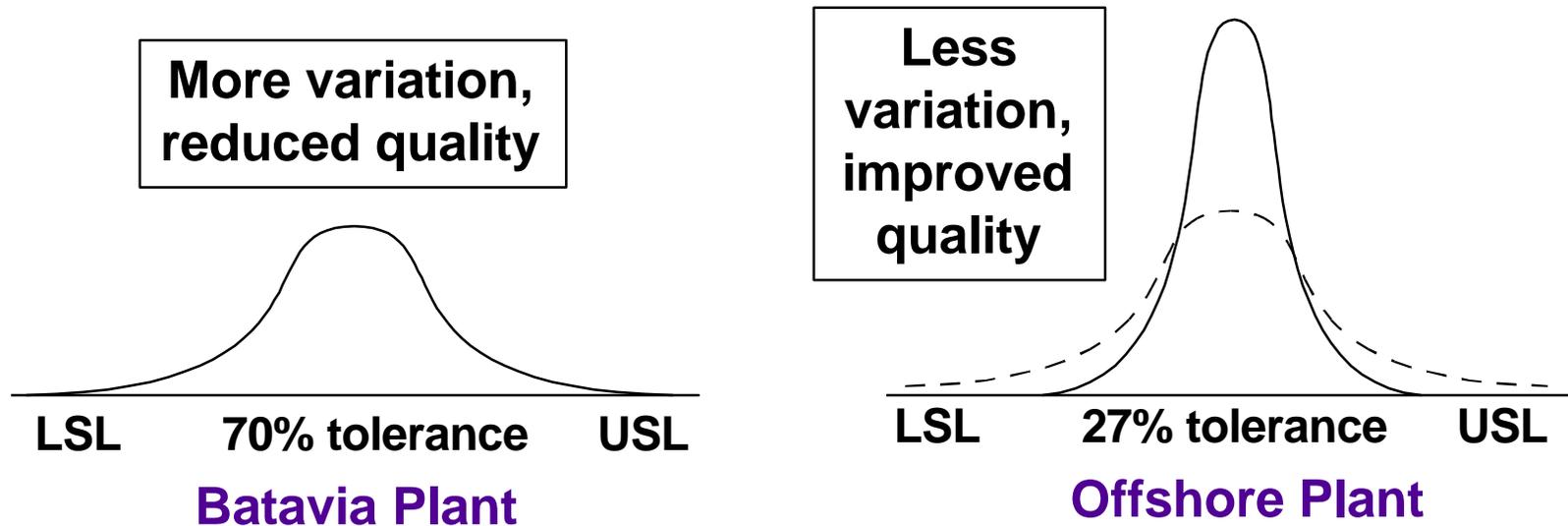
◆ Distribution of measures from the health exam process



*Video...*

***“Continuous Improvement:  
The Batavia Incident”***

# Lessons from Batavia



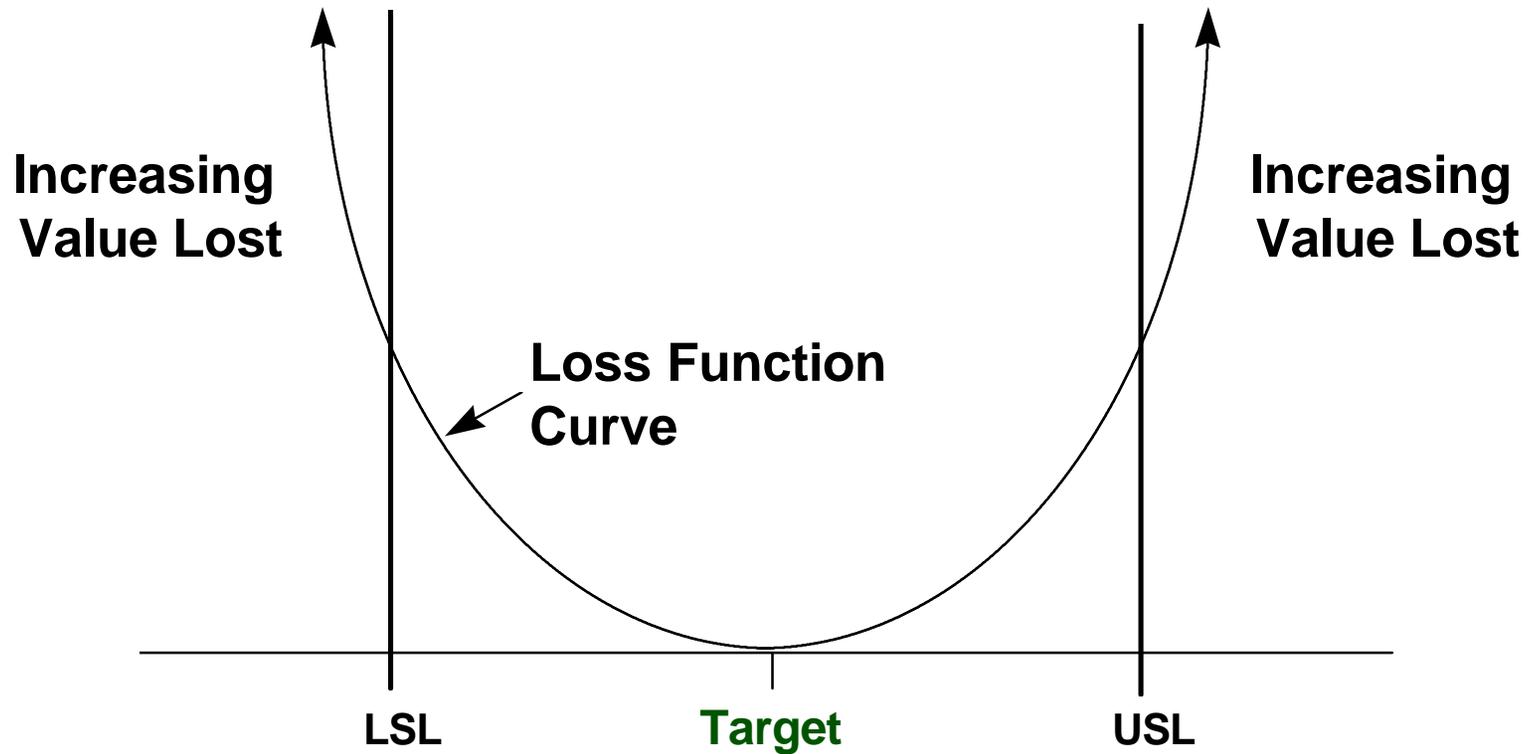
- ◆ All transmissions from both plants were built to the same design criteria
- ◆ Ford discovered building to design criteria did not guarantee quality

# Specification Loss Function



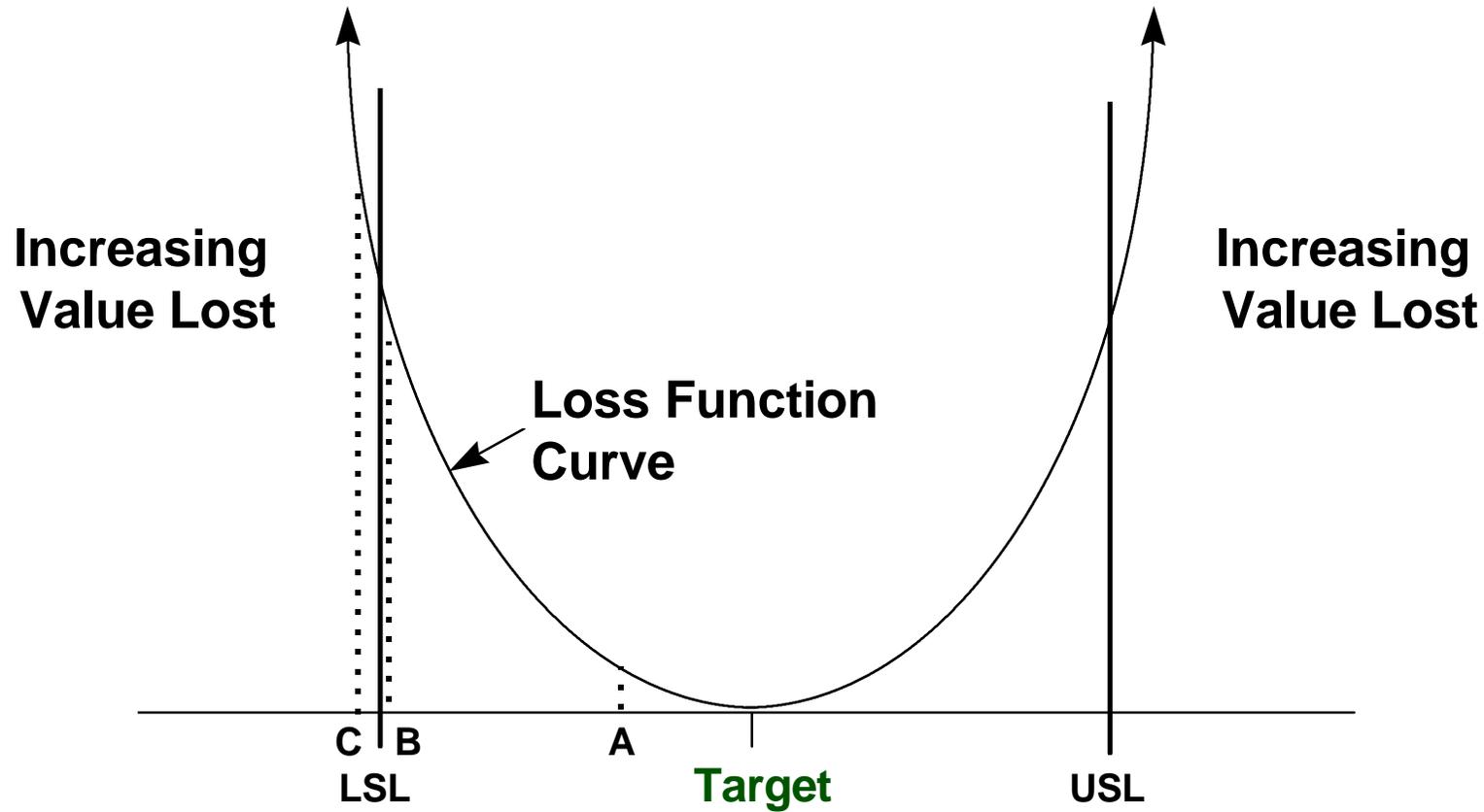
**Measure of quality characteristic**

# Quality Loss Function



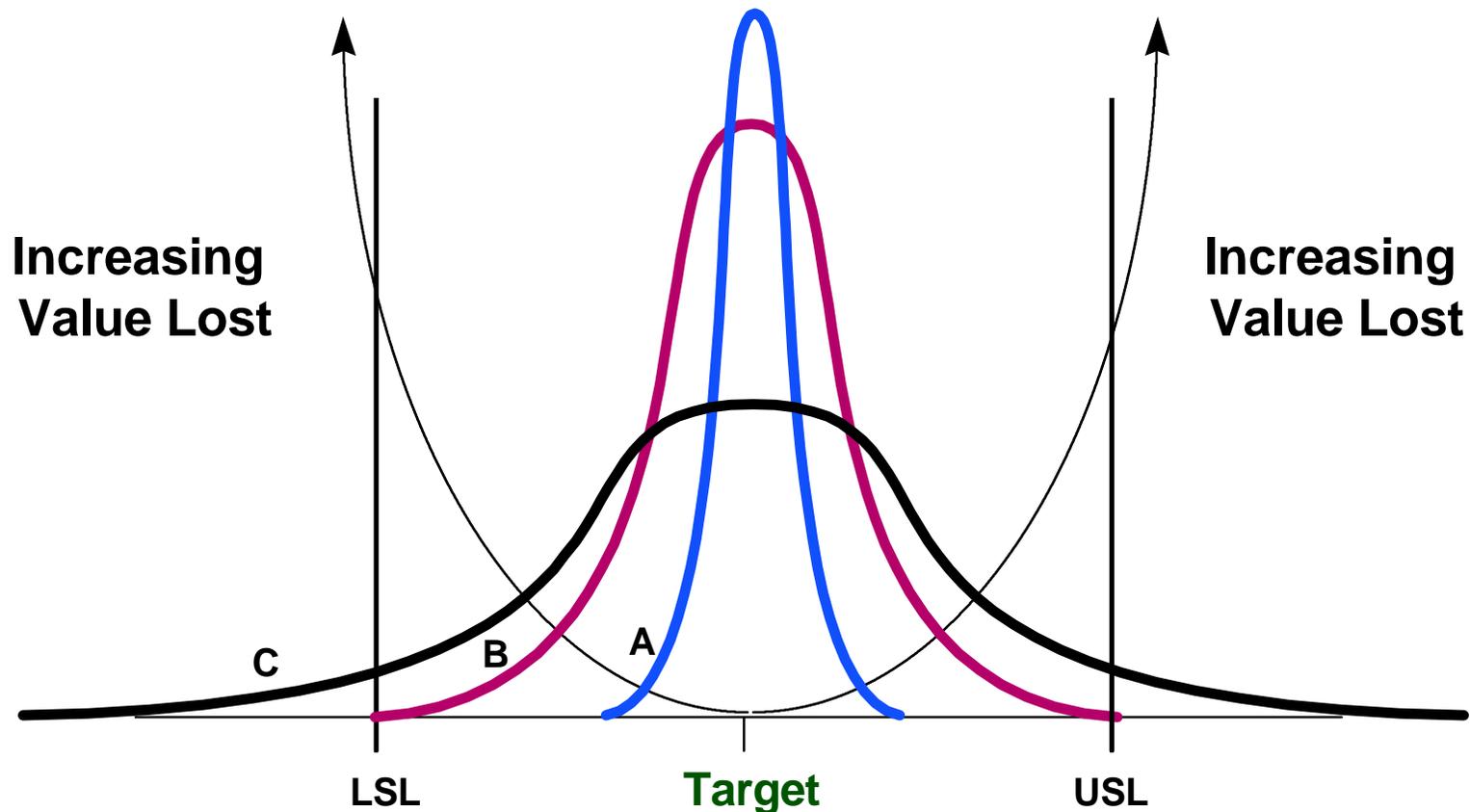
Measure of quality characteristic

# Disadvantages of Specifications



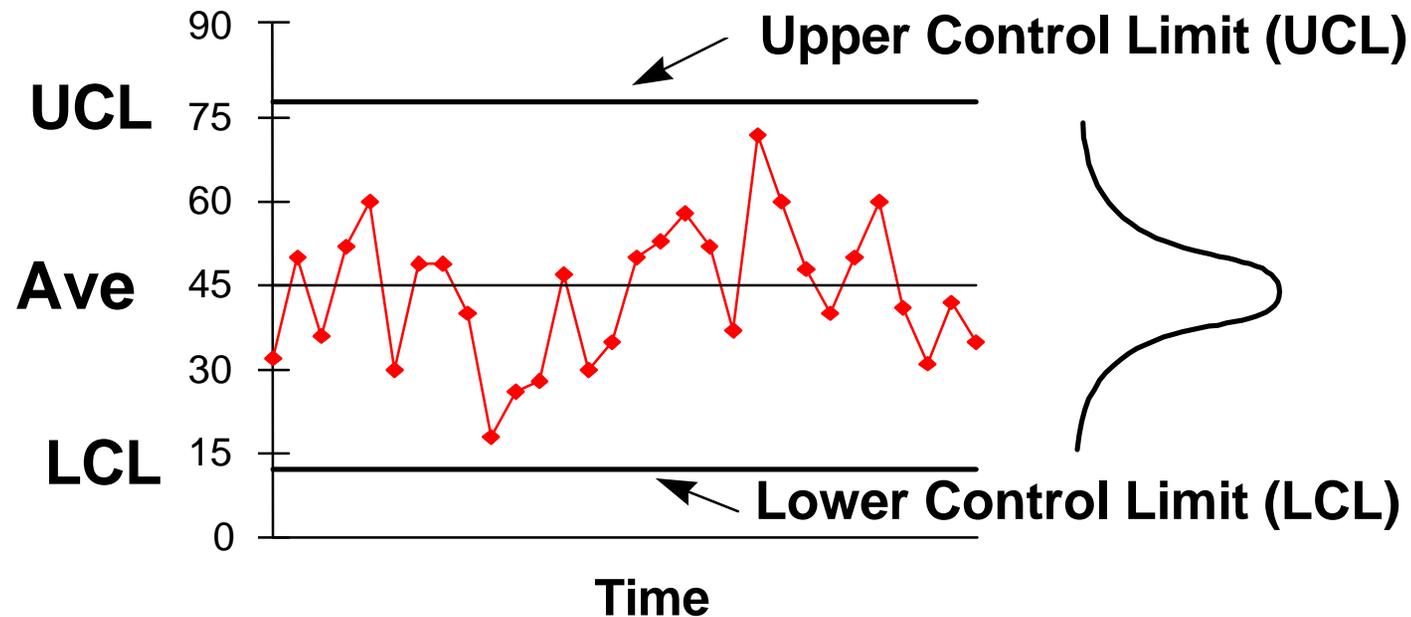
Measure of quality characteristic

# Continual Improvement



Measure of quality characteristic

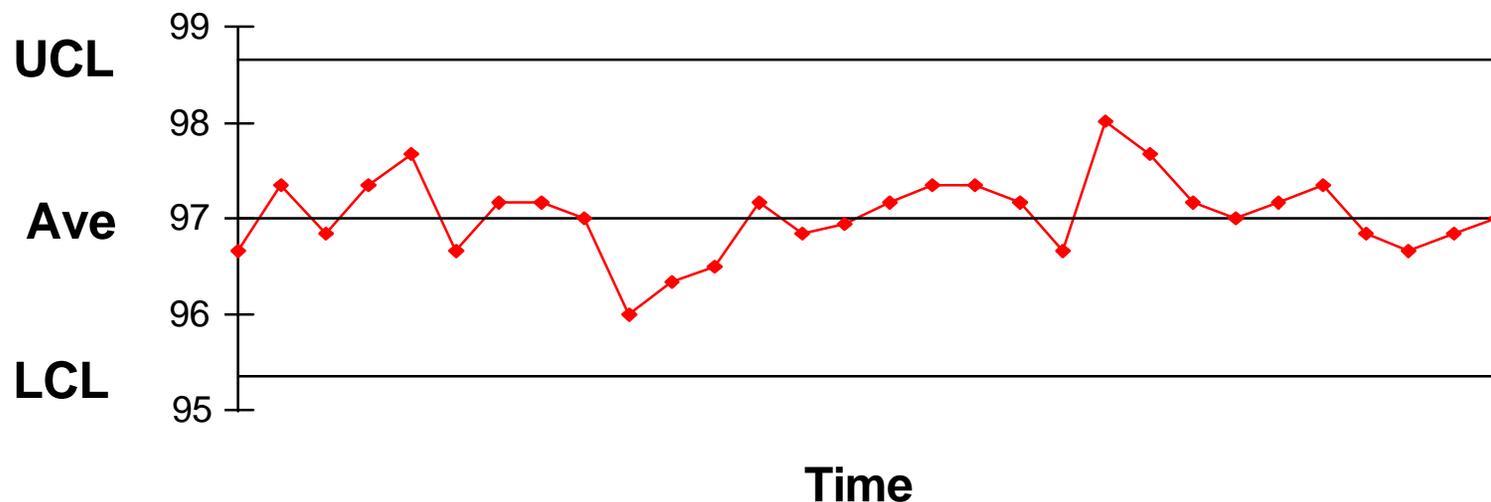
# Variation and Control Charts



- ◆ Control Charts allow us to study what is happening in the process

# Common Cause Variation

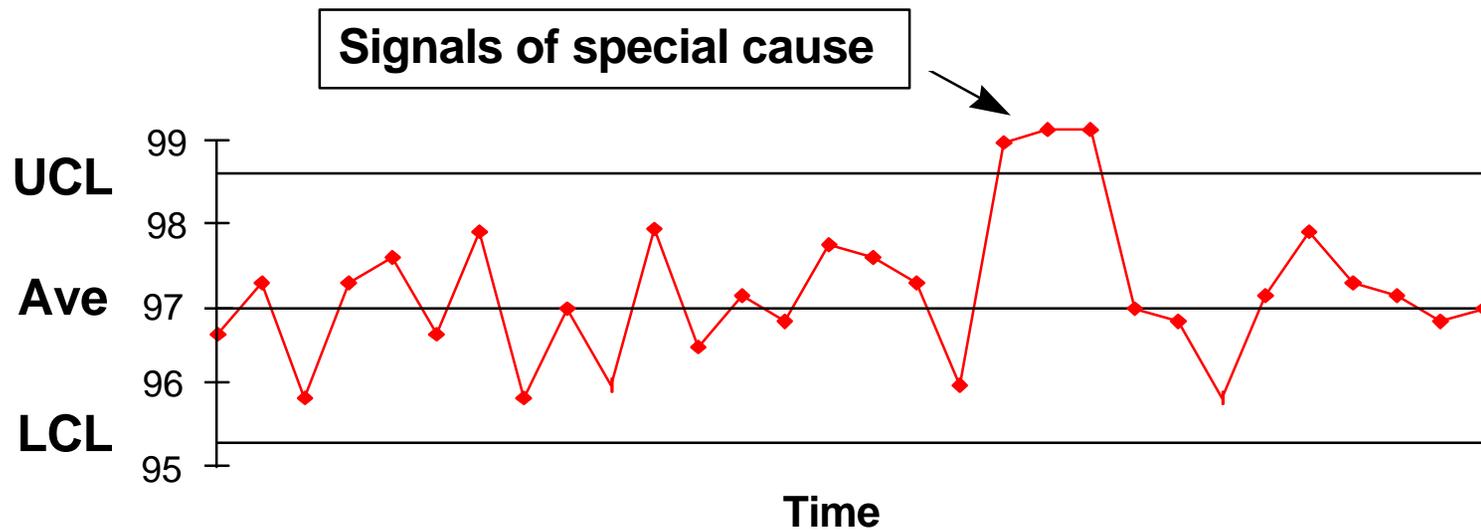
Causes that are inherent in the process over time, affect everyone working in the process, and affect all outcomes of the process



- ◆ **Common cause variation exhibits a random pattern of data points that fall within control limits**

# Special Cause Variation

Causes that are not in the process all the time or do not affect everyone, but arise because of special circumstances



- ◆ Special cause variation exhibits a non-random pattern of data points which may include falling outside control limits

# Control Limits and Specification Limits

- ◆ **Control limits** are determined by the process data and define how the process is functioning
  - The “Voice of the Process”
- ◆ **Specification limits** are determined by design requirements or customer expectations and define the required product or service design dimensions
  - The “Voice of the Customer”

# Stability and Capability

## ◆ STABLE

- Measures fall randomly within the control limits

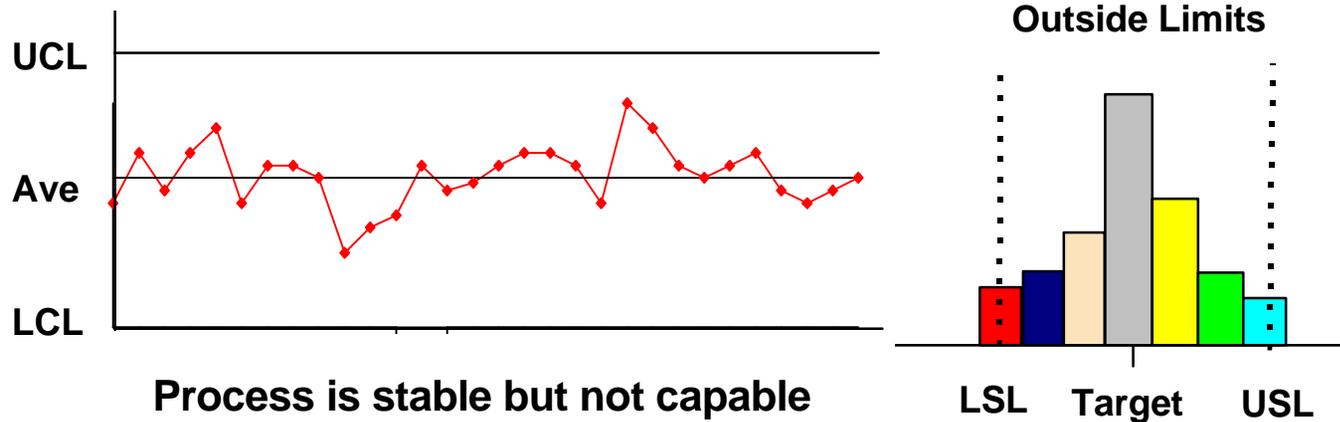
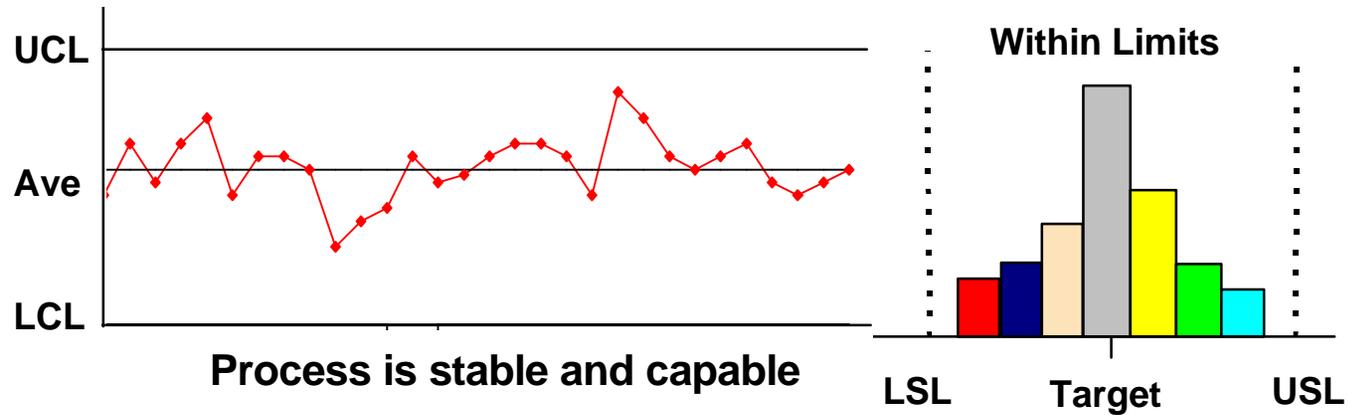
## ◆ UNSTABLE

- Measures fall outside the control limits and/or
- Show a non-random pattern within the control limits

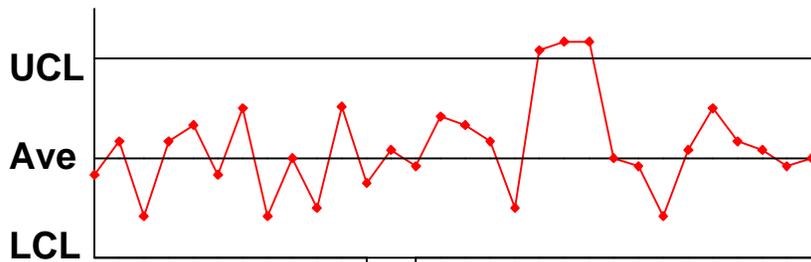
## ◆ CAPABLE

- A stable process that meets customer expectations

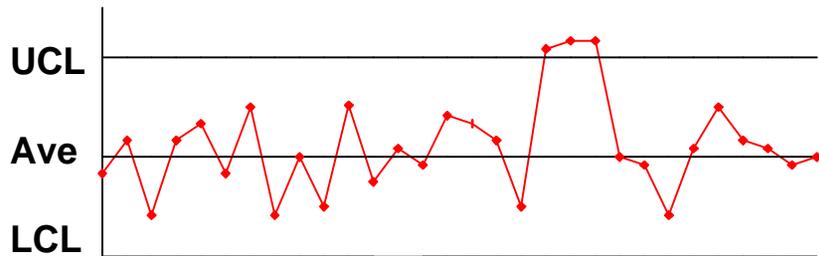
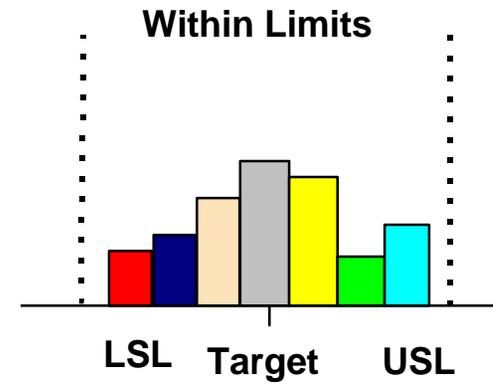
# Stability and Capability related to Common Cause Variation



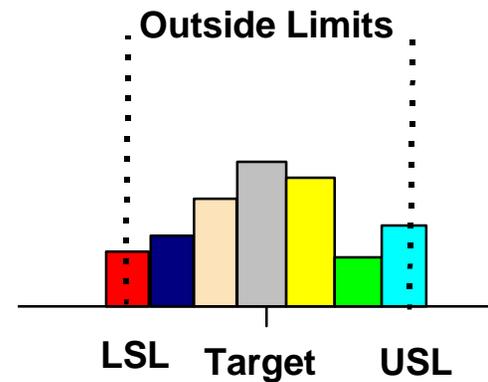
# Stability and Capability related to Special Cause Variation



Process is unstable, so it is not capable  
(even though it meets specifications)



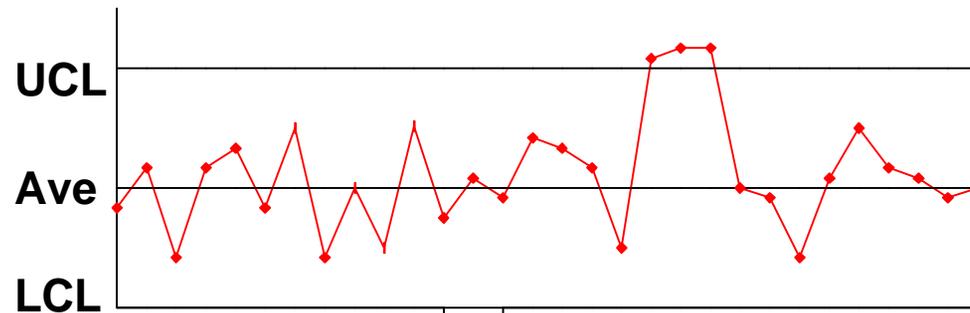
Process is unstable, so it is not capable  
(does not meet specifications)



# Benefits of Stable and Capable Processes

- ◆ **Benefits of a stable process**
  - Prediction of process output
  - Improvement of the process
- ◆ **Benefits of a capable process**
  - Meets customer defined needs
  - Accomplishes the mission

# Reduction of Variation



**Reduction of common and special cause variation require different types of action**

# Responsibility for Reducing Variation

- ◆ Reduction in common cause variation is the responsibility of leadership and management
- ◆ Reduction in special cause variation is the responsibility of the process workers (if authority has been delegated to them)
- ◆ Quality improvement teams have responsibility by charter to take action on common and special cause variation
- ◆ Tampering and underadjusting must be avoided



*Exercise...*

***“The Red Bead  
Experiment”***

# Lessons from the Exercise

- ◆ Variation in the number of red beads resulted from a system created by management
- ◆ Blaming and firing the workers does not improve the system
- ◆ Management is responsible for changing the system so that workers can meet customer defined needs
- ◆ The role of the leaders is to make it possible for people to identify and remove red beads in the organization

# Lesson Summary (1 of 2)

- ◆ Variation is part of the System of Profound Knowledge
- ◆ Variation is inherent in everything
- ◆ Variation can be identified, measured, analyzed, and reduced to improve quality
- ◆ The quality loss function is the rationale for continuous process improvement and shows the cost of process variation
- ◆ Specification limits and control limits are different
- ◆ Variation results from common and special causes

# Lesson Summary (2 of 2)

- ◆ Capable processes are required to accomplish the mission
- ◆ Management is responsible for reducing common cause variation by working on the process
- ◆ People working in the process are responsible for removing special causes of variation