PNSQC

OCTOBER 9-11 2023

AMP IT UP:

TRANSFORMING QUALITY

Neal Peterson

Root Cause Analysis Workshop

PNSQC.ORG

Agenda

- Welcome and introductions
- Overview of root cause analysis
  - The 5 Whys technique
  - Fishbone diagrams
  - Fault tree analysis
- Q&A
- Practicing root cause analysis on a case study

Welcome and Introductions

- Have you ever fixed the wrong thing on the first try? If so, raise your right hand
- If you fixed the wrong thing on the second try also, keep your hand raised
- If you fixed the wrong thing on the third try, keep your hand raised
- If you fixed the wrong thing on the fourth try, keep your hand raised
- If you fixed the wrong thing on the fifth try, keep your hand raised
- If you fixed the wrong thing on more than six tries, keep your hand raised
- Hopefully after today's workshop you will all be able to avoid raising your hands

Root Cause Analysis Overview

- Root cause analysis is an approach for identifying the underlying causes of an incident so that the most effective solutions can be identified and implemented. It's typically used when something goes badly and can also be used when something goes well. Within an organization, problem solving, incident investigation, and root cause analysis are all fundamentally connected by three basic questions:
- What's the problem?
- Why did it happen?
- What will be done to correct it or prevent it from happening again?

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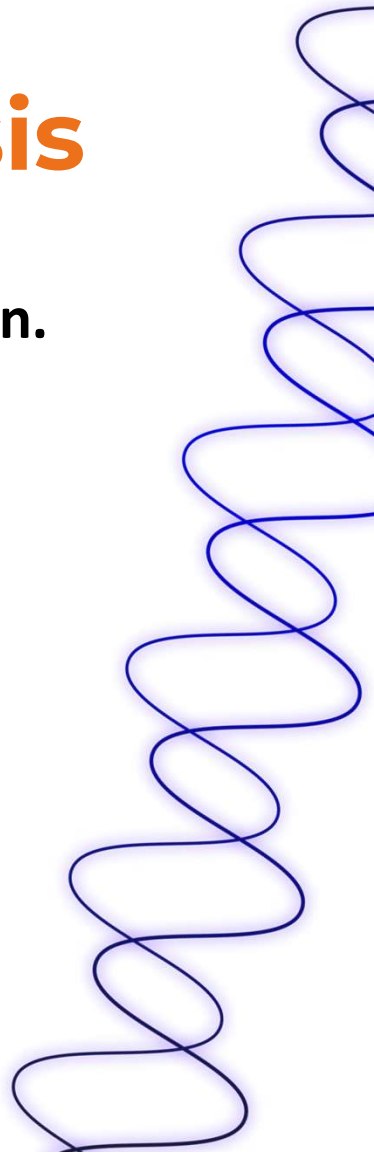
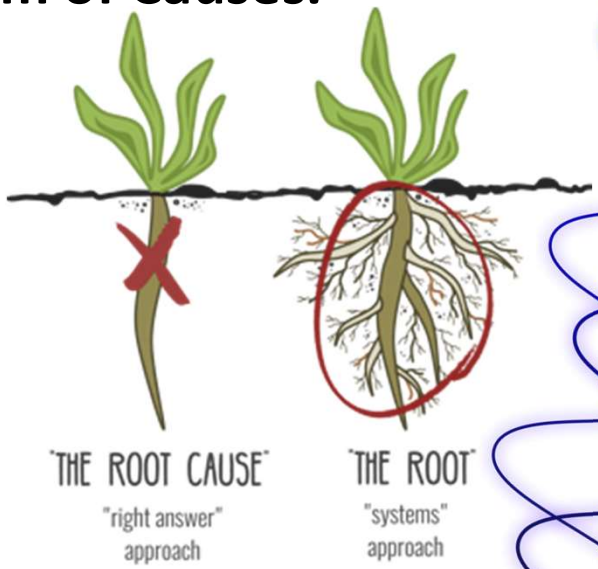
Overview of Root Cause Analysis

- **A Good Root Cause Analysis Provides a Thorough Explanation.**



Overview of Root Cause Analysis

- **A Good Root Cause Analysis Provides a Thorough Explanation.**
- **A Good Root Cause Analysis Reveals a System of Causes.**



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Overview of Root Cause Analysis

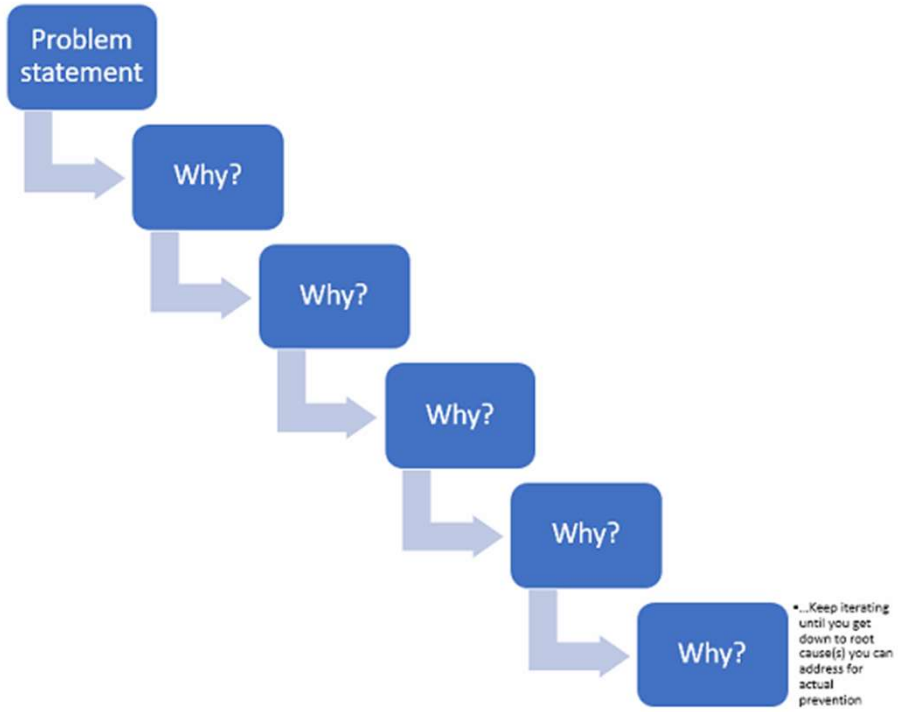
- A Good Root Cause Analysis Provides a Thorough Explanation.
- A Good Root Cause Analysis Reveals a System of Causes.
- A Good Root Cause Analysis Identifies Opportunities to Reduce Risk.
- A Good Root Cause Analysis Avoids Blame and Focuses on Prevention.
- The Output of a Good Root Cause Analysis is Specific Corrective and Preventative Actions That Improve Work Processes.

The 5 Whys

- The 5 Whys technique is a simple but effective problem-solving method that involves repeatedly asking "Why?" until you reach the root cause of the problem. It was developed by Sakichi Toyoda, the founder of Toyota, and is still widely used in manufacturing and other industries today.
- Use 5 Whys for:
  - Troubleshooting
  - Quality improvement
  - And problem solving
- It is most effective when used to resolve simple or moderately difficult problems or in conjunction with other techniques.

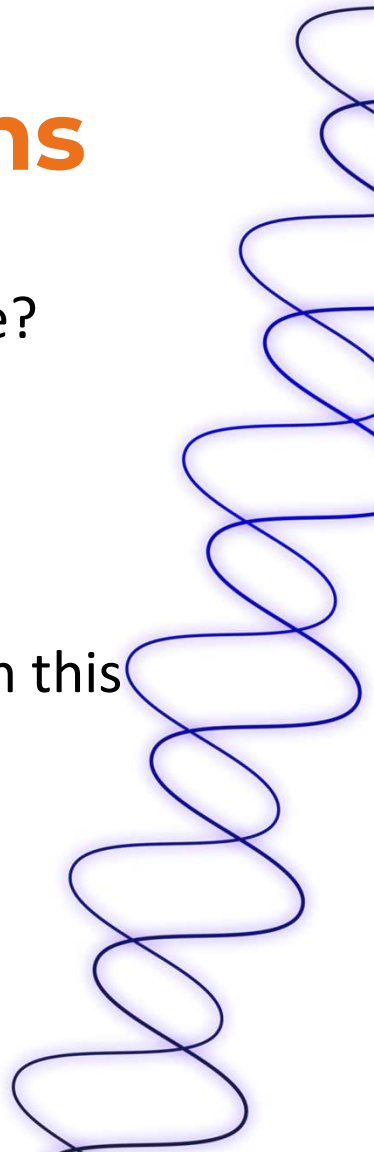
5 Whys Example

- A software application crashes when a user tries to open a specific file.



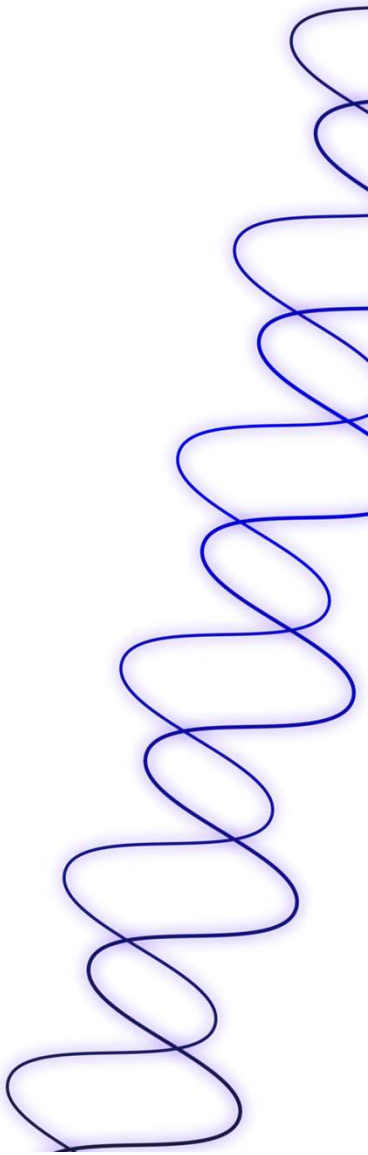
The 5 Whys - Example Questions

- Why does the software crash when a user opens a specific file?
- Why does it only happen with one specific file?
- Why is that file unique?
- Why does the stack trace end at a memory overflow?
- Why does the user only report the error when it happens with this file?



Example Analysis Process

- The developer gathers the following data:
  - Stack trace
  - Log files
  - User report
- Analysis
- Hypothesis
- Test
- Root cause
- Corrective or Preventative Action



The 5 Whys Technique

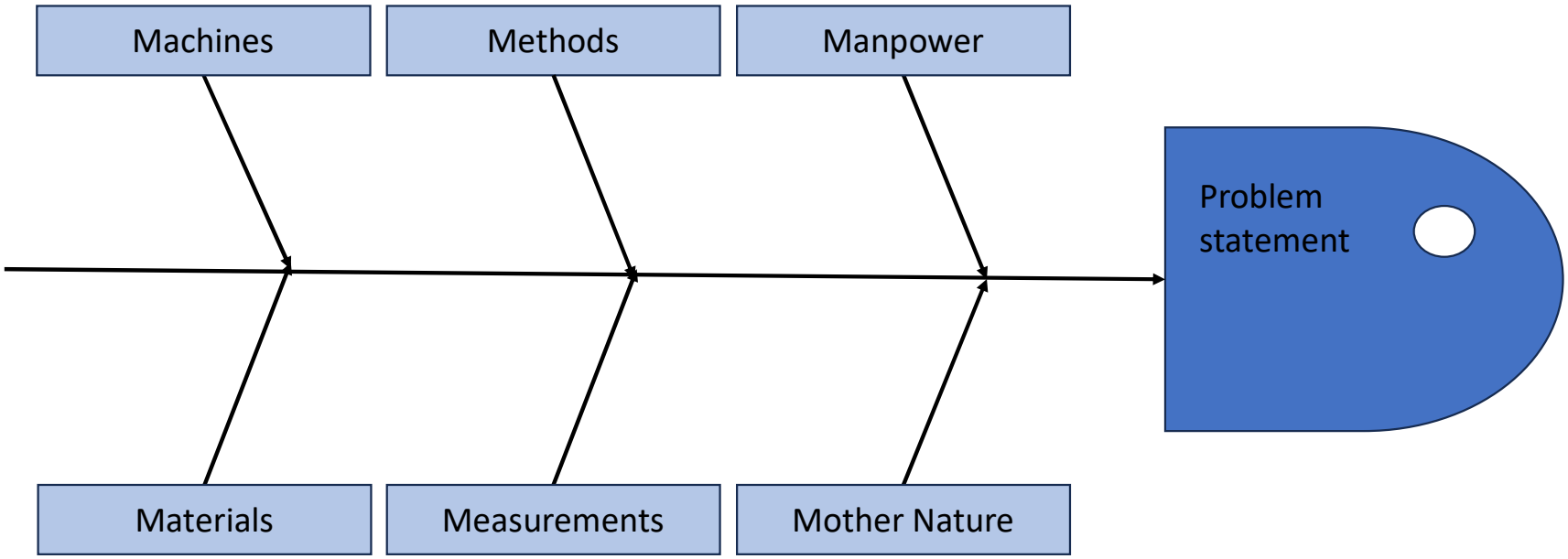
Dos

- Ask Why questions
- Write the causes in boxes
- Build the analysis backwards through time
- Start linear, keep cause-and-effect simple
- Know that 5-Why is a phase unless the problem is simple

Don’ts

- DON’T write sentences
- DON’T make it vertical
- DON’T think there’s only one causal p ath
- DON’T mix chronology with causality
- DON’T think the 5th Why is the root cause

Fishbone Diagrams



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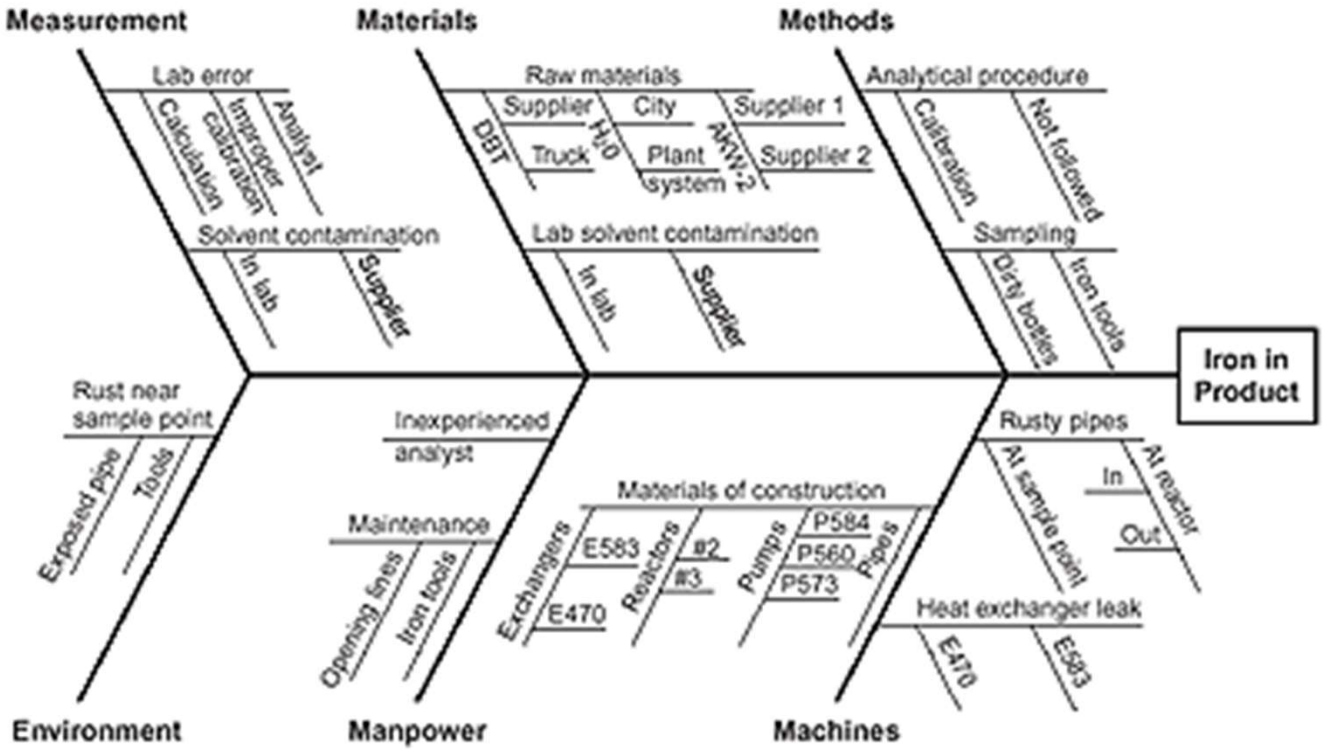
Fishbone Diagrams

- When to Use
  - When identifying potential causes of problems
  - When the team's thinking is in a rut
- Procedure for Use
  - Agree on the problem statement and write it two thirds of the distance to the right of the board approximately in the middle the board vertically. Draw a "fish head" around it.
  - Brainstorm the major categories of the problem. (Use the generic 6Ms if no others come to mind)
  - Write categories of causes on main branches
    - Ask "Why might this happen or be a factor?"
  - Write branch possibilities off each main category
  - Continue to ask Why…

Fishbone Diagram Example



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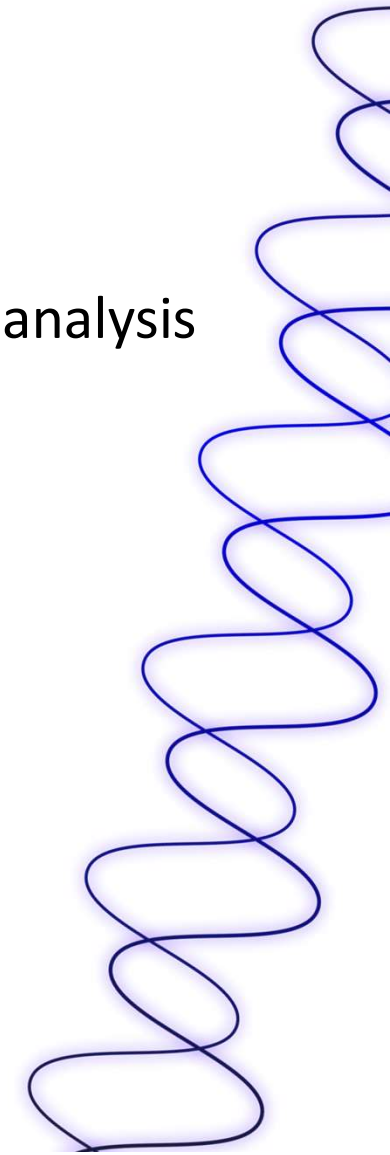
Fishbone Diagrams

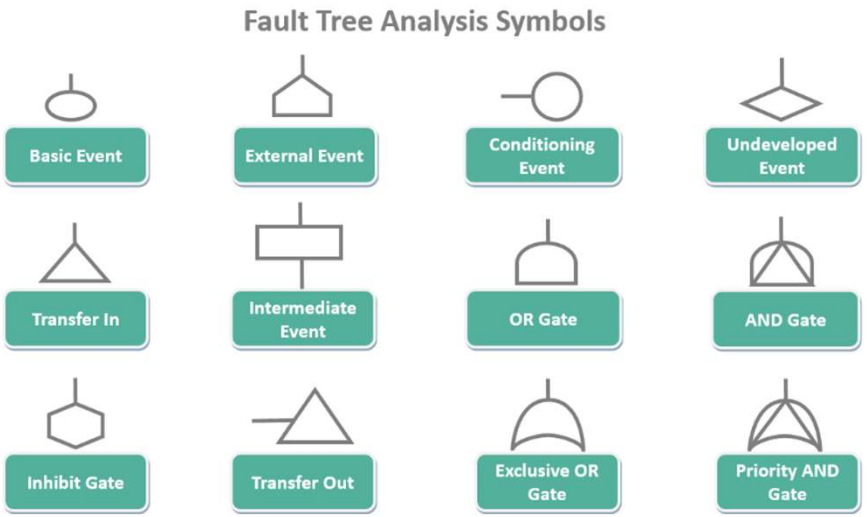
- Used to capture information during brainstorming and initial analysis periods
- Aren’t the end of the analysis
- Should be used as a reference
- Can be amended if additional factors are discovered later



Fault Tree Analysis

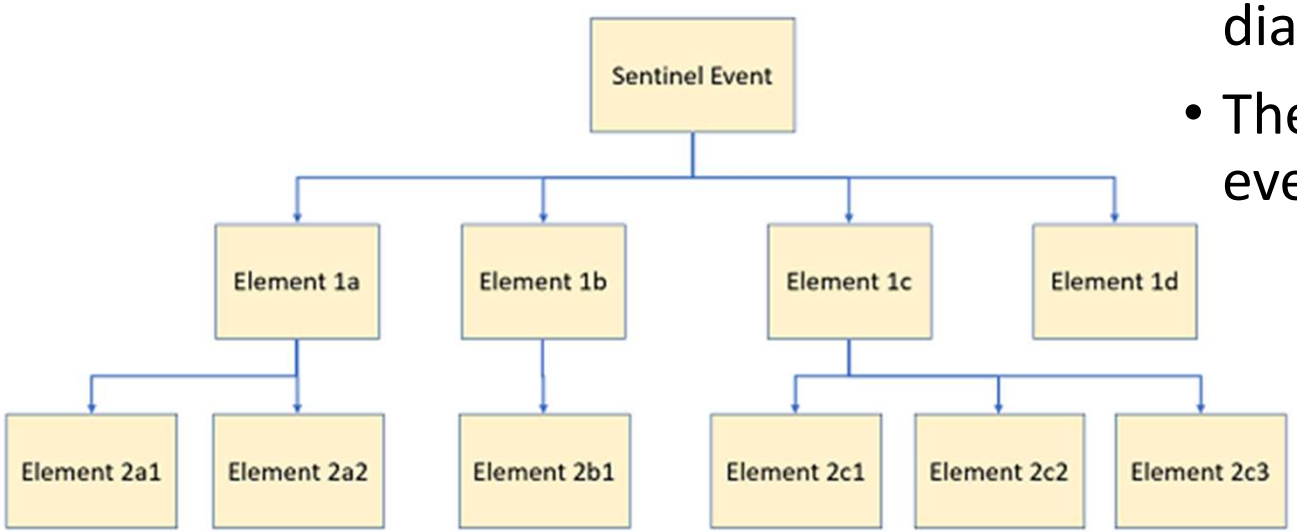
- A fault tree analysis (FTA) is a systematic and deductive approach to analyze the causes of a specific event or failure. It is commonly used in engineering, safety, and risk management fields.
- Structure: A fault tree analysis diagram represents the logical relationships between events and conditions that lead to a specific undesired event or failure. It uses a tree-like structure with a top or sentinel event at the root and various contributing events and conditions as branches.
- Purpose: The purpose of a fault tree analysis is to identify the combinations of events and conditions that can lead to the top event or failure. It helps to understand the probability and criticality of different failure scenarios and supports risk assessment and mitigation strategies.
- Analytical Approach: Fault tree analysis involves a systematic analysis of events and conditions using logical gates (AND, OR, NOT) to represent the relationships between them. It requires a detailed understanding of the system, its components, and their interactions.

Fault Tree Analysis Symbols



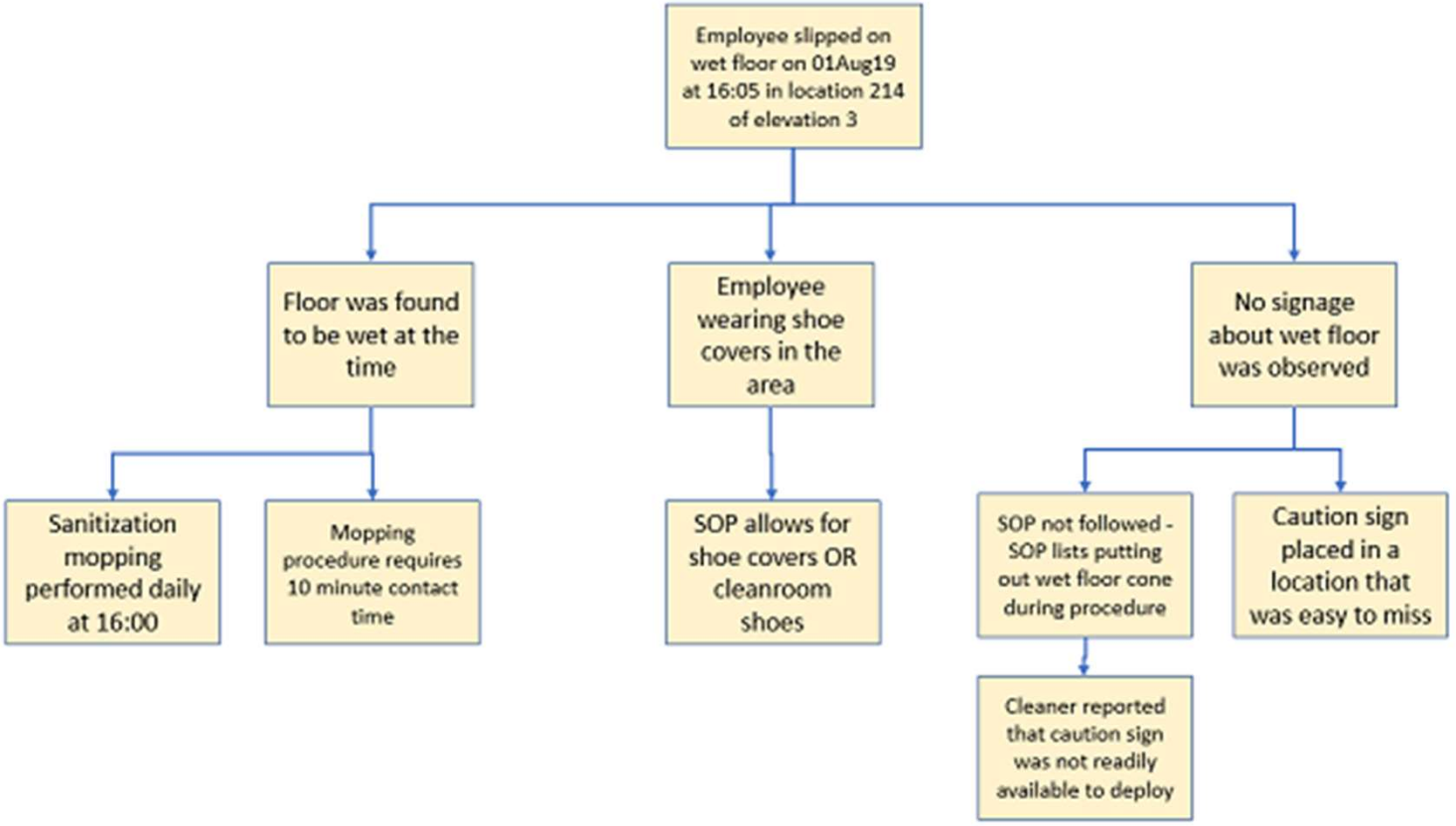
- You'll likely see Symbols like those to the left associated with FTA
- They aren't necessary
- A Fault Tree Analysis can be conducted using Post-It notes on a wall or whiteboard

FTA Procedure

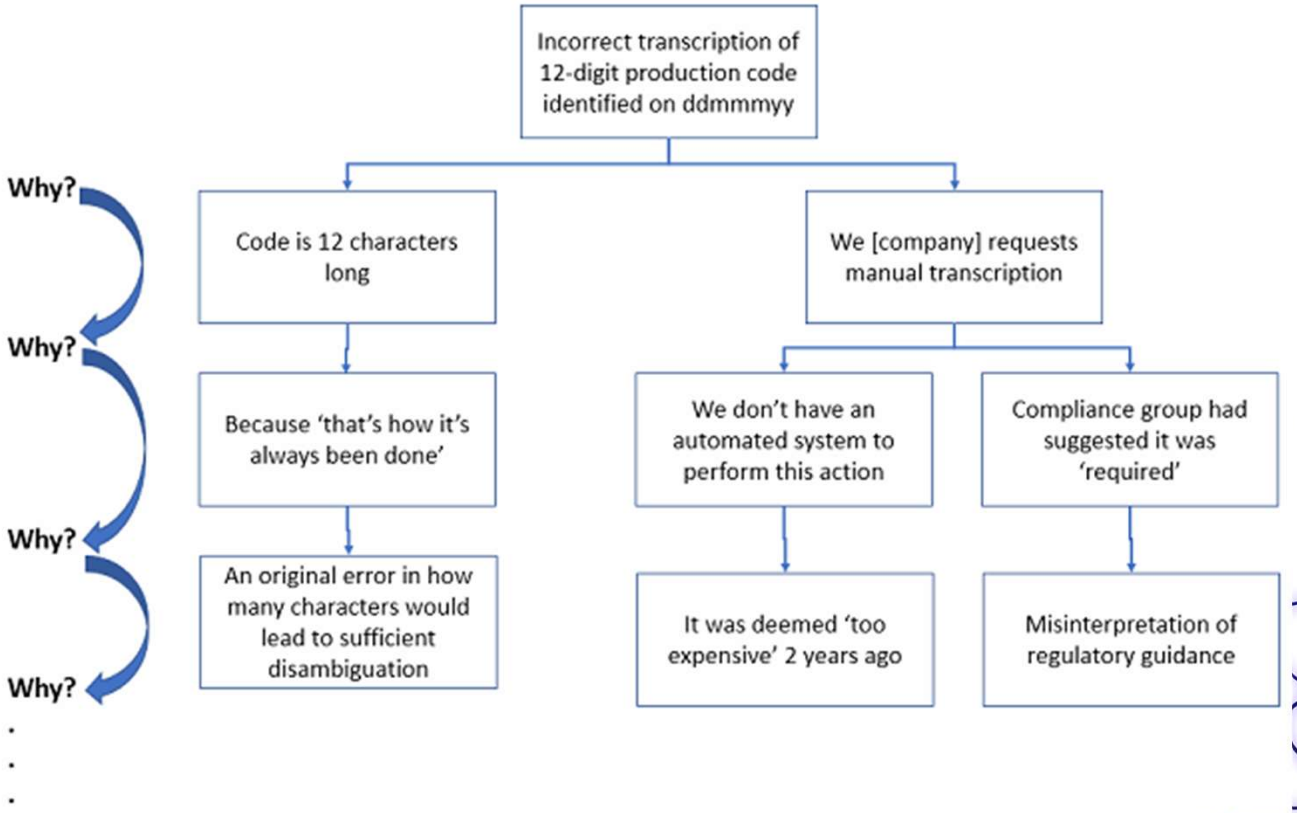


- A problem is called the top or sentinel event on the fault tree diagram, it is listed at the top
- The next row is why or how the event occurred

Example FTA


Employee slipped on wet floor on 01Aug19 at 16:05 in location 214 of elevation 3
Floor was found to be wet at the time
Employee wearing shoe covers in the area
No signage about wet floor was observed
Sanitization mopping performed daily at 16:00
Mopping procedure requires 10 minute contact time
SOP allows for shoe covers OR cleanroom shoes
SOP not followed - SOP lists putting out wet floor cone during procedure
Caution sign placed in a location that was easy to miss
Cleaner reported that caution sign was not readily available to deploy

FTA Vs 5 Why



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Fault Tree Case Study

- FTA is crucial in the automotive industry as it enables automobile manufacturers to assess the risk of probable life-threatening events and look for ways to eradicate them.
- Let us consider some popular features of vehicles:
  - Traction control;
  - Rearview camera;
  - Lane warning systems.
- Each of the features mentioned above can enhance the safety of the vehicle owner and improve the driving experience. Nevertheless, various problems may arise with any of the functions. Some issues could result from mechanical problems, while others could arise due to road conditions, human error, etc. FTA can help companies uncover the problem of a certain automotive function and the events that contribute to failure.

Q&A

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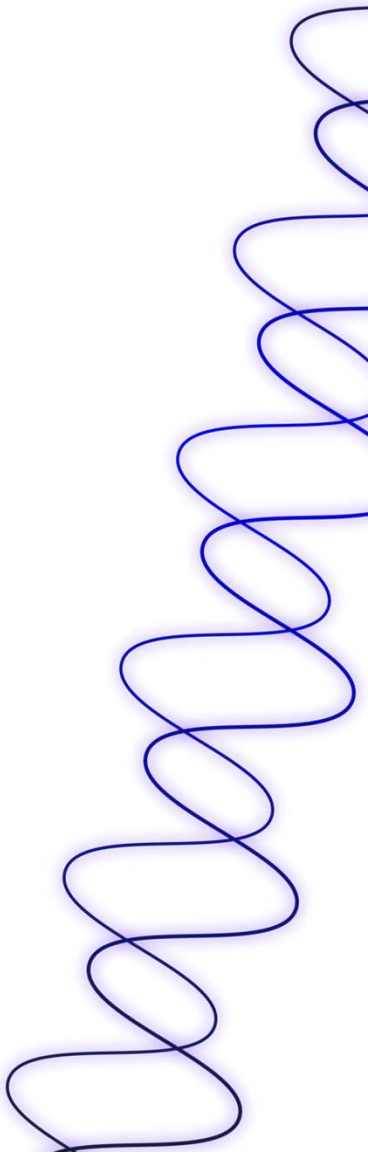
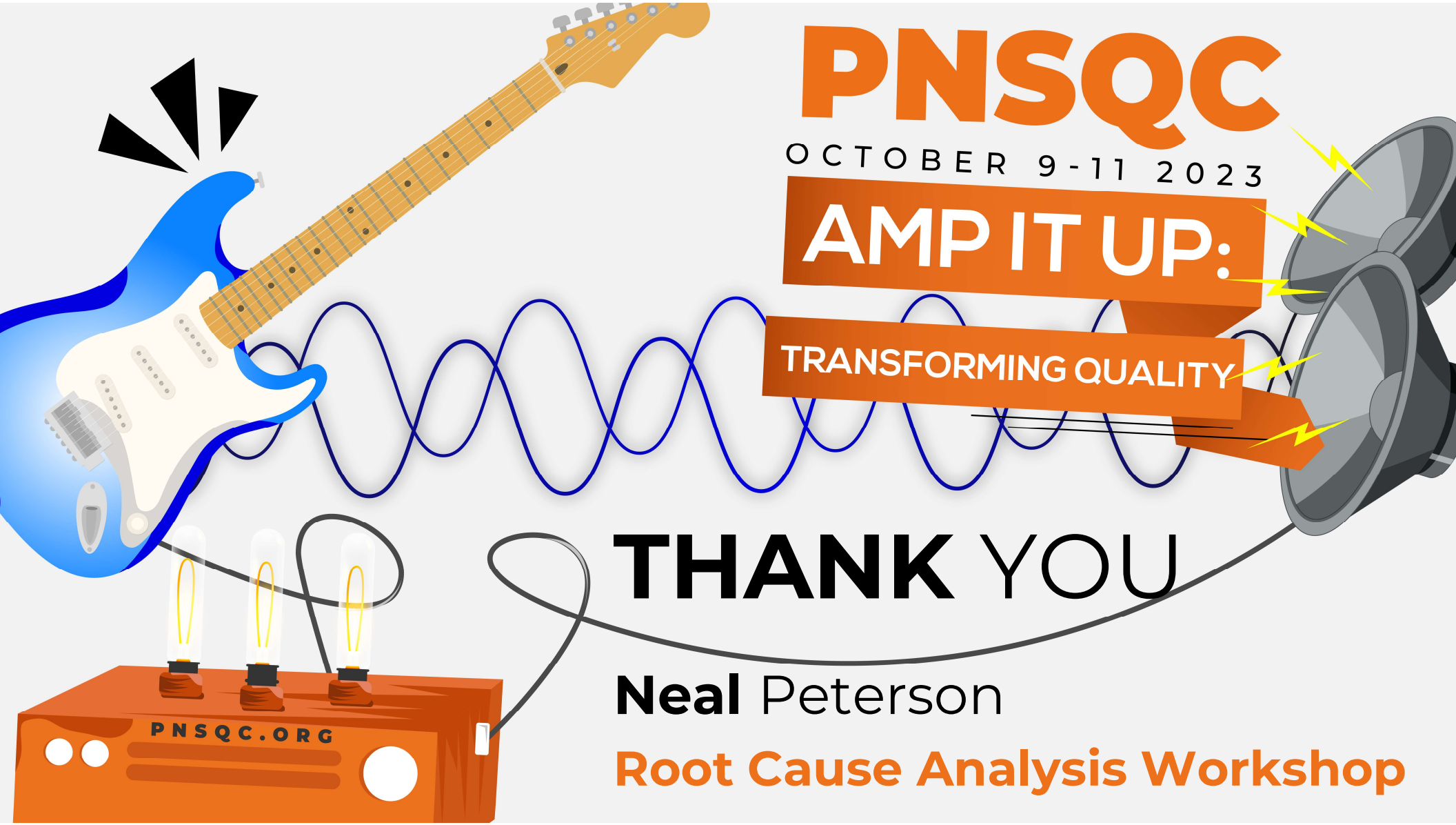


Practicing root cause analysis on a case study

- There's Oil in the River downstream from your factory
  - Letter received from the EPA in March with notice of $25,000 fine if oil is found in the river downstream from your factory in the next 30 days
  - 2nd Letter received from the EPA in April with notice of $40,000 fine if oil is found, along with invoice for $25k fine
  - 3rd Letter received from the EPA in May with notice of $60k fine if oil is found, along with invoice for $40k fine
  - 4th Letter received from the EPA in June with notice of $120k fine along with invoice for $60k fine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A few Resources to check out

- https://www.thinkreliability.com/root-cause-analysis-tools/cause-mapping-examples/
- https://www.6sigma.us/rca/all-about-fault-tree-analysis/
- https://asq.org/quality-resources/articles/case-studies/search#q=fishbone%20diagram