

AQS 200

ROOT CAUSE INVESTIGATION

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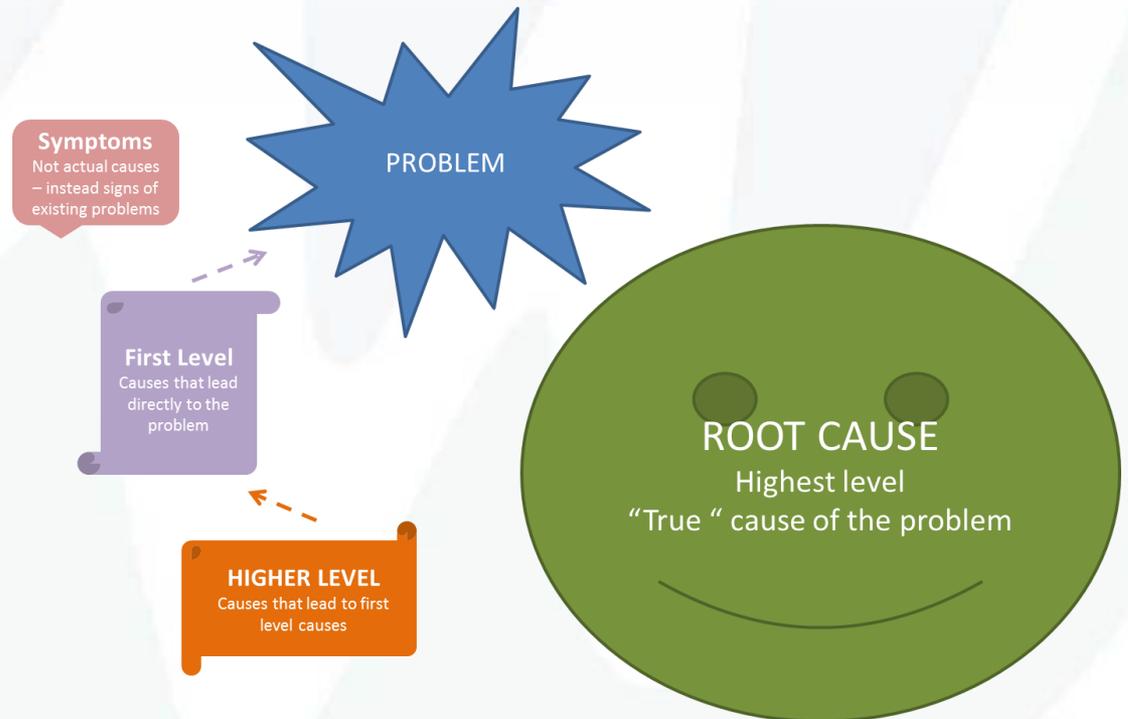
LECTURE 4 – ROOT CAUSE ANALYSIS



Developed as part of NSF ATE Grant #1304474

ROOT CAUSE ANALYSIS

- Root Cause – The fundamental (true) reason a product or process nonconformance occurred.



ROOT CAUSE ANALYSIS

- Root Cause – The fundamental (true) reason a product or process nonconformance occurred.
- Root Cause Analysis (RCA) – Structured investigation (review) aiming to identify (determine) the true cause of a product or process nonconformance (problem) AND the actions necessary to eliminate it.
 - This extends beyond solving the symptoms of a problem, instead drilling down to discover its most fundamental cause.

ROOT CAUSE ANALYSIS

- Structured investigation (review) aiming to identify (determine) the true cause of a product or process nonconformance (problem) AND the actions necessary to eliminate it.
- Not all nonconformance's may require a formal RCA investigation
 - Complexity of the product or process
 - Severity of the nonconformance
- *Tools used to establish root cause would still be the same*

Examples

- Scenario #1
 - Locked my keys in the car
 - Root Cause – distracted
 - Corrective Action – unlock car and retrieve keys
 - Solution - don't ignore warning bells when closing door.

Examples

- Scenario #2
 - Defective parts
 - Cause (treating symptom only) – machine damaged.
 - Solution – fix machine.
 - Defective parts again(!) two weeks later
 - Cause (following RCA) – machine damaged after being hit by forklift because the painted lines were faded.
 - Root Cause – painted lines were faded because there was no process for maintaining the lines due to unclear ownership of the process.
 - Solution – define ownership, create process for maintaining lines.

Root Cause Analysis (RCA)

- RCA is a method for finding permanent solutions
 - Corrective – after problem has occurred
(i.e. customer complaint, scrap lot, miscommunication w/customer, etc.)
 - Preventive – understanding root cause for specific product or process can be translated to others, thereby preventing future recurrences
(i.e. cleaning on die D12GA applied to all dies)

Root Cause Analysis (RCA)

- RCA is a method for finding permanent solutions
 - Corrective – after problem has occurred
 - Preventive – understanding root cause for specific product or process can be translated to others, thereby preventing future recurrences
- Root Cause Analysis (RCA)
 - When is it used ?
 - Where is it used ?
 - Who uses it ?
 - Why use it ?
 - What is RCA ?
 - How to use RCA ?

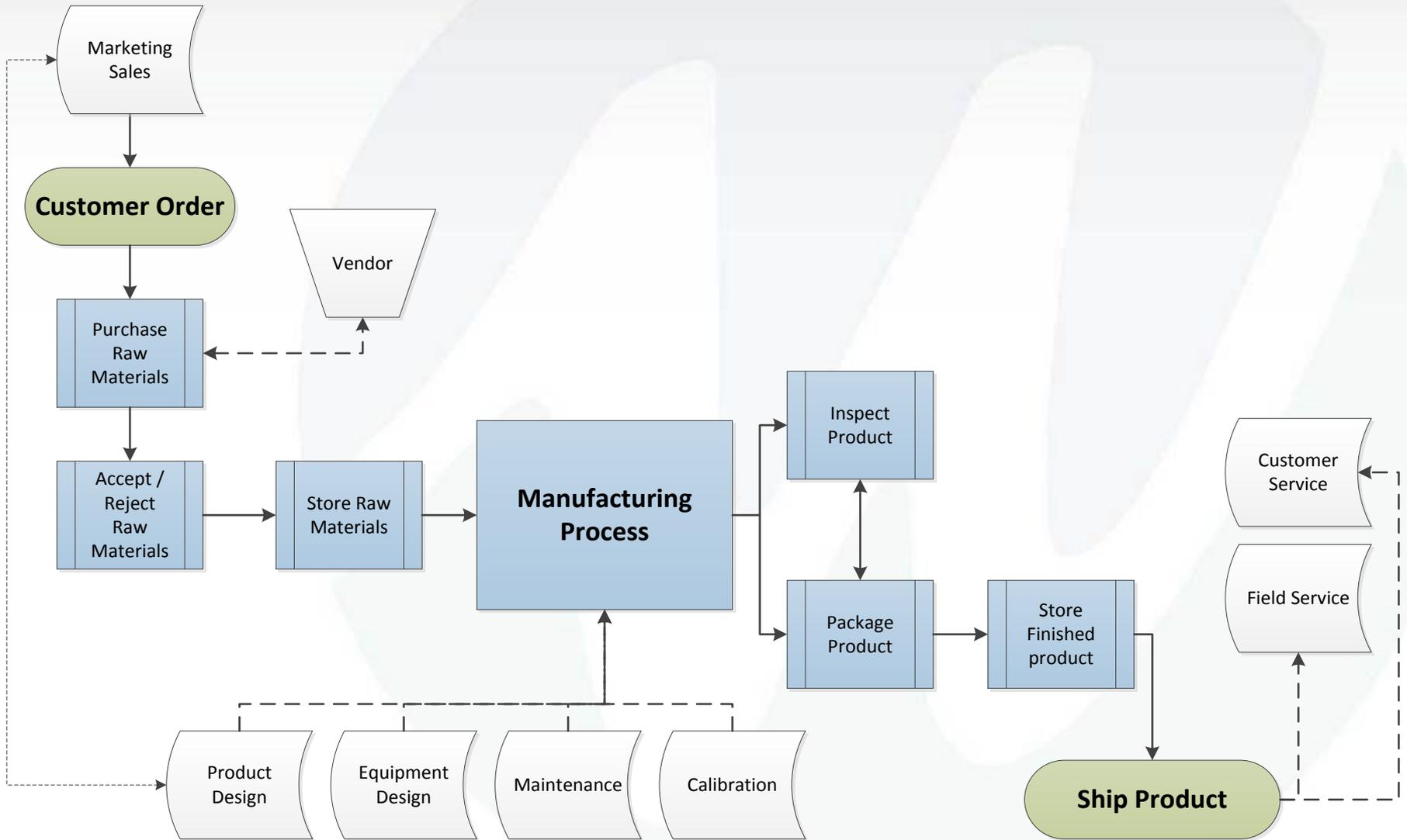
RCA – When ?

- Used when a product /process nonconformance occurs
- Production Issues
 - Product release delays due to scrap lots
 - Repeat production due to returns
 - Equipment Breakdown/Inconsistent
- Process break-downs
 - Contract review (customer expectations)
 - Raw material supply
 - Machine Shop (multiple priorities)
 - Calibration / Tool Maintenance
 - Preventive Maintenance

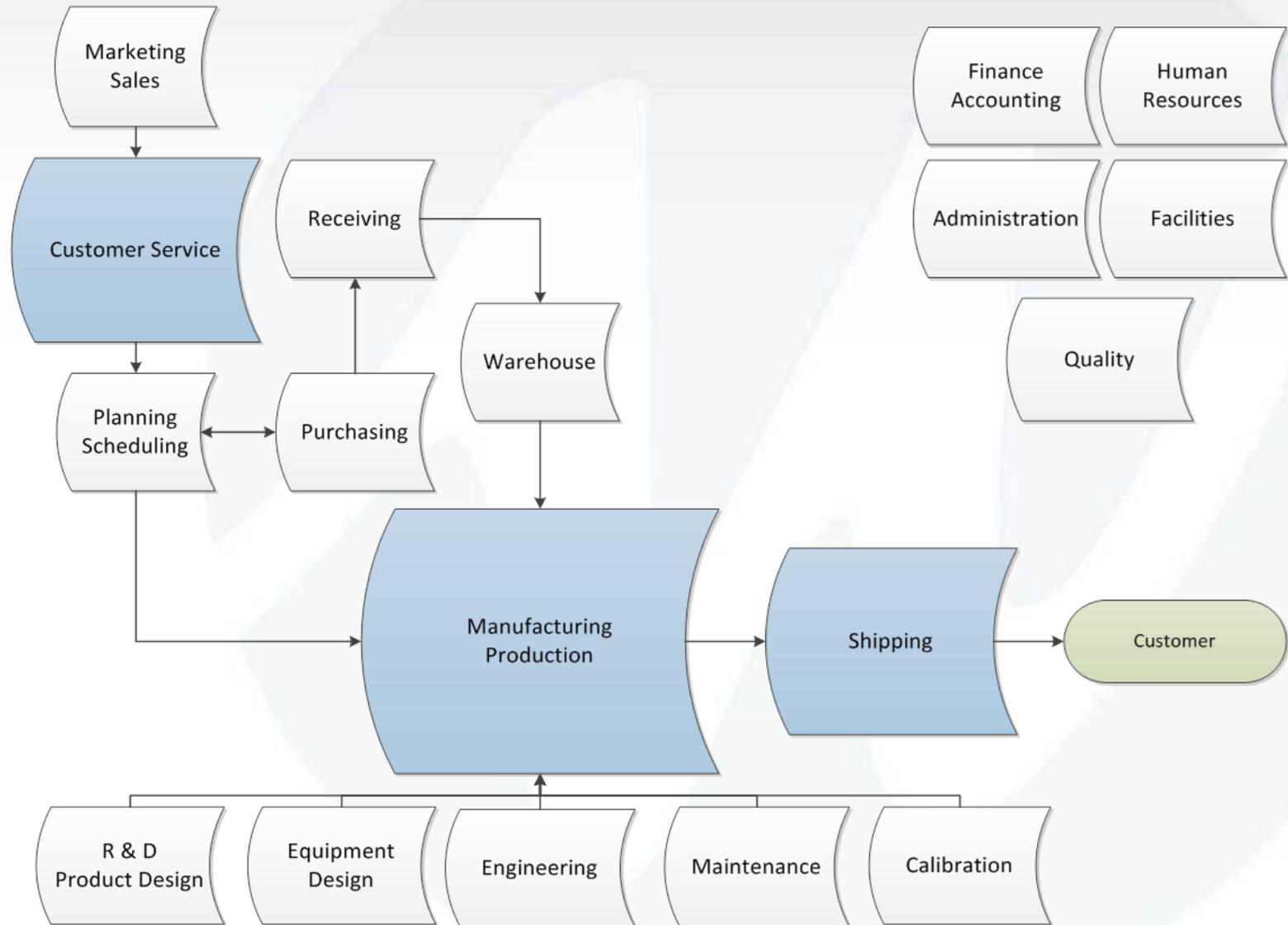
RCA – When ?

- Used when a product /process nonconformance occurs
- Production Issues
- Process break-downs
- **Customer Complaints**
 - Negative trending; repeat issues
- **Audit Findings**
 - Internal Audits (to relevant standard)
 - Customer Audits
 - Registrar or Regulator

RCA – Where?



RCA – Who?



RCA – Who?

- **Everyone !**
 - Quality can provide tools, data analysis, facilitate brainstorming and discussions
 - Department personnel have the expertise and are the subject matter experts
- **Individual Investigations**
 - Daily operations
- **Group Investigations**
 - Repetitive or complex issues

RCA – Who: Conducting an Analysis

- Create team
- Select team members
 - experience the problem
 - are from the process
 - authority to implement solutions
 - quality improvement “expert”
- Analysis lasts about 2 months
- Periodic team meetings

RCA Team(s)

- Membership
 - Champion (Initiates concept or idea for change/improvement)
 - Sponsor (supports the plans, activities and outcomes)
 - Team Leader (facilitates investigation, communicates to management)
 - Members
 - Participants
 - Subject matter experts for their area of the process(es)
 - Gather the data and perform the analysis

RCA Team(s)

- Stages
 - **Forming:** team comes together and begins process of understanding other members
 - Review the project
 - Establish roles (assigning task categories – contribution)
 - Determine meeting times (frequency)
 - Evaluate that all functions represented
 - **Storming:** team members adjusting to working as a team rather than individually
 - Project may be different than anticipated or more difficult
 - Conflict resolution

RCA Team(s)

- Stages
 - **Norming:** agree on mutually accepted ideas to move forward
 - Some work gets accomplished
 - Trust is building
 - Share ideas and work products without hesitation
 - **Performing:** members working together to reach common goal
 - Diagnose and solve problems
 - Large amount of work is accomplished

RCA Team(s)

- Stages
 - Forming: team comes together and begins process of understanding other members
 - Storming: team members adjusting to working as a team rather than individually
 - Norming: agree on mutually accepted ideas to move forward
 - Performing: members working together to reach common goal
 - **Closing (Adjourning)**: results shared, loose ends tied up, team disbanded
 - **Recognition**: contribution acknowledge and celebrated

RCA Team(s)

- Barriers
 - Groupthink
 - Rush to conclusion, avoid discussion(s)
 - Mob mentality
 - Conflict
 - Personalities vs Positions
 - Contribution levels of various members
 - Logistics
 - Multiple shifts
 - Machine availability
 - Departmental Priorities
 - Training
 - Knowledge of the various tools

RCA – Why?

- Nonconformance's are costly in time, money and perceptions
 - Customer Complaints
 - Costly to investigate
 - Customer confidence
 - Audit Findings
 - Practices mirror procedures (and vice versa)
 - ISO compliance (9000:2015 and 13485:2003)
 - Customer expectations

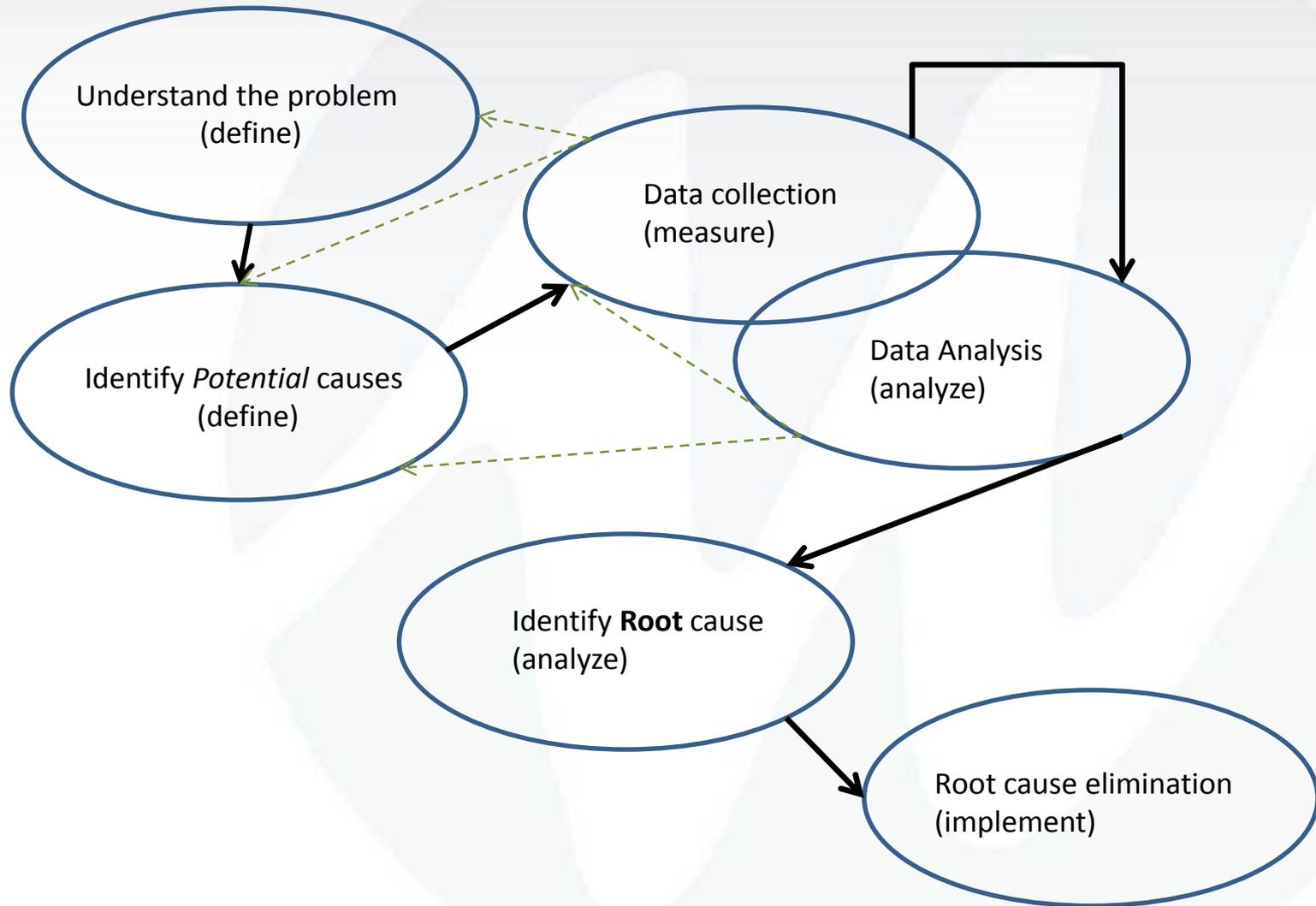
RCA – Why?

- Nonconformance's are costly in time, money and perceptions
 - Customer Complaints
 - Audit Findings
 - Production Issues
 - Material costs
 - Production delays (time is money)
 - Capacity for new business
 - Personnel (Manpower)
 - FRUSTRATION !

RCA – What /How ?

- Process for evaluating a problem and finding a permanent solution
 - Deming
 - Plan – Do – Study (Check) - Act
 - Six Sigma – DMAIC
 - Define *(Plan)*
 - Measure *(Do)*
 - Analyze *(Study)*
 - Improve *(Act)*
 - Control *(Act)*

RCA – What /How ?



Root Cause Analysis

Groups of root cause analysis tools correspond to the steps in problem solving

- Problem understanding
- Problem cause investigation
- Problem cause data collection
- Problem cause data analysis
- Root cause identification
- Problem elimination
- Solution implementation

Note – while tools are presented in a logical order, their use is not restricted to an individual phase; when solving problem, utilize whichever tools are appropriate/necessary

Root Cause Analysis – Tool Overview

- Understanding
 - Flow charts
 - Paint picture of process(es)
 - Critical Incident
 - Identify most critical issues within a problem
 - Spider Chart
 - Comparison chart for benchmarking
 - Performance matrix
 - Prioritization tool (determines importance)

Root Cause Analysis – Tool Overview

- Understanding
- Cause Investigation
 - Brainstorming
 - Generating multiple ideas
 - Brain-writing
 - Simliar to brainstorming
 - Is-Is not matrix
 - Separate factors based on relevance
 - Nominal Group technique
 - Categorization technique
 - Paired Comparisons
 - Consensus technique

Root Cause Analysis – Tool Overview

- Understanding
- Cause Investigation
- **Data Collection**
 - Sampling
 - Determine sub-set of interest
 - Surveys
 - Collect customer/employee opinions
 - Checksheet
 - Forms used to collect data/information

Root Cause Analysis – Tool Overview

- Data Analysis
 - Histogram
 - Bar graph used to evaluate frequency, shape
 - Pareto chart
 - Bar graph used to establish priority/ larger contributors
 - Scatter chart
 - Demonstrates relationships between variables
 - Problem Concentration Diagram
 - Map of system to indicate where issues may be
 - Relations Diagram
 - Indicates logical relationships between different ideas
 - Affinity Diagram
 - Categorization tool used to correlate ideas

Root Cause Analysis – Tool Overview

- Understanding
- Cause Investigation
- Data Collection
- Data Analysis
- **Root Cause Identification**
 - Cause and effect chart
 - Machine, Method, Materials, Personnel
 - Matrix diagram
 - Visual technique for spotting relationships
 - Five Whys
 - Question deeper into issues/results
 - Fault Tree Analysis
 - Using data to predict what may occur

Root Cause Analysis – Tool Overview

- Understanding
- Cause Investigation
- Data Collection
- Data Analysis
- Root Cause Identification
- **Root Cause Elimination**
 - Six Thinking Hats
 - Theory of inventive problem solving (TRIZ)
 - Systematic inventive thinking (SIT)

Root Cause Analysis – Tool Overview

- Understanding
- Cause Investigation
- Data Collection
- Data Analysis
- Root Cause Identification
- Root Cause Elimination
- **Solution Implementation**
 - Tree Diagram
 - Force Field Analysis

HOMework

Identify problem of interest from news, previous work history, etc.

Formulate a preliminary problem statement
Bring some background as needed for discussion

Example: contaminated peanut butter (Louisiana)
class registration process

