3 Legged 5 Why Analysis

"A Focused Approach to Solving Problems"

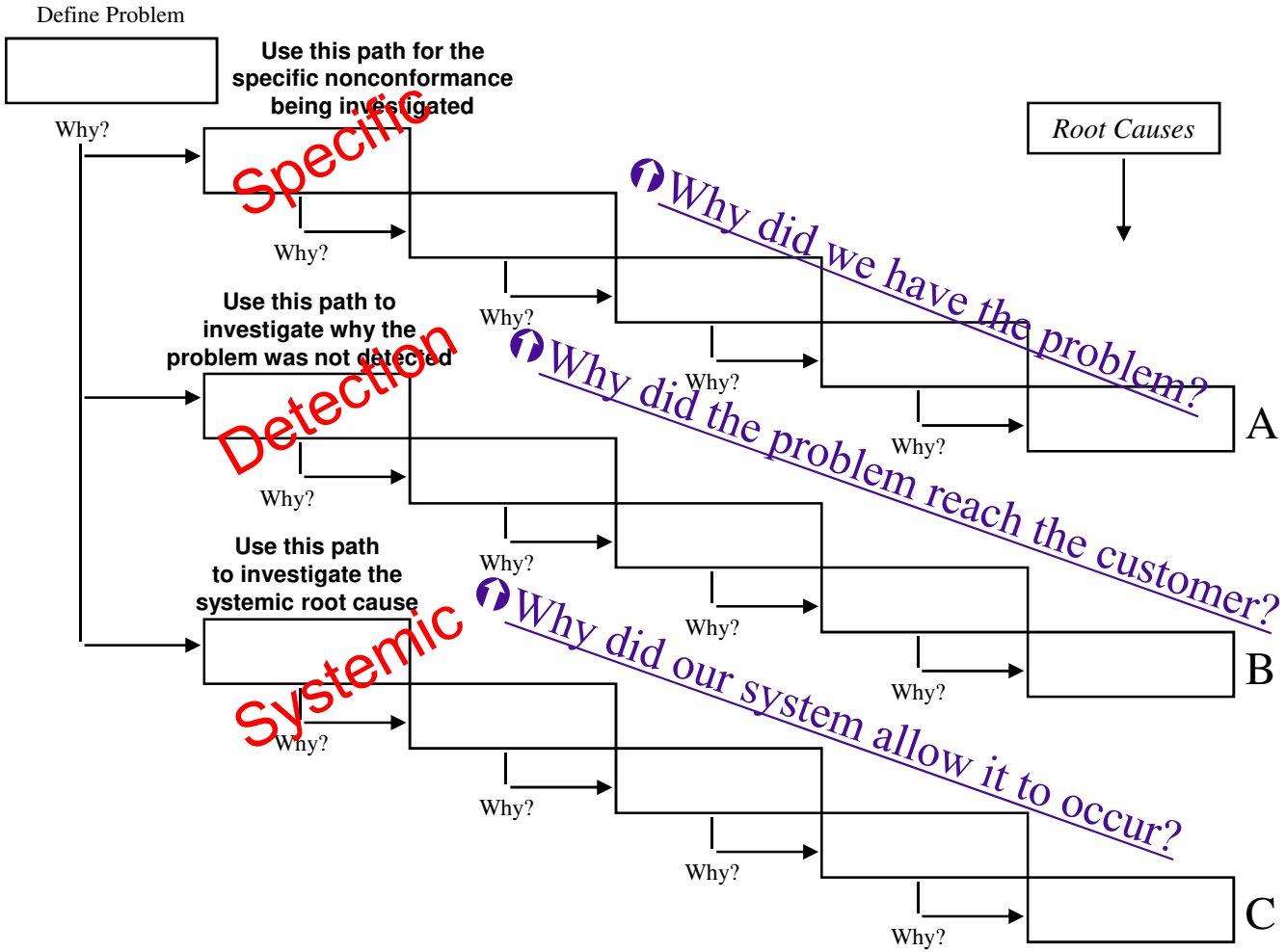
CLARIOS

When to Use 5 Why

- Customer Issues
  - May be requested for formal or informal complaints
  - May be requested for warranty issues
- Internal Issues
  - Quality System Audit Non-conformances
  - First Time Quality or Internal Quality Issue

5 Why, when combined with other problem solving methods, is a very effective tool

3-Legged / 5-Why Format



Corrective Actions	Date
A. B. C.	

Lessons Learned
•

Look Across / Within Plant
•

5 Why Analysis

- **General Guidelines**
  - A cross-functional team should be used to problem solve
  - Don’t jump to conclusions or assume the answer is obvious
  - Be absolutely objective

5 Why Analysis

- **General Guidelines**
  - Ask “Why” until the root cause is uncovered
    - May be more than 5 Whys or less than 5 Whys
  - If you are using words like “because” or “due to” in any box, you will likely need to move to the next Why box
  - Root cause can be turned “on” and “off”
    - Will addressing/correcting the “cause” prevent recurrence?
    - If not what is the next level of cause?
  - If you don’t ask enough “Whys”, you may end up with a “symptom” and not “root cause”.
  - Corrective action for a symptom is not effective in eliminating the cause
    - Corrective action for a symptom is usually “detective”
    - Corrective action for a root cause can be “preventive”
  - Path should make sense when read in reverse using “therefore”

Problem Definition

- Define the problem
  - Problem statement clear and accurate
  - Problem defined as the customer sees it
  - Do not add “causes” into the problem statement

- Examples:
  - GOOD: Customer received a part with a broken mounting pad
  - NOT: Customer received a part that was broken due to improper machining

  - GOOD: Customer received a part that was leaking
  - NOT: Customer received a part that was leaking due to a missing seal

Specific Problem

- Specific Problem
  - Why did we have the specific non-conformance?
  - How was the non-conformance created?

  - Root cause is typically related to design, operations, dimensional issues, etc.
    - Tooling wear/breaking
    - Set-up incorrect
    - Processing parameters incorrect
    - Part design issue

  - Typically traceable to/or controllable by the people doing the work

Specific Problem

- Specific Problem
  - Root Cause Examples
    - Parts damaged by shipping – dropped or stacked incorrectly
    - Operator error – poorly trained or did not use proper tools
    - Changeover occurred – wrong parts used
    - Operator error – performed job in wrong sequence
    - Processing parameters changed
    - Excessive tool wear/breakage
    - Machine fault – machine stopped mid-cycle

Specific Problem

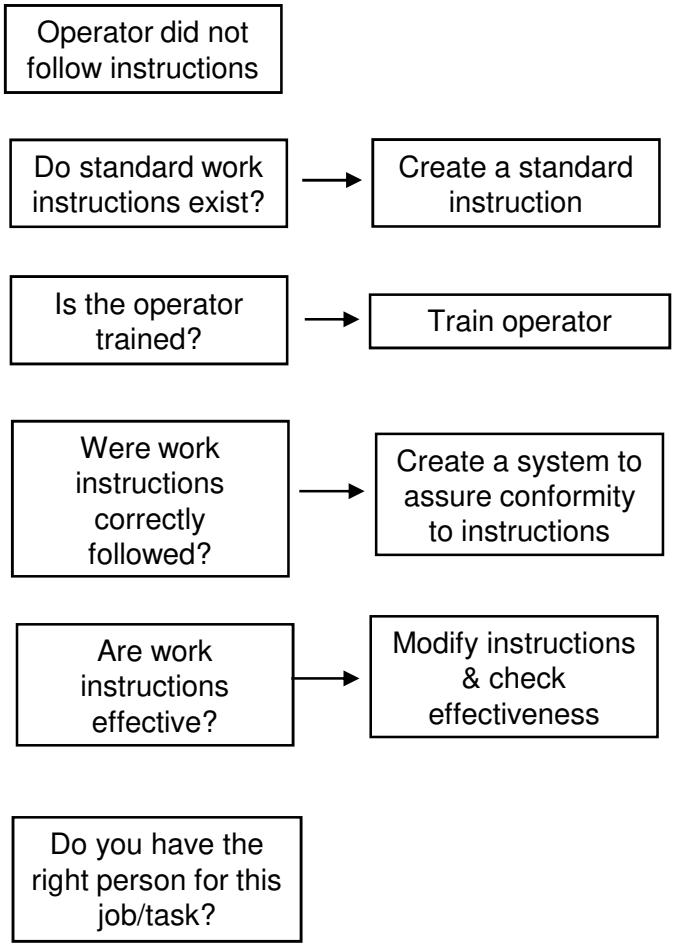
What if root cause is?

Operator did not follow instructions

Do we stop here?

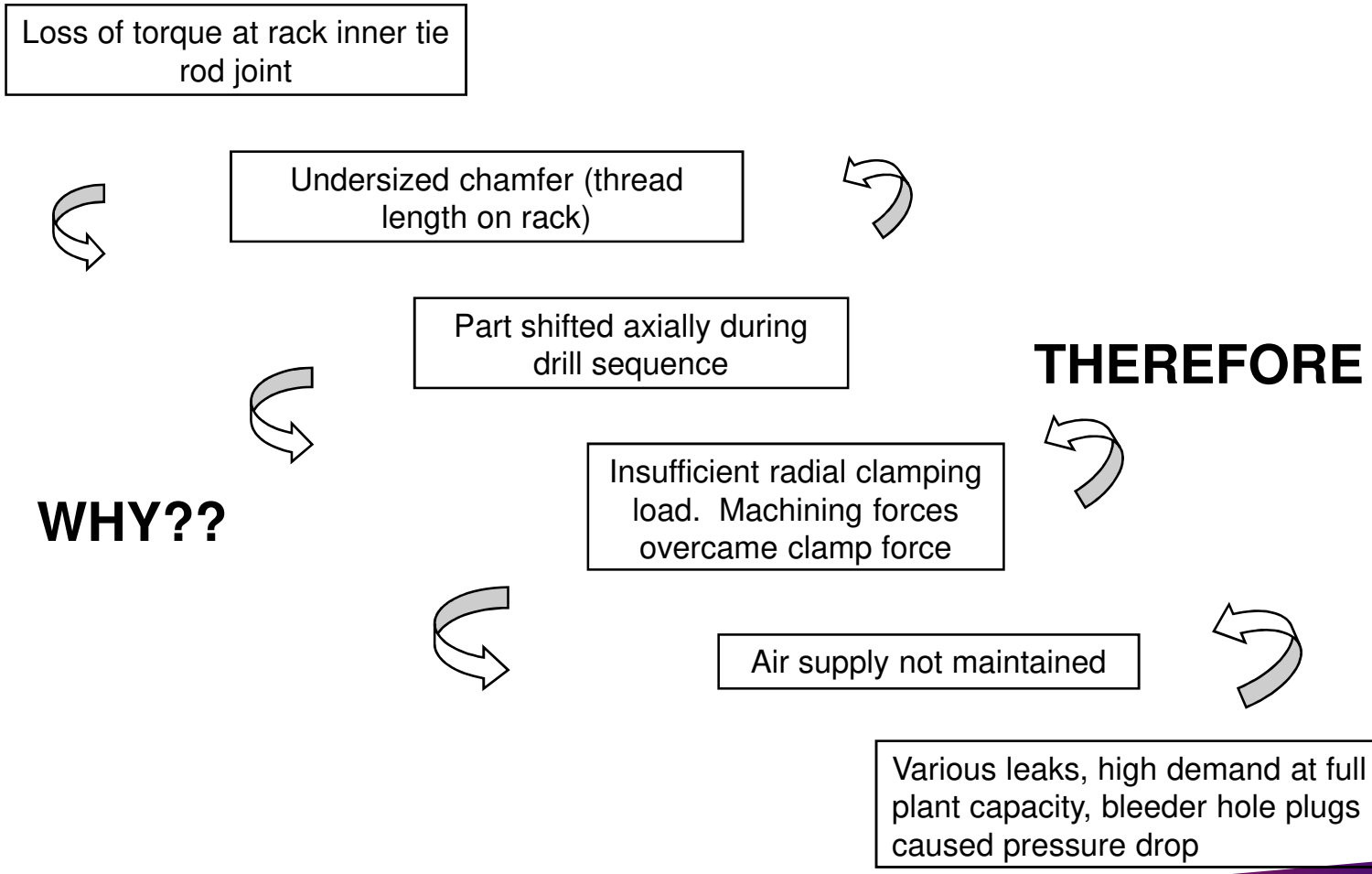
Specific Problem

Or do we attempt to find the root cause?



Specific Problem

Specific Problem Example



Detection

- Detection:
  - Why did the problem reach the customer?
  - Why did we not detect the problem?
  - How did the controls fail?

  - Root Cause typically related to the inspection system
    - Error-proofing not effective
    - No inspection/quality gate
    - Measurement system issues

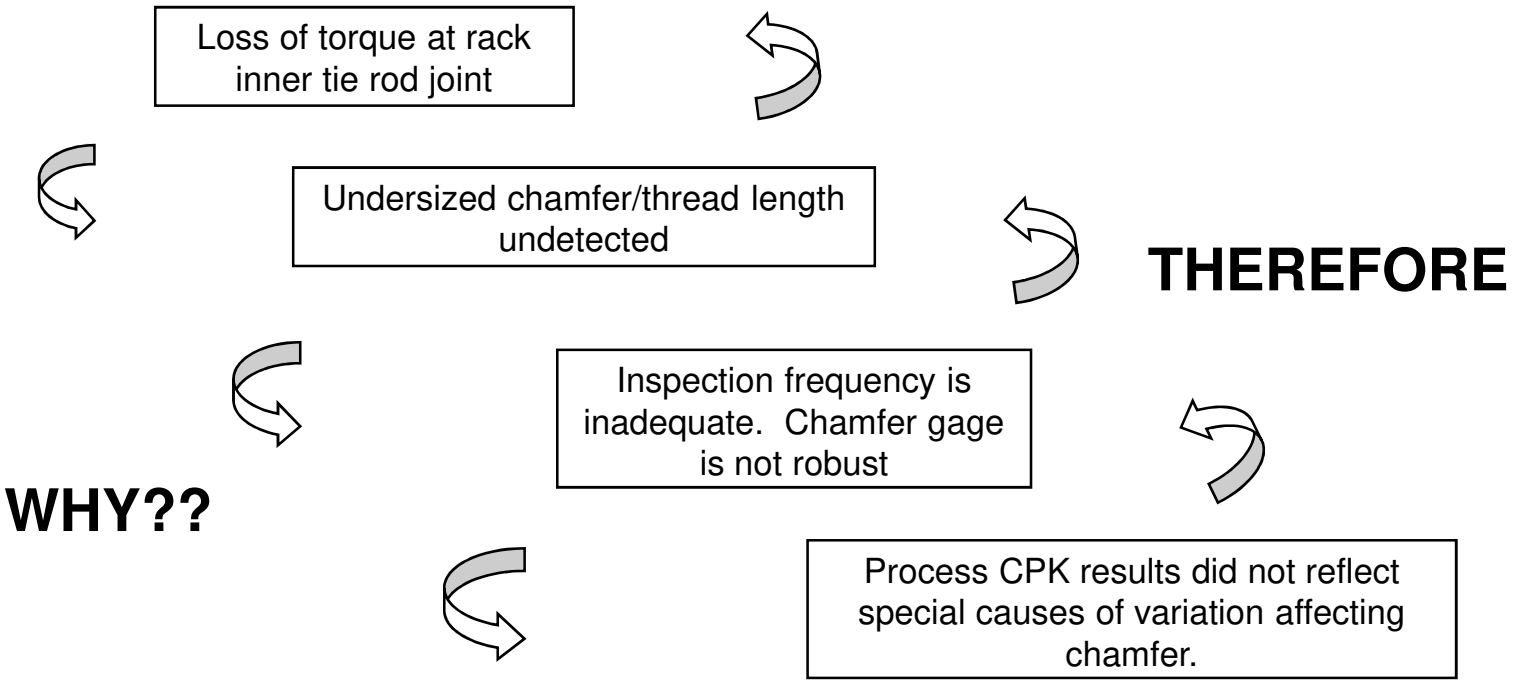
  - Typically traceable to/or controllable by the people doing the work

Detection

- Detection
  - Example Root Causes
    - No detection process in place – cannot be detected in our plant
    - Defect occurs during shipping
    - Detection method failed – sample size and frequency inadequate
    - Error proofing not working or bypassed
    - Gage not calibrated

Detection

Detection Example



Systemic

- Systemic
  - Why did our system allow it to occur?
  - What was the breakdown or weakness?
  - Why did the possibility exist for this to occur?

  - Root Cause typically related to management system issues or quality system failures
    - Rework/repair not considered in process design
    - Lack of effective Preventive Maintenance system
    - Ineffective Advanced Product Quality Planning (FMEA, Control Plans)

  - Typically traceable to/controllable by Support Functions, Policies, Procedures

Systemic Issue

- Systemic
  - Helpful hint: The root cause of the specific problem leg is typically a good place to start the systemic leg.

  - Root Cause Examples
    - Failure mode not on PFMEA – believed failure mode had zero potential for occurrence
    - New process not properly evaluated
    - Process changed creating a new failure cause
    - PFMEAs generic- not specific to the process
    - Severity of defect not understood by team
    - Occurrence ranking based on external failures only, not actual defects

Systemic

Systemic Root Cause Example

Loss of torque at rack inner tie rod joint

Ineffective control plan related to process parameter control (chamfer)

Low severity for chamfer control

Dimension was not considered an important characteristic – additional controls not required

Insufficient evaluation of machining process and related severity levels during APQP process

WHY??

THEREFORE

Corrective Actions

- Corrective Actions
  - Corrective action for each root cause
  - Corrective actions must be feasible
  - If Customer approval required for corrective action, this must be addressed in the 5 why timing
  - Corrective actions address processes the “supplier” owns
  - Corrective actions include documentation updates and training as appropriate

Specific Problem

Corrective Action Example

Loss of torque at rack inner tie rod joint

Undersized chamfer (thread length on rack)

Part shifted axially during drill sequence

Insufficient radial clamping load. Machining forces overcame clamp force

WHY??

Air supply not maintained

Various leaks, high demand at full plant capacity, bleeder hole plugs caused pressure drop

•Corrective Action:

•Reset alarm limits to sound if <90 PSI.

•Smith 10/12/13

•Disable machine if <90 PSI.

•Jones 9/28/13

•Dropped feed on drill cycle to .0058 from .008.

•Davis 10/10/13

•Clean collets on Kennefec @ PM frequency

•Smith 10/12/13

•Added dedicated accumulator (air) for system or compressor for each Kennefec

•Smith 10/12/13

•Verify system pressure at machines at beginning , middle, and end of shift

•Smith 10/12/13

Detection

Corrective Action:

- Implement 100% sort for chamfer length and thread depth.
  - Smith 9/26/13
- Create & maintain inspection sheet log to validate
  - Davis 8/22/13
- Redesign chamfer gage to make more effective
  - Jones 11/30/13
- Increase inspection frequency at machine from 2X per shift to 2X per hour
  - Johnson 10/14/13
- Review audit sheets to record data from both ends on an hourly basis
  - Davis 10/4/13
- Conduct machine capability studies on thread depth
  - Jones 9/22/13
- Perform capability studies on chamfer diameters
  - 10/14/13
- Repair/replace auto thread checking unit to include thread length.
  - 10/18/13

Corrective Action Example

Loss of torque at rack inner tie rod joint

Undersized chamfer/thread length undetected

Inspection frequency is inadequate. Chamfer gage is not robust

Process CPK results did not reflect special causes of variation affecting chamfer.

WHY??

Systemic

Loss of torque at rack inner tie rod joint

Ineffective control plan related to process parameter control (chamfer)

Low severity for chamfer control

Dimension was not considered an important characteristic – additional controls not required

Insufficient evaluation of machining process and related severity levels during APQP process

WHY??

Corrective Action Example

Corrective Action:

- Design record, FMEA, and Control Plan to be reviewed/upgraded by Quality, Manufacturing Engineering
- Update control plan to reflect 100% inspection of feature
- PM machine controls all utility/power/pressure
- Implement layered audit schedule by Management for robustness/compliance to standardized work

Lessons Learned:

- PFMEA severity should focus on affect to subsequent internal process (immediate customer) as well as final customer
- Measurement system and gage design standard should be robust and supported by R & R studies
- Evaluate the affect of utility interruptions to all machine processed (air/electric/gas)

5-Why Critique Sheet

- **General Guidelines:**
  - Don't jump to conclusions..don't assume the answer is obvious
  - Be absolutely objective
  - A cross-functional team should complete the analysis

- **Step 1:** Problem Statement
  - State the problem as the Customer sees it…do not add "cause" to the problem statement

5-Why Critique Sheet

- **Step 2:** Three Paths (Specific, Detection, Systemic)
  - There should be no leaps in logic
  - Ask Why as many times as needed. This may be fewer than 5 or more than 5 Whys
  - There should be a cause and effect path from beginning to end of each path. There should be data/evidence to prove the cause and effect relationship
  - The path should make sense when read in reverse from cause to cause – this is the “therefore” test (e.g. – did this, therefore this happened)
  - The specific problem path should tie back to issues such as design, operations, supplier issues, etc.
  - The detection path should tieback to issues such as control plans, error-proofing, etc.
  - The systemic path should tie back to management systems/issues such as change management, preventive maintenance, etc

5-Why Critique Sheet

- **Step 3:** Corrective Actions
  - There should be a separate corrective action for each root cause. If not, does it make sense that the corrective action applies to more than one root cause?
  - The corrective action must be feasible
  - If corrective actions require Customer approval, does timing include this?

- **Step 4:** Lessons Learned
  - Document what should be communicated as Lessons Learned
    - Within the plant
    - Across plants
    - At the supplier
    - At the Customer
  - Document completion of in-plant Look Across (communication of Lessons Learned) and global Look Across

Summary of Key Points

- When do you use it?
- Use a cross-functional team
- Never jump to conclusions
- Ask “WHY” until you can turn it off
- Use the “therefore” test for reverse path
- Strong problem definition as the customer sees it
- Specific Leg – Typically applies to people doing work
- Detection Leg – Typically applies to people doing work
- Systemic Leg - Typically applies to support people
  - Start with root cause of specific leg
- Corrective actions with date and owner
- Document lessons learned and look across

3 Legged 5 Why Analysis

QUIZ

3x5 Why's Quiz

Select all that apply

The purpose of the 3 Legged 5 Whys is:

To successfully analyze a given problem

Facilitate cross-functional interaction to solve a problem

A tool requested in the Problem Solving Workbook

To identify the specific, detection and systemic root causes

ALL ABOVE

3x5 Why's Quiz

Select all that apply

The 3 Legged 5 Whys recognizes the three following causes:

1.- Specific to the problem

2.- Personal Training issues

3.- Failure in the Detection

4.- Systemic issue

1, 3 AND 4

3x5 Why's Quiz

Match the columns

( )Use the " " test for reverse path

( ) Why did the problem reach the customer?

( ) Communication of Lessons Learned

( ) Why did we have the problem?

( ) Ask " " as many times as needed

( ) Why did our system allow it to occur?

( ) Can be turned "on" and "off"

A) Systemic

B) Therefore

C) Root cause

D) Detection

E) Why

F) Look across

G) Specific

B, D, F, G, E, A, C

3x5 Why's Quiz

Is the following statement true or false?

The problem definition statement has to be clear and accurate and the causes shall be added.

True

False

FALSE

Define the problem:
Problem statement clear and accurate
Problem defined as the customer sees it
Do not add "causes" into the problem statement

3x5 Why's Quiz

Select all that apply

In the specific problem, the Root cause is typically related to design, operations, dimensional issues, etc.

Tooling wear/breaking

Set-up incorrect

Processing parameters incorrect

Part design issue

ALL ABOVE

Are the following statements true or false?

There should be a separate corrective action for each root cause. The corrective action must be feasible

TRUE FALSE

The systemic path should tie back to management systems/issues such as change management, preventive maintenance, etc

TRUE FALSE

The specific problem path should tie back to issues such as design, operations, supplier issues, etc.

TRUE FALSE

The detection path should tie back to issues such as control plans, error proofing, measurement system, gage not calibrated etc.

TRUE FALSE