MOOG

June 19, 2017
Rev A

Continuous Improvement Workshop: Permanent Corrective Actions

Agenda

- **Purpose & Goals of this Workshop**
- **Guidelines on Initiation Criteria**
  - When and Why we issue a Corrective Action
- **Best Practices on How to Write a Corrective Action Response**
  - Section-by-section
- **TIPQA System**

Moog Quality Team

- **Site Quality Manager – Dawn Salvatore**
- **Assembly Quality Engineers**
- **Quality Assurance Manager**
- **Purchasing Manager and Buyers**
- **Supplier Quality Engineers**
  - Steve Van Raay – Outside Processes
  - Bob Mietzner – Machined Parts
  - Daniel Hensel – Machined Parts & all other

Purpose
& Goals of this Workshop

Guidelines – Corrective Action Initiation Criteria

- **After today you should know:**
  - Why a Corrective Action is issued by Moog
  - Who should respond to a Corrective Action
  - How to perform Containment
  - How to arrive at the Root Cause
  - The purpose of Objective Evidence
  - The difference between Corrective and Preventative Action

- **Our goal is to provide you with the toolbox to perform the best possible RCCA you can.**

Guidelines:

Why and When We Issue a Corrective Action Request

Guidelines – Corrective Action Initiation Criteria

What is a “Corrective Action”?

A **Permanent Corrective Action** is immediate and preventative action taken on an assignable cause to **permanently** fix a systemic or process-related issue

Guidelines – Corrective Action Initiation Criteria

What is a “Corrective Action”?

- Ongoing Improvement initiatives
- *Documents* the work done!
- NOT a reprimand

Guidelines – Corrective Action Initiation Criteria

A Corrective Action is an Opportunity for *Improvement*

Guidelines – Corrective Action Initiation Criteria

- Moog Customer Request
- Audit Finding
- Significant Cost/Safety
- Recurring Issue

Guidelines – Corrective Action Initiation Criteria

- Corrective Actions that you submit are not only reviewed by internal parties, but are subject to review by others
  - Including customers, auditors, and regulating bodies from government agencies
- It is critical that all Corrective Actions submitted stand the scrutiny of the aforementioned parties
- It should be understood that what we do is necessary for the safety and well-being of the public

What is our #1 priority?


TO KEEP THESE PEOPLE SAFE

Best Practices:

How To Perform a Good Root Cause Investigation and Permanent Corrective Action

Best Practices – Administrative Data

Administrative Data

- Part Number, Part Quantity, Rejection #, Date CA issued, Date CA DUE
- BEST PRACTICES: Make sure the data is complete and correct. Be mindful of Bill Of Material (BOM) differences, revision, and affected quantity

It is Moog's responsibility to provide all the Administrative Data,
But it is your responsibility to validate it is complete and correct.

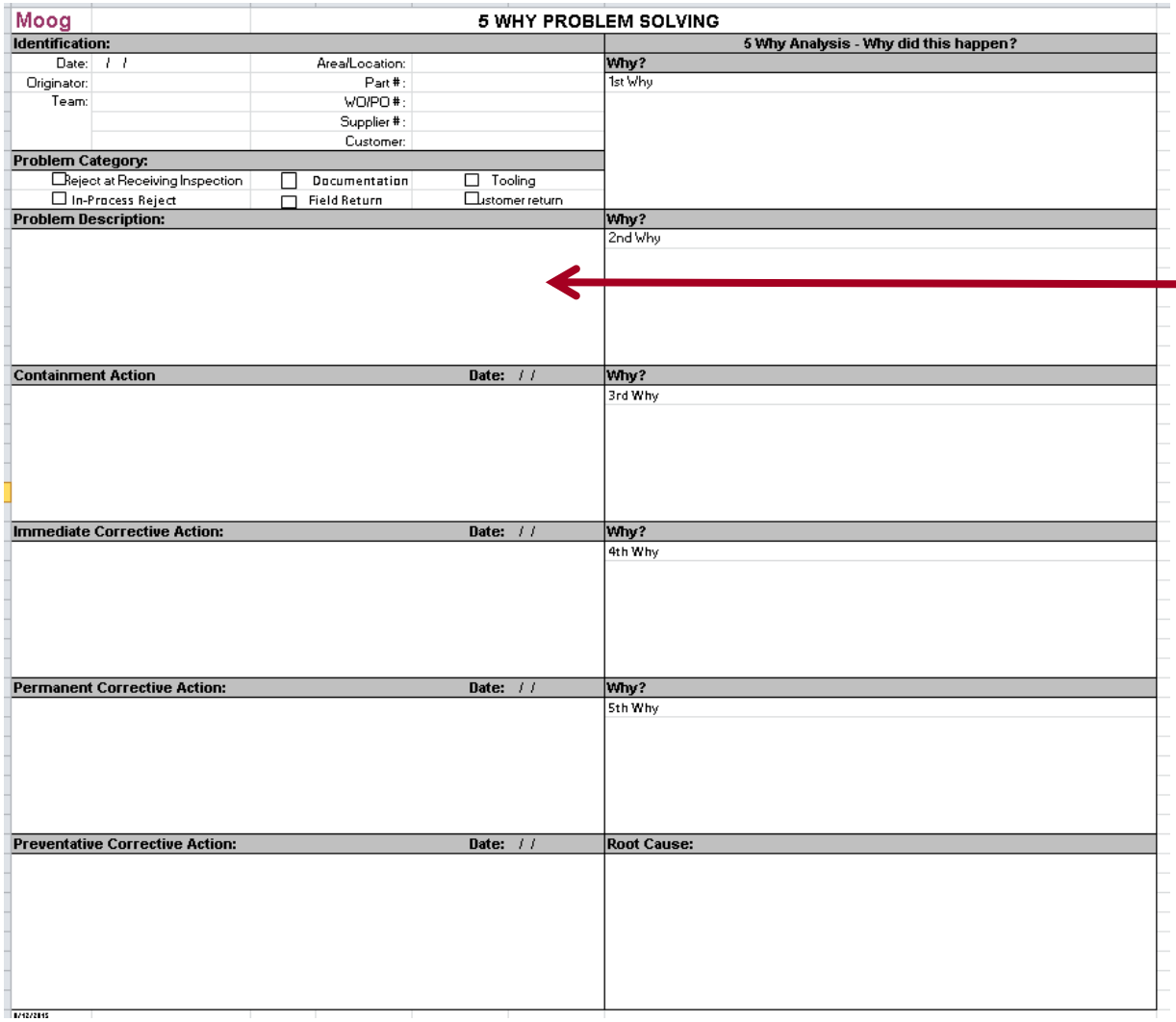
Best Practices – Description of the Finding

Description of the Finding

- Describe the Non-Conformance. The action will only be as good as the finding!
- BEST PRACTICES: Be as objective and complete as possible. Make sure all references are noted, such as drawing feature sheet/zone, specification paragraph, PO provision, etc.
- Statement should describe “should be” condition and “is” condition.
- Again, the root cause will only be as good as the description of the finding.

It is Moog’s responsibility to provide as much information as clearly as possible, But it is your responsibility to make sure you **understand the problem!**

Best Practices – Moog CA Worksheet



Moog

5 WHY PROBLEM SOLVING

Identification:		**5 Why Analysis - Why did this happen?**
Date: / /	Area/Location:	**Why?**
Originator:	Part # :	1st Why
Team:	WO/PO # :	
	Supplier # :	
	Customer:	
Problem Category:		
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		4th Why
Permanent Corrective Action:	**Date: / /**	**Why?**
		5th Why
Preventative Corrective Action:	**Date: / /**	**Root Cause:**

Input Problem Description in your own words here

After Receiving a Corrective Action request the first thing you need to do is…what?

Best Practices:
Containment

Best Practices – Containment

- What is your organization going to put in place **IMMEDIATELY** to prevent Moog from receiving any further non-conforming product?
- **All** throughout the supply chain:
  - **YOUR** suppliers and sub-tier suppliers
  - Raw, WIP, and Finished Inventory
  - In-transit to Moog
  - Moog Incoming Stores
- What did **YOU** ship in case **WE** missed it?
- Identify **Inspection GAP** and implement **SHORT TERM detection method** to prevent non-conforming product from reaching Moog
- Ensure **ALL** necessary personnel in your organization/supply chain are **AWARE** of the non-conformity **AND** the Containment Actions

Best Practices – Containment

- Has to happen in the 1st **24-48 Hours** after a Corrective Action request.
- Must ID **ALL** the product in the Supply Chain – from your suppliers; to your Raw, WIP and finished Inventories; to product in-transit to Moog; to Moog incoming stores
- **Awareness is key**. All necessary personnel must become immediately aware of the defect and the actions taken to contain it.

STOP THE BLEEDING. CONTAIN THE OIL.

Is this a Permanent Corrective Action?

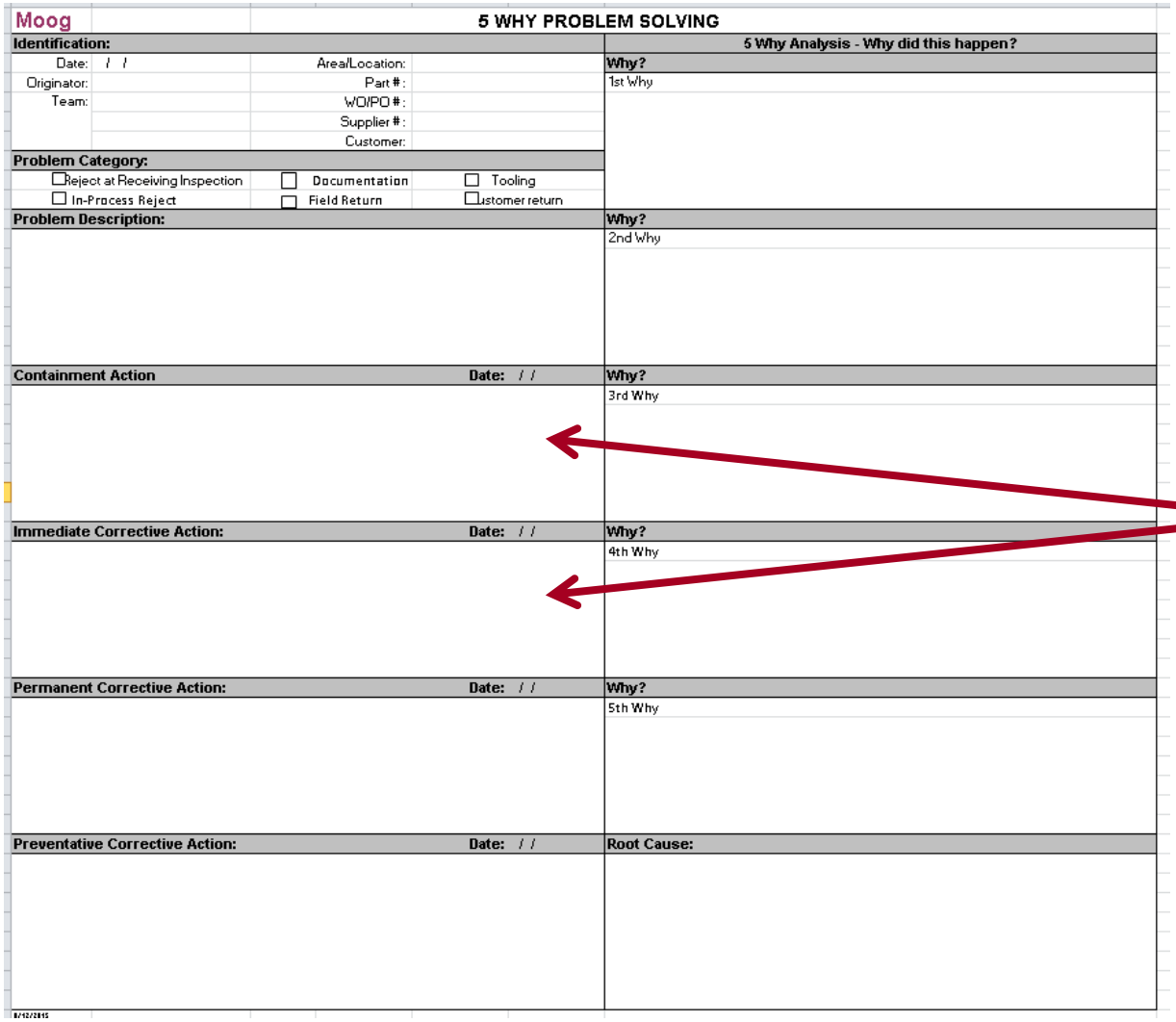
Best Practices – Containment

- **There are two parts to Containment:**

Contain Defective Material

Identify Inspection Gap

Best Practices – Moog CA Worksheet



Moog

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5 Why Analysis - Why did this happen?

Why? 1st Why

Why? 2nd Why

Why? 3rd Why

Why? 4th Why

Why? 5th Why

Root Cause:

Input Containment Action within 24-48 hrs

Break Out Session:

Containment

Best Practices:
Root Cause Investigation

FORM A TEAM

Best Practices – Form a Team

Who should be on the team?

- Operator
- Manufacturing Engineer
- Design Engineer
- Quality Engineer
- Inspector
- Buyer
- Customer Service
- Management
- Others as applicable!

Best Practices – Root Cause

- As a **TEAM**, determine the **Root Cause**
- At Moog, we look for evidence that critical thinking has occurred regarding Root Cause identification
  - Use of tools
    - 5 Why's
    - Cause and Effect (C&E)/Fishbone Diagrams
    - Process Maps
  - Include Objective Evidence
- A good root cause is not common
- Corrective Action is only as good as the Root Cause identification!

Best Practices – Root Cause

What is a Root Cause?

Best Practices – Root Cause

A Root Cause response must consider **2** facets:

1) Process Issue or Systemic Issue

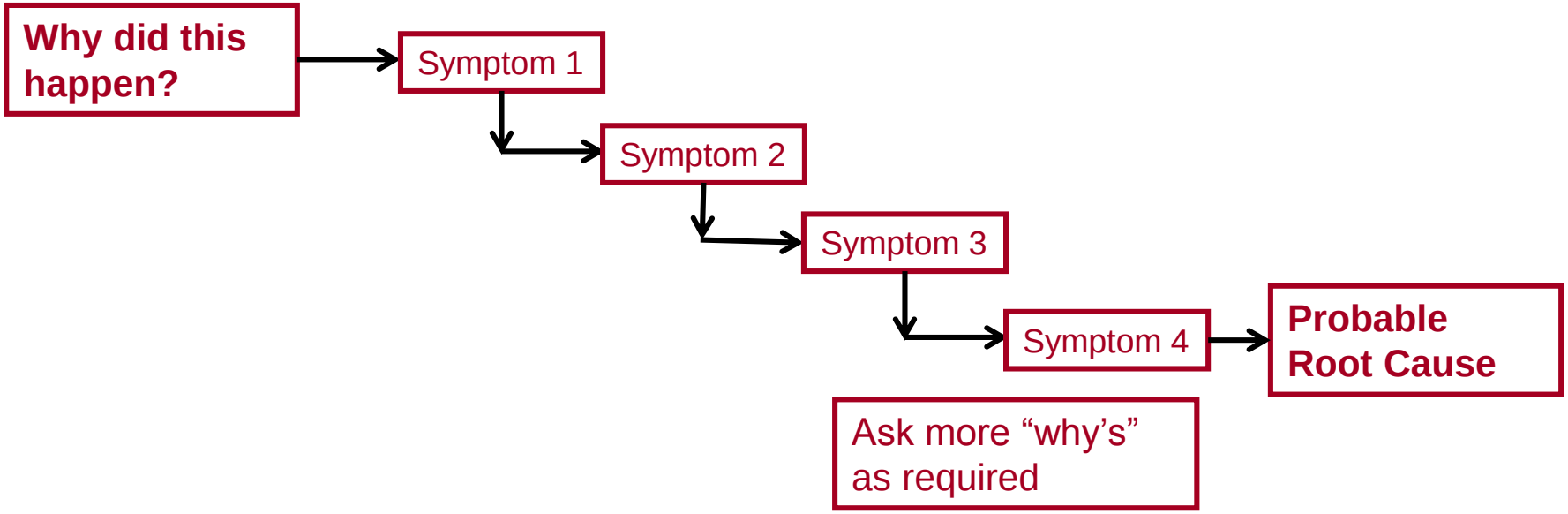
What caused the non-conformance in the first place? What allowed it to happen? What act or failure to act allowed the event to occur?

2) Failure to Detect

How did the part leave your building? Why was it certified as conforming?

Best Practices – 5 Why

- Begin the questioning process with the “most likely” major cause
- Ask “Why does this defect occur or condition exist?”
  - Rule of Thumb is to ask “why” **5 times**
    - Early questions are usually superficial, obvious. As question continues, it becomes progressively more difficult and a more thought-provoking assignment
    - **Stop** when you reach an impacting yet achievable **action**. (don’t fix the axis of Earth!).
    - May have to perform this exercise for different scenarios/paths.



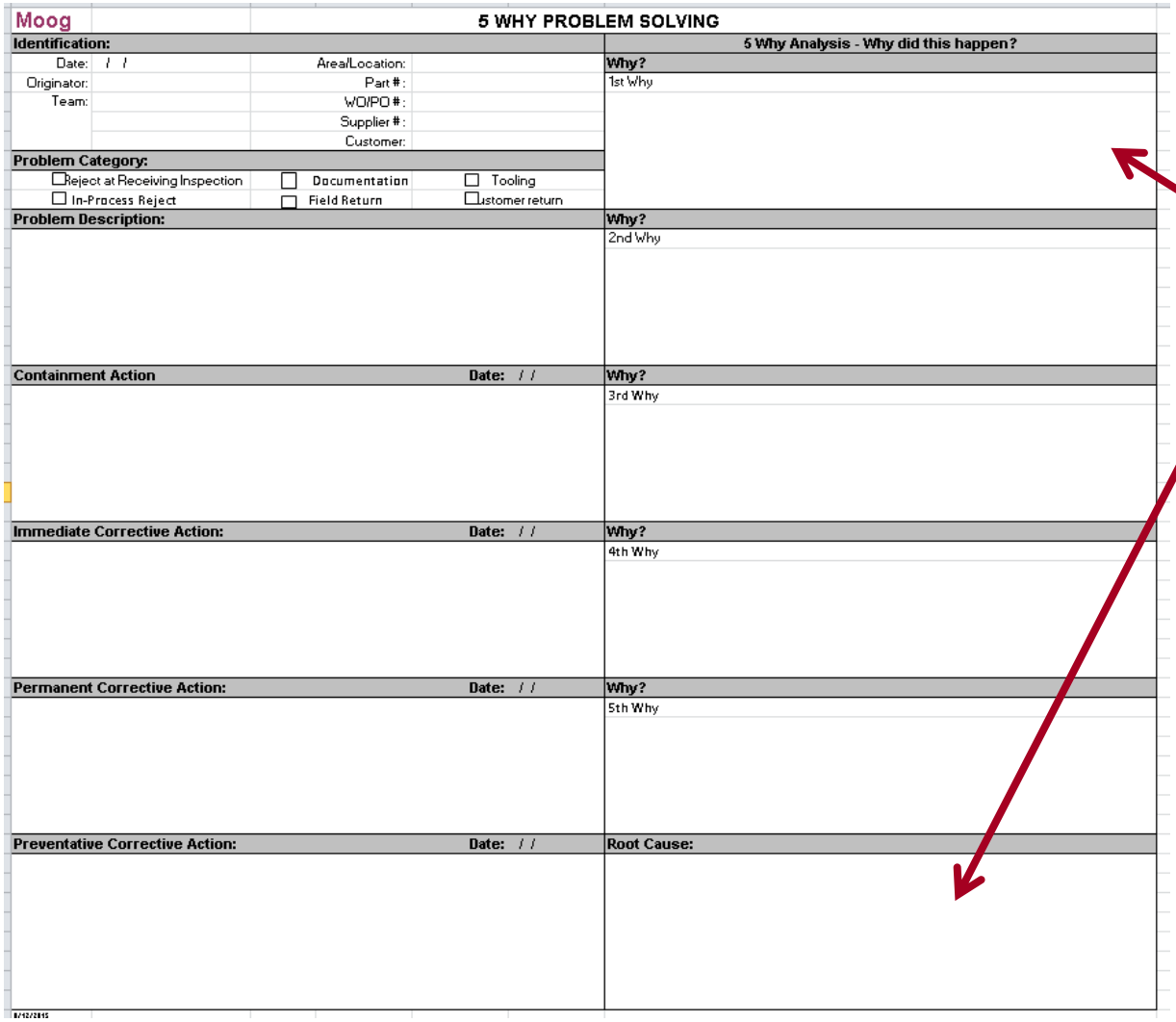
Best Practices – 5 Why Example

- **1. Why is the Jefferson Memorial in Washington D.C. deteriorating?**
  - Because harsh chemicals are frequently used to clean the monument
- **2. Why are harsh chemicals needed?**
  - To clean off the large number of bird droppings on the monument
- **3. Why are there a large number of bird droppings on the monument?**
  - Because the large population of spiders in and around the monument are a food source to the local birds
- **4. Why is there a large population of spiders in and around the monument?**
  - Because vast swarms of insects, on which the spiders feed, are drawn to the monument at dusk
- **5. Why are swarms of insects drawn to the monument at dusk?**
  - Because the lighting of the monument in the evening attracts the local insects

Best Practices – 5 Why Example

- **1. Why is there a high reject rate of widgets?**
  - Because the plastic is stained.
- **2. Why is the plastic stained?**
  - Because there is excess oil in the cutting machine.
- **3. Why is there excess oil in the cutting machine?**
  - Because it is clogging as it has been months since it was cleaned.
- **4. Why is it so long since it was cleaned?**
  - Because we only service machines when they break down, not on a preventative basis.
- **5. Why only service after breakdowns?**
  - Because maintenance says it is cheaper
    - But what about the cost of rejects and rework?

Best Practices – Moog CA Worksheet



Moog

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Ask 5 Why's to arrive at Root Cause

Best Practices – 5 Why

- Asking **Why** is a way of identifying the underlying root cause of a problem so that this can be tackled, rather than dealing only with superficial symptoms.

- It should be seen as a **simple** and **quick** alternative to Cause and Effect Analysis.

- The **5 Why** strategy is an easy and often effective tool for root cause identification, however for more complex issues C & E Analysis by be required.

Best Practices – Cause and Effect (C&E)/Fishbone Analysis

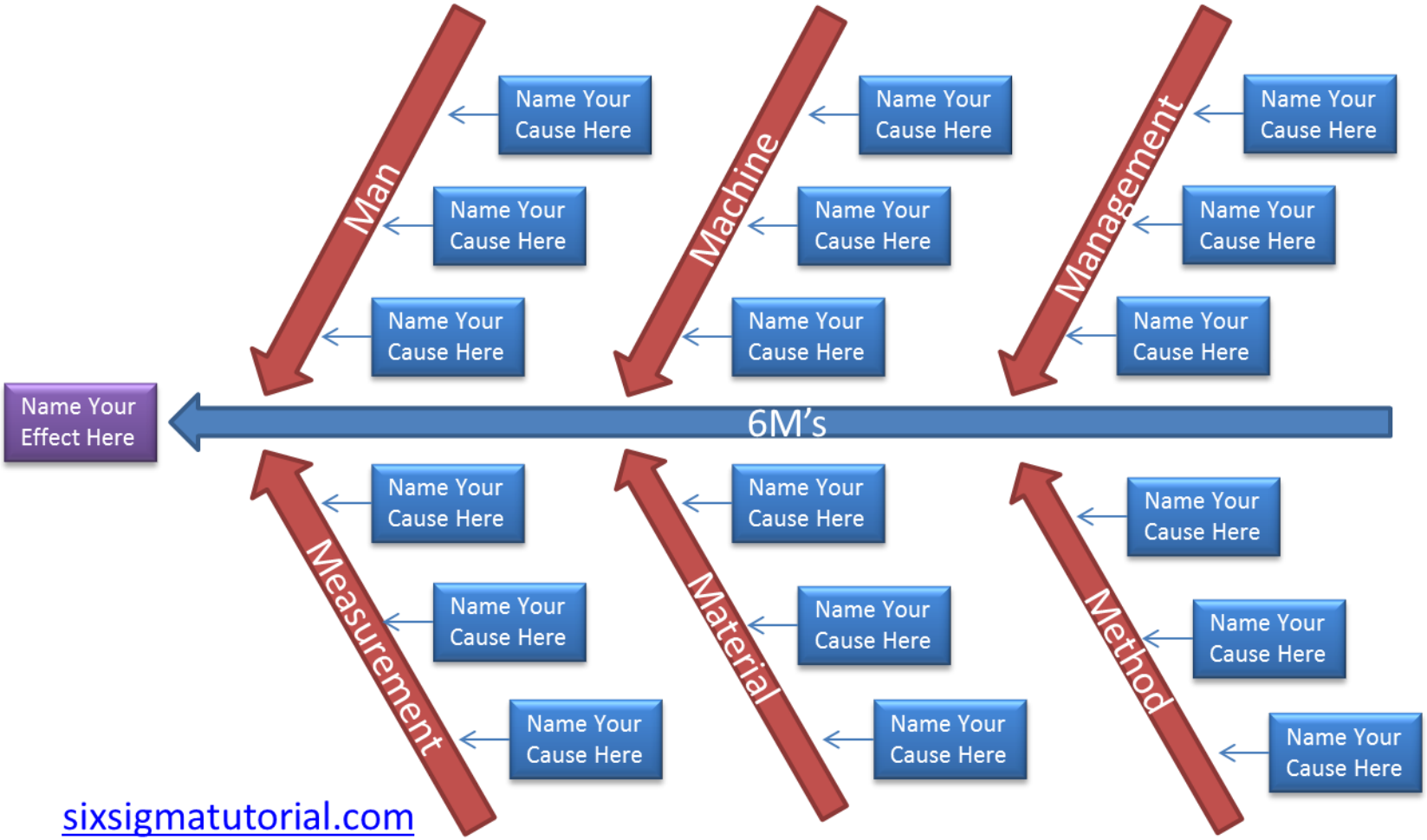
- **What is a Fishbone diagram or Fishbone Analysis?**
  - Fishbone diagram is an analysis tool to provide systematic way of understanding effects and the causes that create those effect. The design of the diagram looks like the skeleton of a fish hence, it is referred to as the fishbone diagram.

- **A fishbone diagram can be used when you:**
  - Want to study **all the possible reasons** why a process is having difficulties, problems, or breakdowns in the initial stages of the process.
  - Need to identify areas for data collection

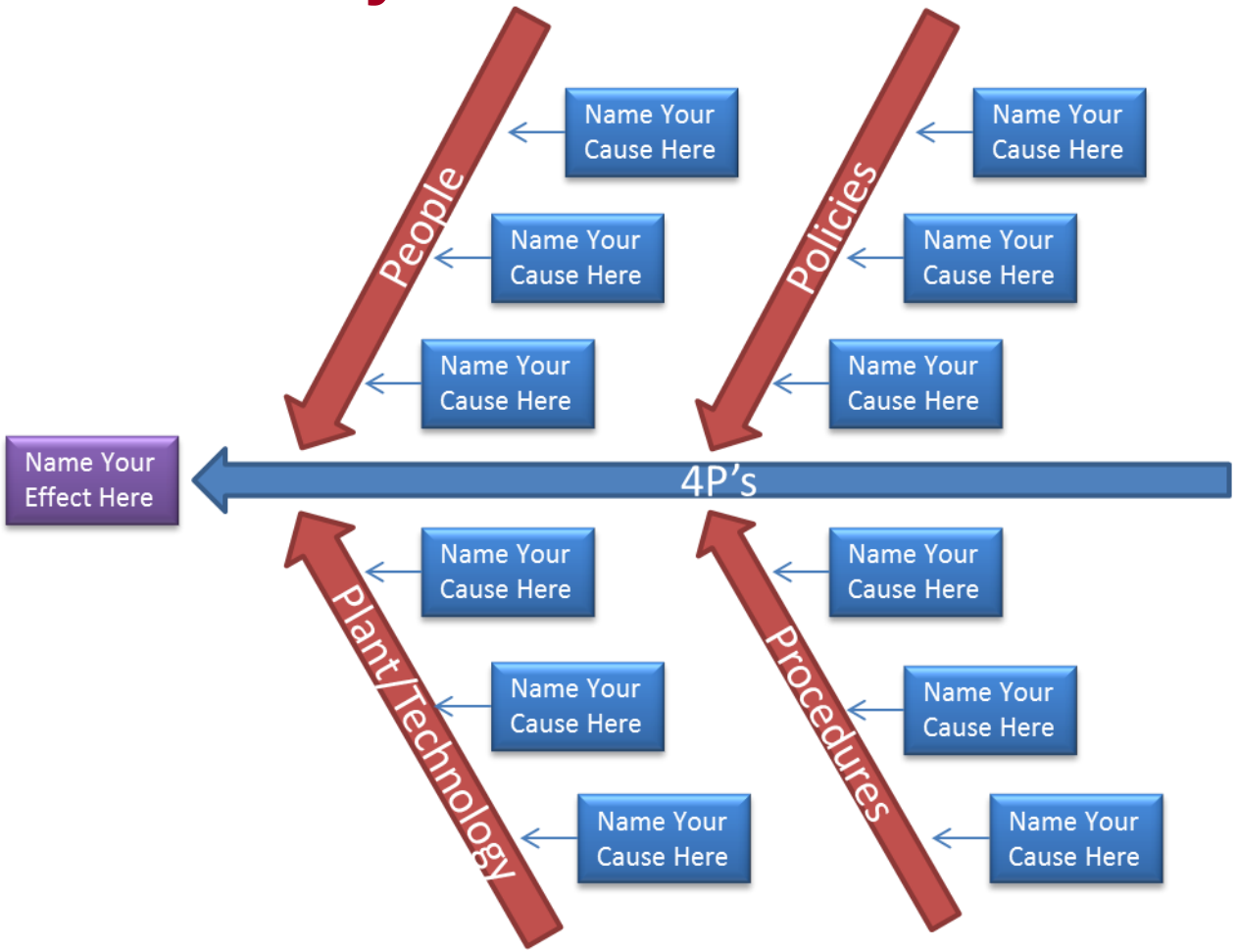
Best Practices – Cause and Effect (C&E) /Fishbone Analysis

- **Creating a Fishbone Diagram:**
  1. List the problem/issue to be studied in the head of the fish
  2. Label each bone of the fish. The major categories typically used are:
     1. The 6 M's: Methods, Machines, Materials, Manpower, Measurement, Management
     2. The 4 P's: Place, Procedure, People, Policies
  3. Within the categories, brainstorm possible causes for the issue. List them on the fish.
  4. Analyze the results, identify the **most likely causes**.
  5. Evaluate the different most likely causes to identify the Root Cause.

Best Practices – Cause and Effect (C&E) /Fishbone Analysis



Best Practices – Cause and Effect (C&E) /Fishbone Analysis



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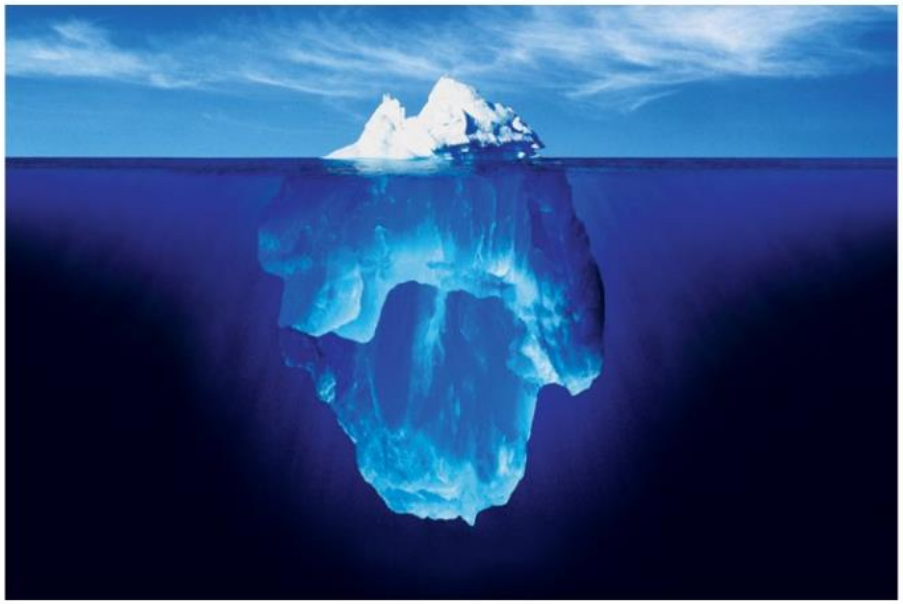
Best Practices – Root Cause



Most problems are below the surface. Get to the ROOT cause.

Best Practices – Root Cause

- Verify that you have identified both 1) the Process or Systemic Issue, and 2) the failure to detect.

- Once you have found the Root Cause, you must reassess the immediate Containment activity you took before, to ensure you have **FULL containment**.

Break Out Session:

Root Cause Investigation

Best Practices:
Permanent Corrective Action

Guidelines – Permanent Corrective Action

What is a “Corrective Action”?

A **Permanent Corrective Action** is immediate and preventative action taken on an assignable cause to **permanently** fix a systemic or process-related issue

Best Practices – Permanent Corrective Action

Actions must be credible – Objective Evidence (OE) must back up completed actions

Open Actions need **Owners** and **Due Dates**

Again, Permanent Corrective Actions will only be as good as the root causes defined!

(notice the repeated use of the word “permanent”)

Guidelines – Permanent Corrective Action

Examples include:

- Updating Work Instructions/Procedures
- Drawing Changes
- Process Changes
- Tooling
- Visual Guides
- Poke-a-yoke assembly set ups
- Training *to the corrected action*

Best Practices – Objective Evidence

Objective Evidence:

- Provides **tangible evidence of change**
- Provides **verification documentation**
- Can be audited and reviewed by **anyone** (such as independent **Corrective Action Board,** or **CAB**)
- Provides closure and feedback to **Moog** (and sometimes **Moog's Customer**)
- Stands on its own (what happens if you and your team win the **lottery** and leave work tomorrow? Will the Corrective Action still be in place?)
- **Always** provide Objective Evidence. We will ask for it!

Let's look at some Examples

Best Practices – Permanent Corrective Action

- **Root Cause: “Inspection error (we missed it!).”**
- **C/A: “We will apply 100% Inspection from now on.”**

Is this a good response?

Best Practices – Permanent Corrective Action

- **Root Cause: "Inspection error (we missed it!)."**
- **C/A: "We will apply 100% Inspection from now on."**
- **Quality cannot be inspected into a product.**
- **Did inspection create the feature?**
  - If not, it can NOT be the Root Cause!
- 100% Inspection by a person is *never* 100% effective.
- How does Inspection prevent the problem from happening again?
- "Why was it missed and what will prevent them from missing it again?" are just two of the questions to ask.
- Was the right tool (calibrated & capable) used to Inspect at the point of manufacture? (Gauge Reproducibility & Reliability, R&R)
- Inspection can be used as a **validation** of the Corrective Action.
- **Quality cannot be inspected into a product!**

Best Practices – Permanent Corrective Action

- **Root Cause: “Wrong gage, tool, machine or material used.”**
- **C/A: “We will use right gage, tool, machine or material from now on.”**

Is this a good response?

Best Practices – Permanent Corrective Action

- **Root Cause: "Wrong gage, tool, machine or material used."**
- **C/A: "We will use right gage, tool, machine or material from now on."**

Remember to keep asking Why!

- Are the correct, gages/tools/machine/material called out and correctly identified on the instruction/router/job order?
- What will prevent this from happening again?
- Where is the **objective evidence**?

Best Practices – Permanent Corrective Action

- **Root Cause: “Operator screwed up. People make mistakes.”**
- **C/A: “We have reprimanded and trained the operator.”**

Is this a good response?

Best Practices – Permanent Corrective Action

- **Root Cause: "Operator screwed up. People make mistakes."**
- **C/A: "We have reprimanded and trained the operator."**

Focus on the Process placed in the hands of the operator

- What allowed the operator to do this?
- Has the process been mistake-proofed?
  - Is the program correct?
  - Are Work Instructions correct and do they have the right amount of detail?
- Never blame the operator
- Remember the Objective Evidence!

Best Practices – Permanent Corrective Action

- **Root Cause: "It wasn't us, it was the Moog-directed sub-tier."**
- **C/A: "We have requested an alternate sub-tier from Moog."**

Is this a good response?

Best Practices – Permanent Corrective Action

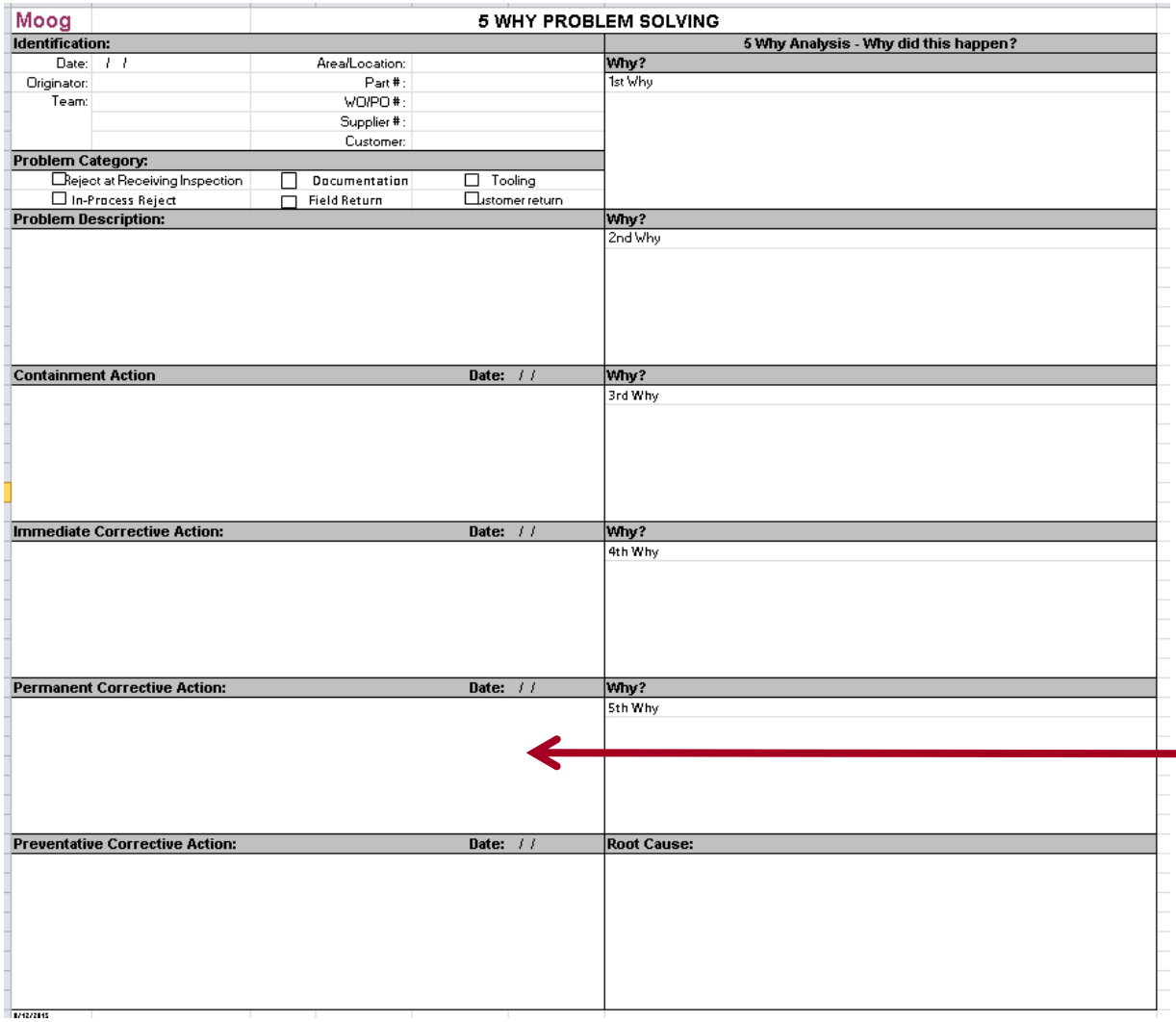
- **Root Cause: "It wasn't us, it was the Moog-directed sub-tier."**
- **C/A: "We have requested an alternate sub-tier from Moog."**

- Who is getting the Purchase Order contract from Moog?
- Who is signing the CofC?

YOU ARE

- You are responsible for the product you ship to Moog. If action must be taken against the sub-tier, you must take it.
- You may use sub-tier response in addition your own CA response. But be mindful of the due dates!

Best Practices – Moog CA Worksheet



Moog

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Preventative Corrective Action:		**Date: / /**	**Root Cause:**

Input Permanent Corrective Action

Break Out Session:

Permanent Corrective Action

Best Practices:

Verification / Follow Up

Best Practices – Verification / Follow Up

- **What is Verification?**
  - You, someone on the Corrective Action **Team**, or an assigned Verifier, **verifies** – or Checks – that the Corrective Action was implemented **successfully and completely**, and that it is **working**
- The Verification **Plan** is submitted with the Permanent Corrective Action
  - Actual Verification can be performed at a later date, usually about a month

Best Practices – Verification / Follow Up

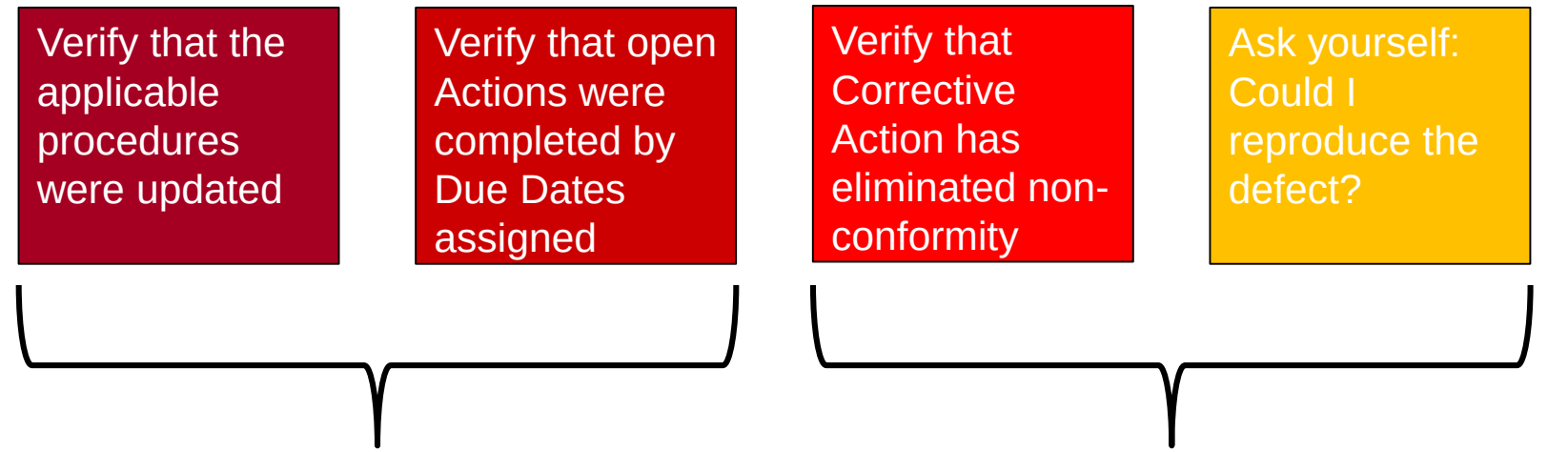
- **What do you look for in Verification?**

Two-step process:

1) Verify Corrective Action was implemented **successfully** and **completely**
2) Verify Corrective Action is **working**

Best Practices – Verification / Follow Up

- **What do you look for in Verification?**

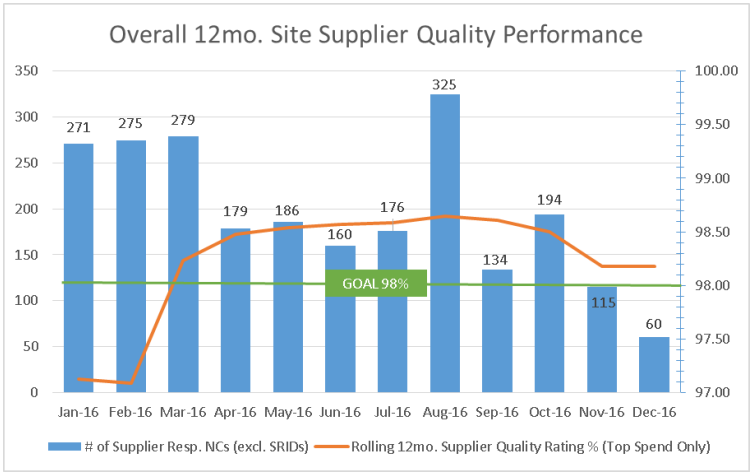


Best Practices – Verification / Follow Up

- **Document** the Corrective Action results and provide informational **feedback**.
- Let everyone know what has been done, include it in the job folder, post it, make it visual!

Best Practices – Verification / Follow Up

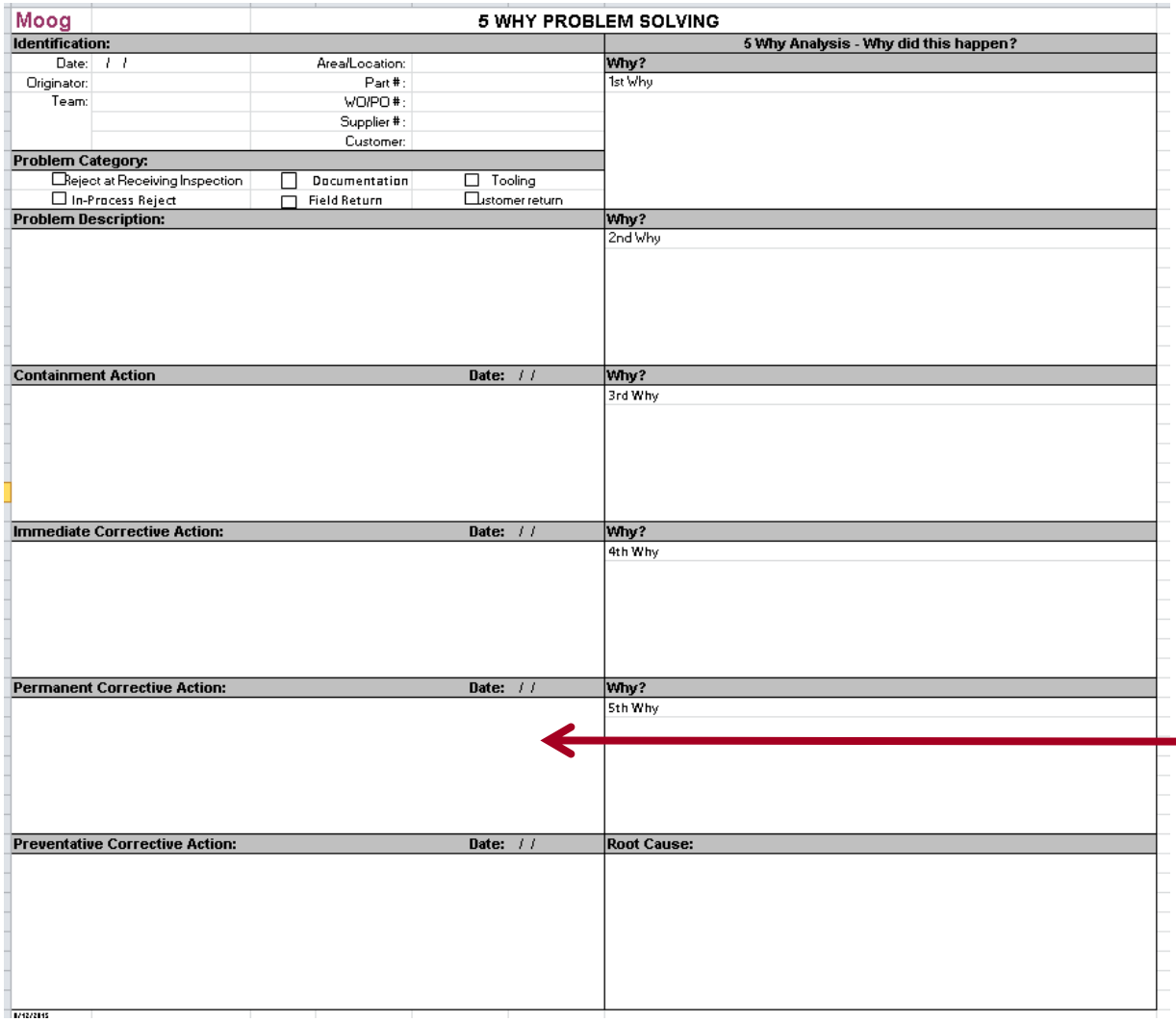
- Post measurement charts where everyone can see them
- Let everyone know what the charts mean to your business
  - By the way, this is a new AS9100 Rev D requirement, titled **Awareness**
- Keep the charts as simple as possible; always note which direction is good!



Best Practices – Verification / Follow Up

- Train all affected employees **to the Corrected Action**
- Document the training on a training record
- Provide this record as **Objective Evidence** in your Corrective Action response

Best Practices – Moog CA Worksheet



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Verification *Plan* should be included in Permanent Corrective Action Response

Congratulations!

Congratulations!

You have completed and submitted a Root Cause and Corrective Action. You have also submitted Objective Evidence, and either Verified it is working, or provided a Verification plan.

Are you done?

NO

Best Practices:

Preventative Action

Best Practices – Preventative Action

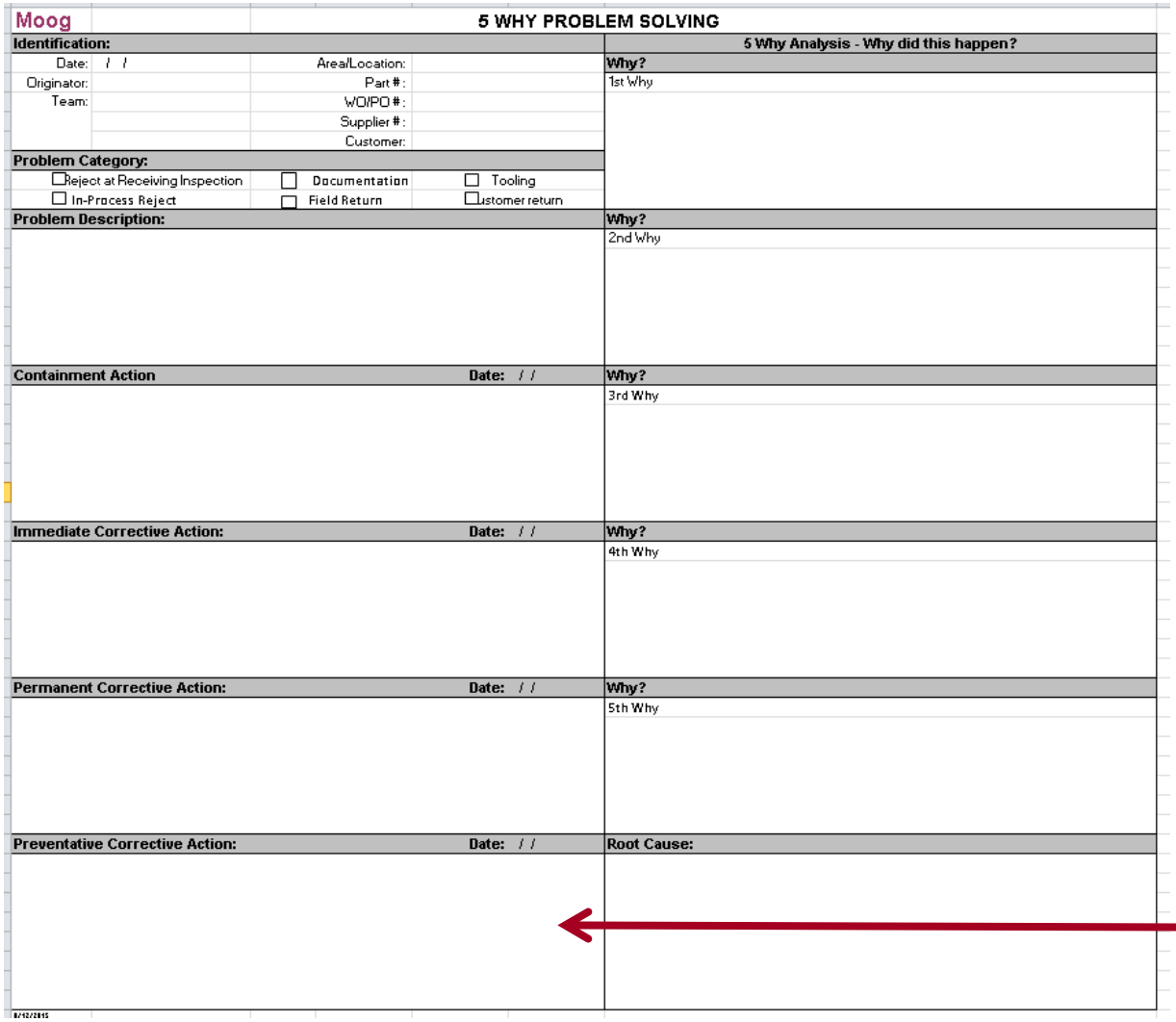
- Look across ALL Moog parts – could they see the same failure?
- Look across ALL your customers – having a “special process” for only one customer such as Moog is a **FAILURE MODE**.
- Why wait for a Corrective Action request? Take steps **now** to minimize risks later!

Best Practices – Preventative Action

- If you produce a shaft of multiple lengths for Moog and you completed a Corrective Action on one part number, does it apply to all the other parts also?
  - Could they see the same failure mode?
  - Do those routers/processes need to be reviewed and updated as well?

- If you perform an Outside Process for Moog and you resolve a processing issue for one part number, does it apply to all other parts?
  - Be wary of any “special processes”!

Best Practices – Moog CA Worksheet



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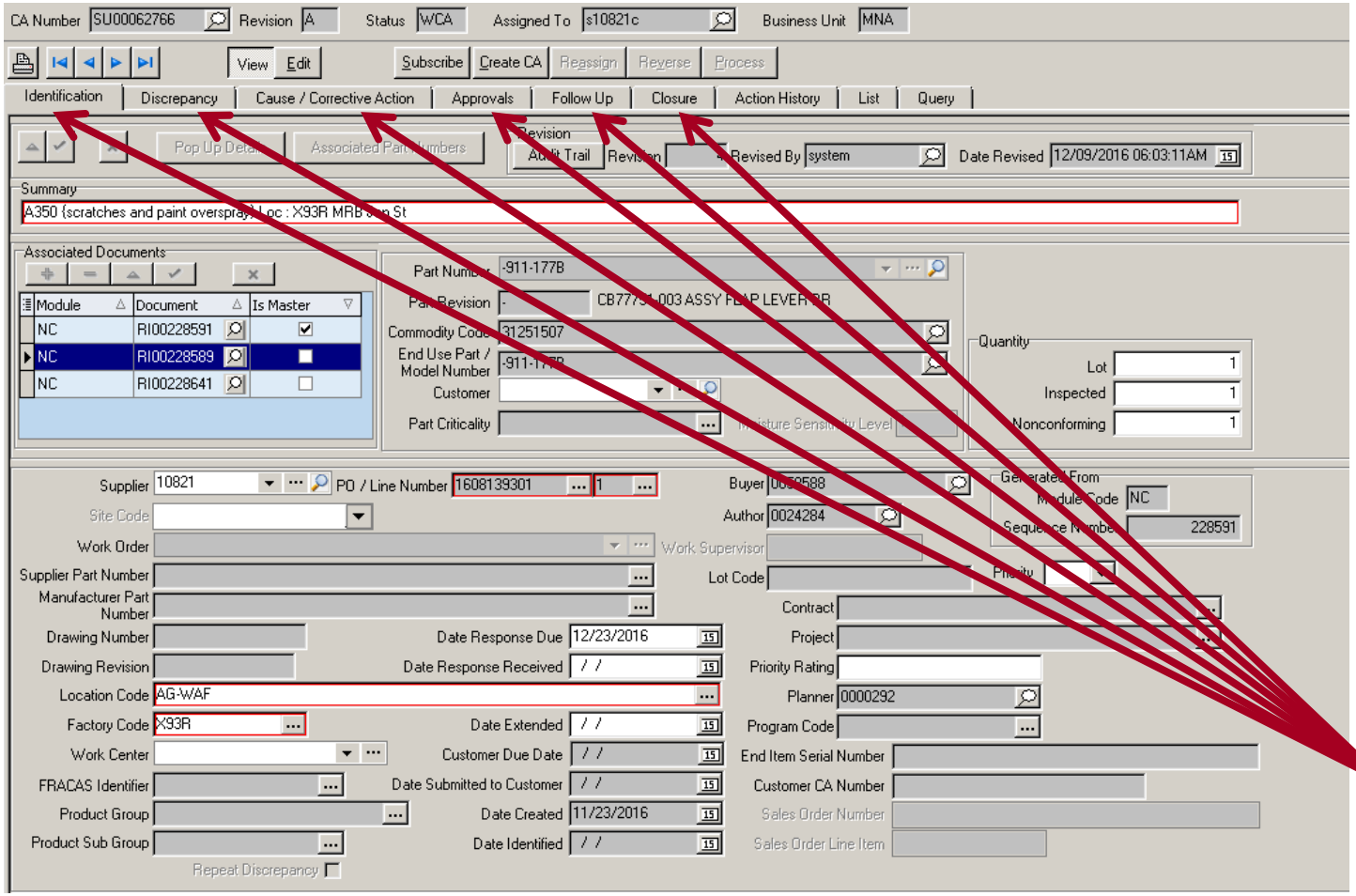
Input Preventative Corrective Action here

Break Out Session:

Preventative Action

Best Practices:
Using TipQA

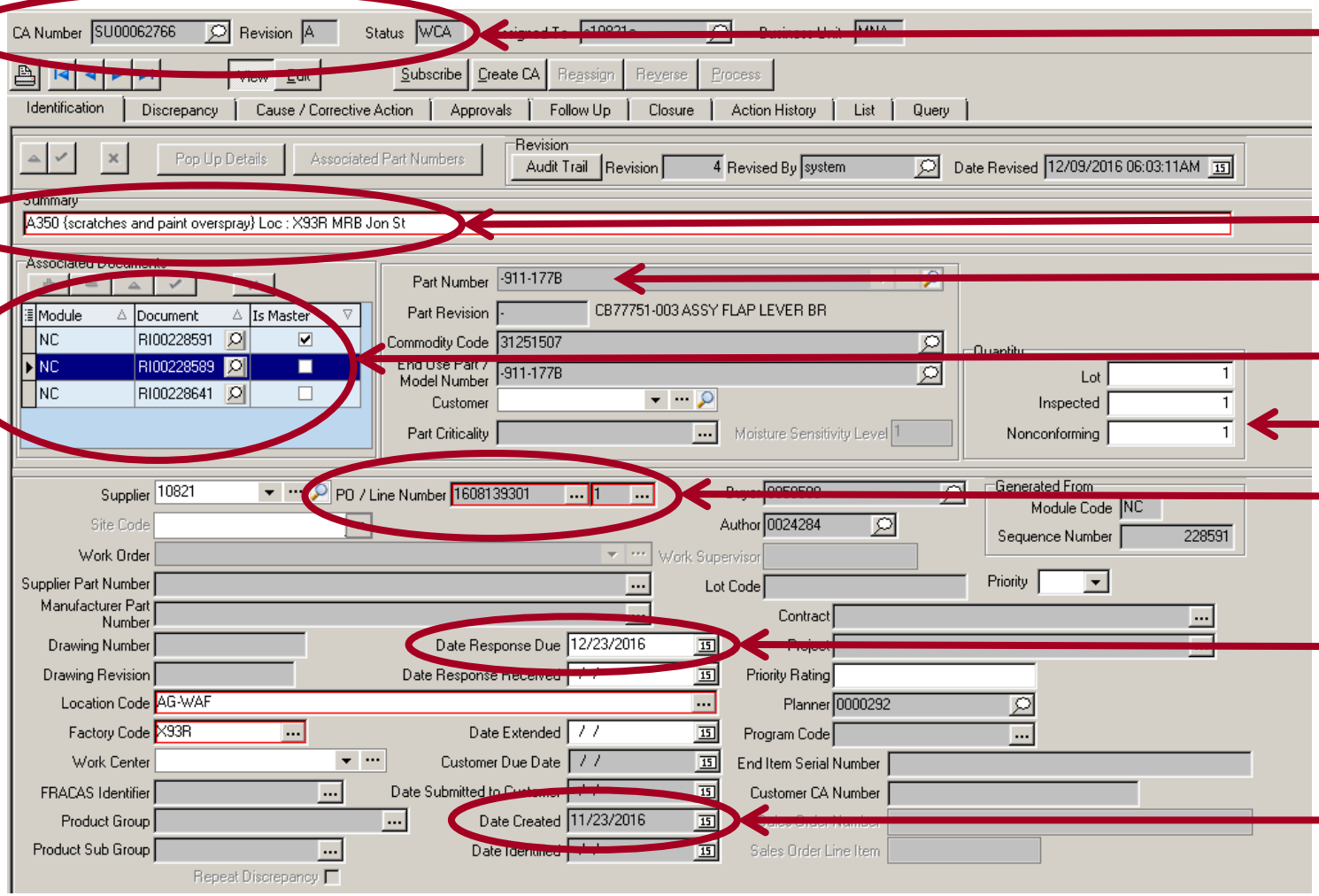
Best Practices – Using TipQA



Use tabs to navigate. Left-to-right workflow

MNA - North America

Best Practices – Using TipQA; Administrative Data



CA# & Status

Brief Summary

Part Number

Associated NCs

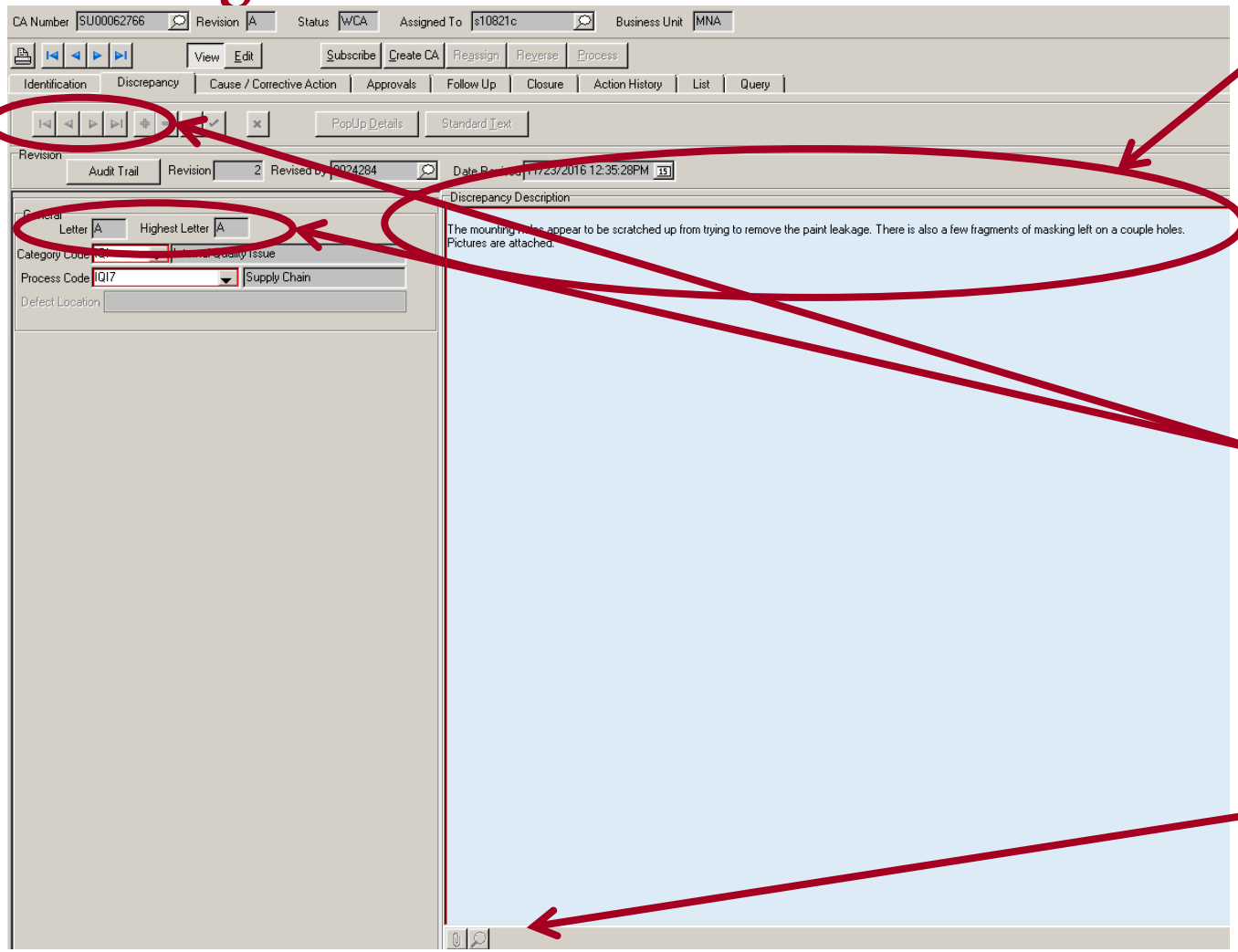
Qty

PO # & Line

Date Response Due

Date Created

Best Practices – Using TipQA; Description of the Finding

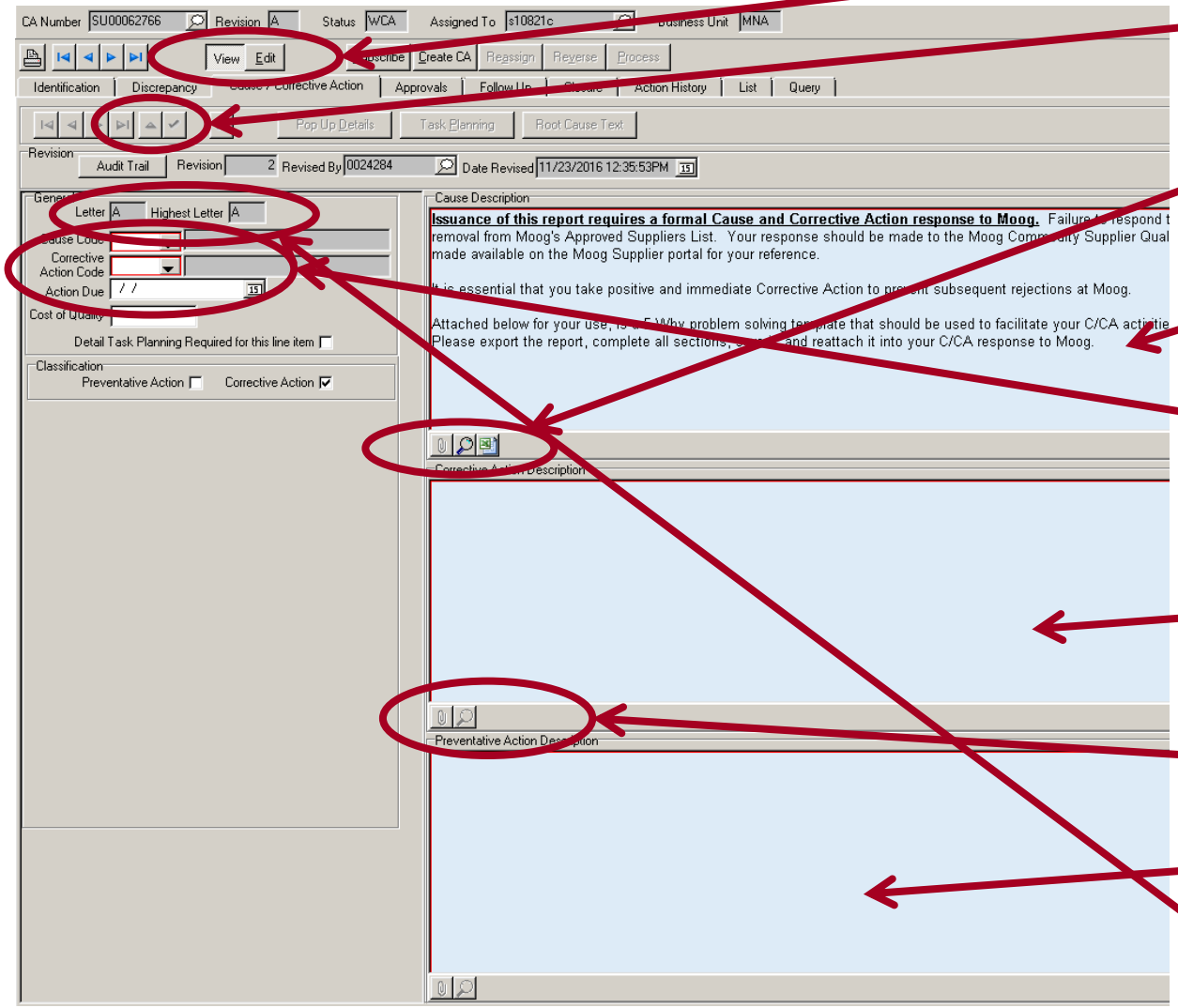


Detailed description of the finding

Each non-conformance for which the CA was issued will have it's own "Letter" (e.g. NC line). Click to advance. Pay attention to – and respond to – each one!

Attachments, such as photos or test reports, will be attached here. If not, check the NC.

Best Practices – Using TipQA: RCCA



Must be in Edit mode

Click blue triangle

Use the 5-Why spreadsheet to complete your Root Cause investigation

Re-state your Root Cause here

Remember to select the Cause Code and CA Code from the drop-down

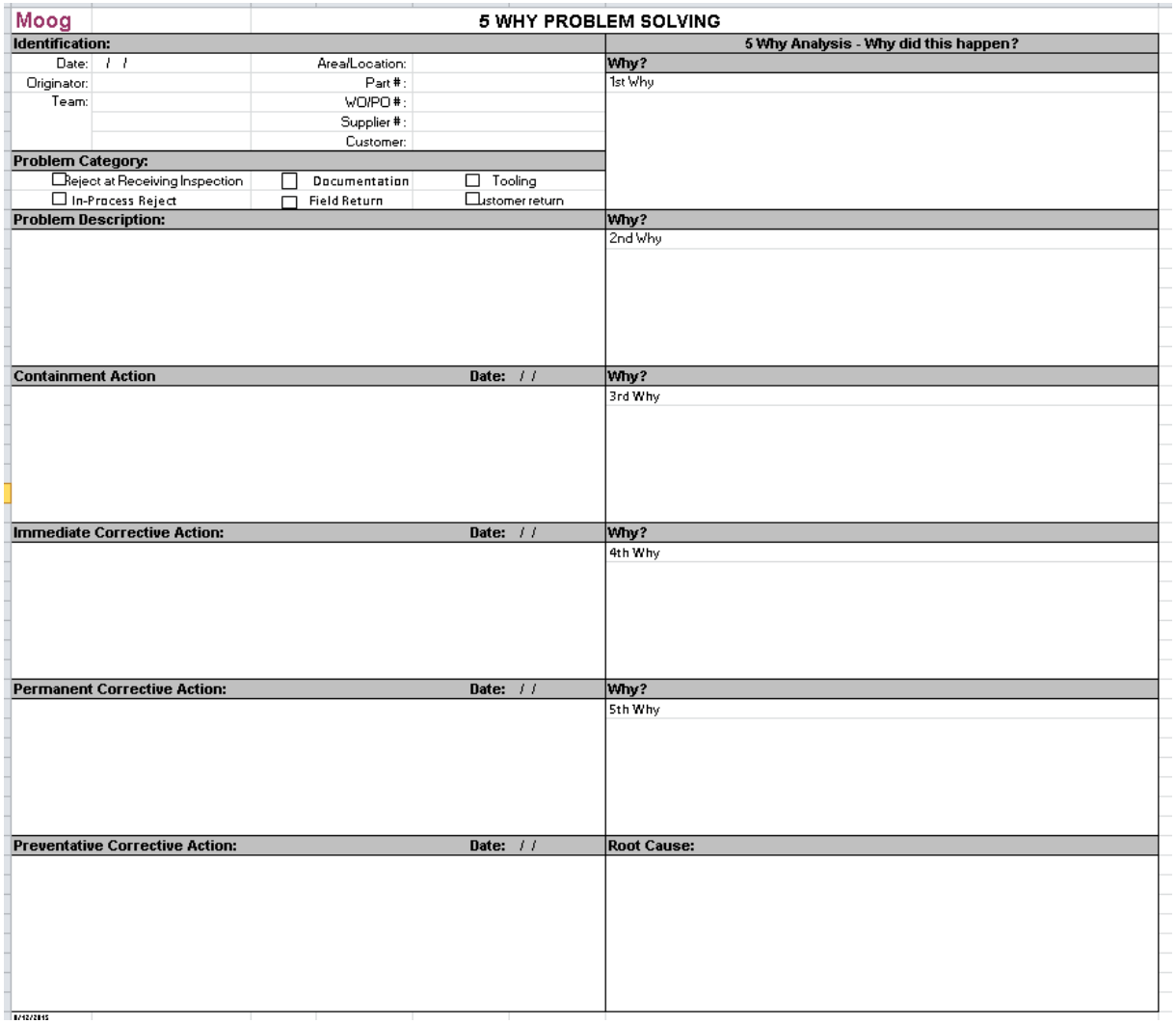
Input Permanent Corrective Action here. Be as detailed as possible. Should include Verification plan!

Attach Objective Evidence

Input Preventative Action here. Be as detailed as possible.

Again, watch the letters

Best Practices – Moog CA Worksheet

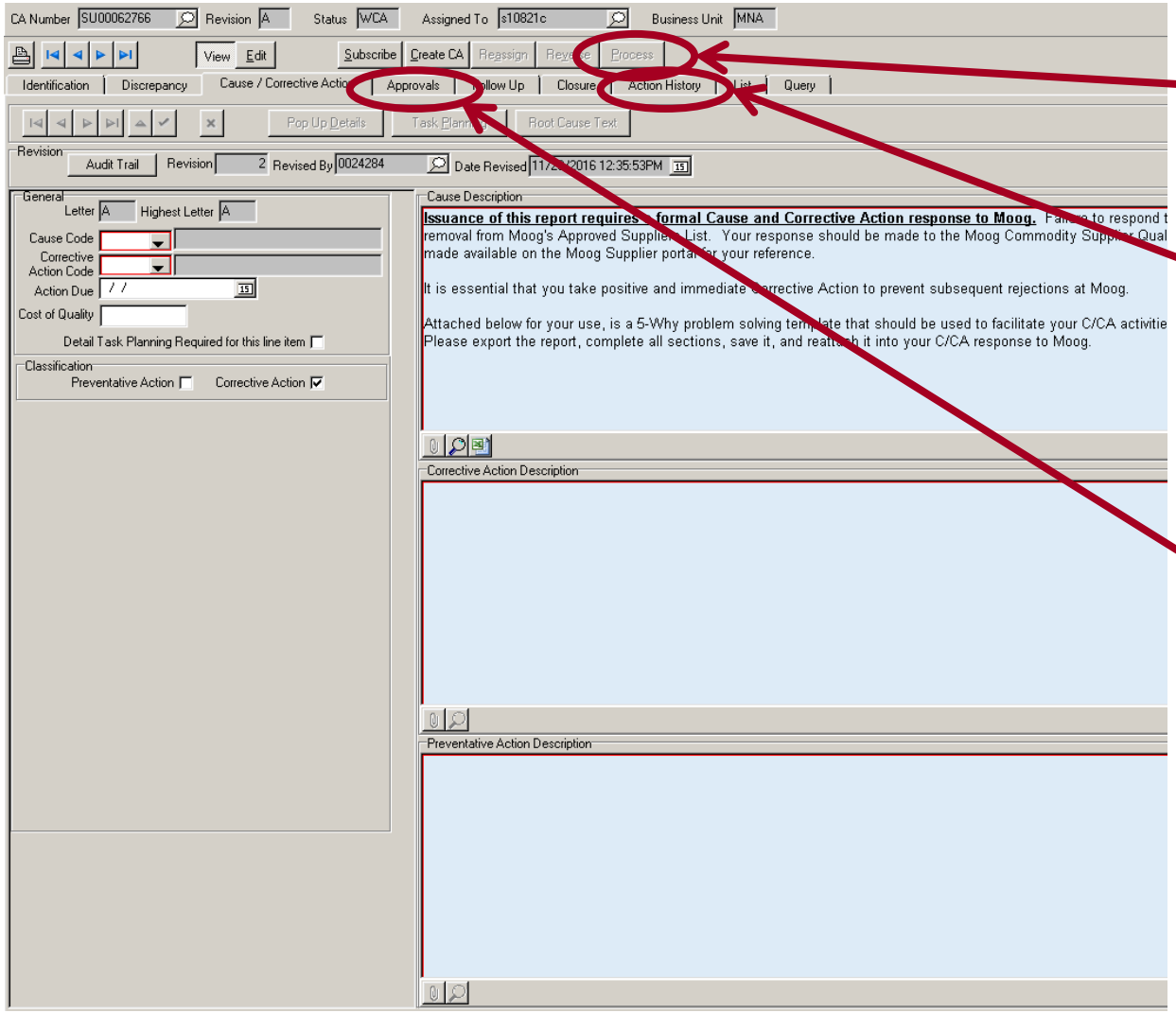


Moog

5 WHY PROBLEM SOLVING

Identification:			**5 Why Analysis - Why did this happen?**
Date: / /	Area/Location:		**Why?**
Originator:	Part # :		1st Why
Team:	WO/PO # :		
	Supplier # :		
	Customer:		
Problem Category:			
☐ Reject at Receiving Inspection	☐ Documentation	☐ Tooling	
☐ In-Process Reject	☐ Field Return	☐ Customer return	
Problem Description:			**Why?**
			2nd Why
Containment Action		**Date: / /**	**Why?**
			3rd Why
Immediate Corrective Action:		**Date: / /**	**Why?**
			4th Why
Permanent Corrective Action:		**Date: / /**	**Why?**
			5th Why
Preventative Corrective Action:		**Date: / /**	**Root Cause:**

Best Practices – Using TipQA; RCCA



When complete, you must select “Process”. Status will change from WCA to WA

To confirm that you have submitted, observe the “Action History” tab

Once a Moog representative reviews and approves, it goes to the Corrective Action Board for review. After CAB acceptance, CA will enter Follow-Up (Verification) stage. You may observe the Approvals in the “Approvals” tab

If at any time the CA is not approved, it will be sent back to you for updates

Summary

Guidelines – Corrective Action Initiation Criteria

What is a “Corrective Action”?

A **Corrective Action** is immediate and preventative action taken on an assignable cause to permanently fix a systemic or process-related issue

Summary

What is a “Corrective Action”?

Ongoing Improvement initiatives

Documents the work done!

NOT a reprimand

Summary

- **FORM A TEAM**
- **CONTAIN** the non-conformance – Supply Chain, Detection, and Awareness
- A Corrective Action is only as good as it's **Root Cause**
- Get to the REAL **Root Cause** – there can be more than one!
- IMPLEMENT solid **Corrective Actions**
- SHOW **Objective Evidence**
- **VERIFY** the Corrective Action
  - Ask yourself if the defect could be reproduced by others
- **PREVENT** the defect from occurring on other parts

Best Practices – Containment

- **There are two parts to Containment:**

Contain Defective Material

Identify Inspection Gap

Best Practices – Root Cause

A Root Cause response must consider **2** facets:

1) Process Issue or Systemic Issue

What caused the non-conformance in the first place? What allowed it to happen? What act or failure to act allowed the event to occur?

2) Failure to Detect

How did the part leave your building? Why was it certified as conforming?

Summary

Actions need **Owners** and **Due Dates**

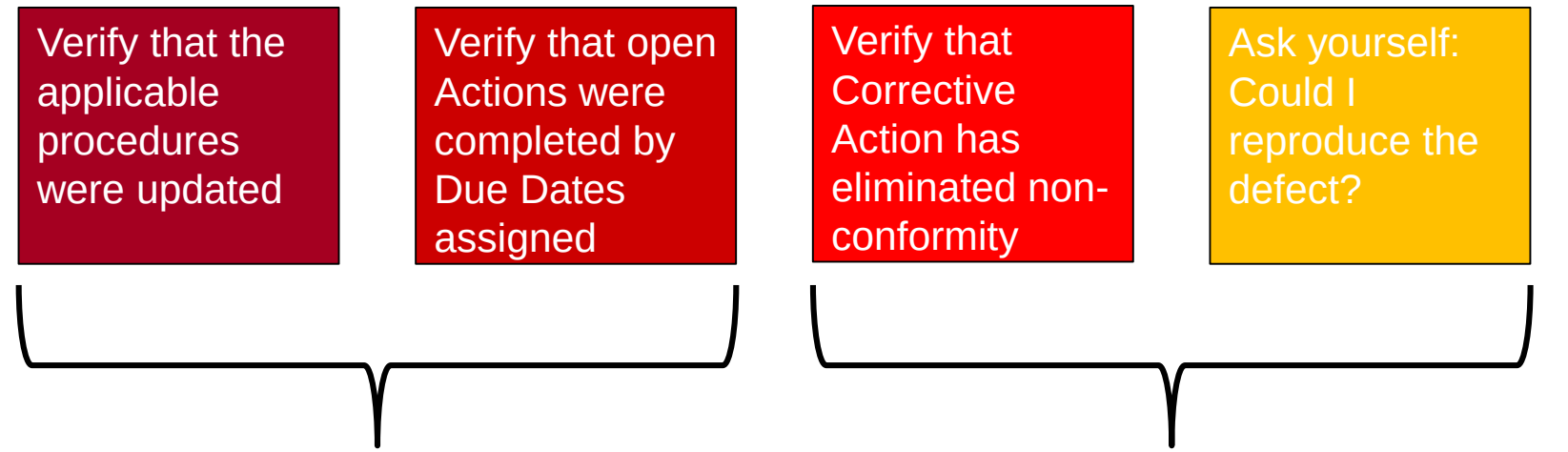
Actions must be credible – Objective Evidence (OE) must back up completed actions

Again, Permanent Corrective Actions will only be as good as the root causes defined!

(notice the repeated use of the word “permanent”)

Best Practices – Verification / Follow Up

- **What do you look for in Verification?**



Best Practices – Preventative Action

- Look across ALL Moog parts – could they see the same failure?
- Look across ALL your customers – having a “special process” for only one customer such as Moog is a **FAILURE MODE**.
- Why wait for a Corrective Action request? Take steps **now** to minimize risks later!

Summary

A Corrective Action is an Opportunity for *Improvement*

What is our #1 priority?


TO KEEP THESE PEOPLE SAFE

Congratulations!

Congratulations!

You have completed a Continuous Improvement activity for the benefit of your organization, Moog, and all your other customers.

Do you keep going?

YES

Thank you!

End.

Supplemental Material

Summary

Continuous Improvement is ***continuous***

Best Practices – Cause and Effect (C&E)/Fishbone Analysis

- **Creating a Fishbone Diagram:**
  - List the problem/issue to be studied in the head of the fish
  - Label each bone of the fish. The major categories typically used are:
    - The 6 M's: Methods, Machines, Materials, Manpower, Measurement, Management
    - The 4 P's: Place, Procedure, People, Policies
  - Repeat this procedure with each factor under the category to produce sub-factors. Continue asking, "Why is this happening?" and put additional segments each factor and subsequently under each sub-factor.
  - Analyze the results, identify the 'most likely causes".
  - Evaluate the most likely causes to identify the true Root Cause.

Best Practices – Permanent Corrective Action

"We talked to the operator, he/she will be trained"

Is training alone sufficient?

- Never blame the operator
- Focus on the process placed in the hands of the operator
- What allowed the operator to do this?
- Can the process be mistake-proofed?

Best Practices:
Good CA Example

Best Practices – Good CA Example

Revision Control

Revision Control

Revision	Reason for Change	Release Date	Author
NC	Initial Release	2/1/2017	D. Hensel
A	Added Permanent CA examples, moved Containment ahead of Form a Team, added Containment slide		D. Hensel