ThinkReliability®

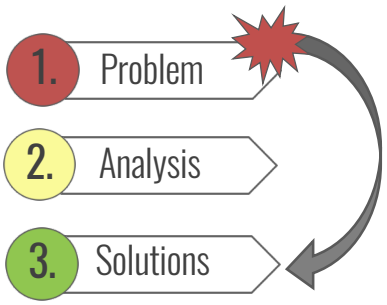
5-Why Cause Mapping® Learning Guide

Problem Solving and Troubleshooting
for Frontline Professionals

Problem-Solving Steps

There are three fundamental steps to problem solving and troubleshooting. These steps are the foundation for any problem-solving method.

1. What's the problem?
2. Why did it happen?
3. What will be done?

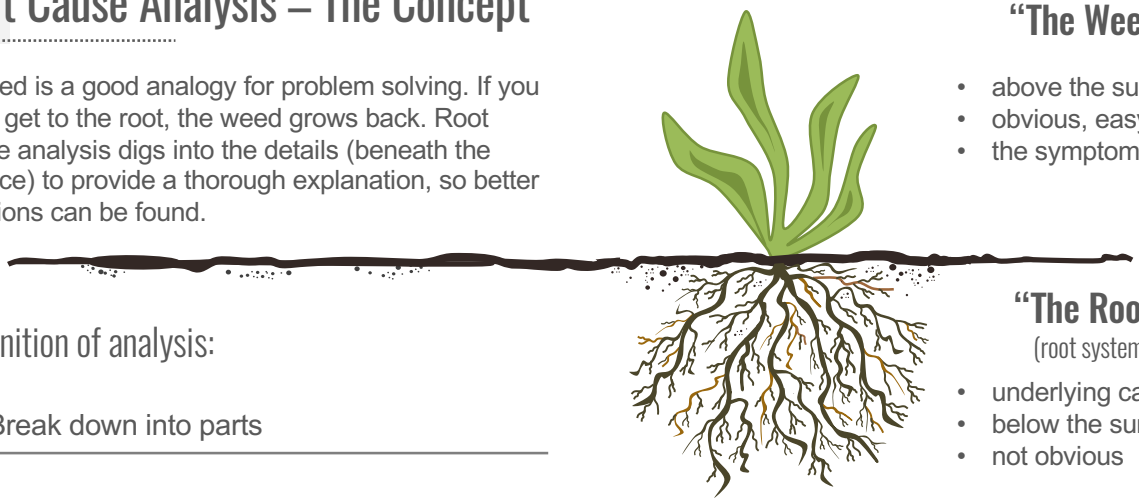


Common Error

People tend to jump straight from problem to solution, thus skipping over the analysis. A thorough analysis is critical to revealing more opportunities to prevent recurrence.

Root Cause Analysis – The Concept

A weed is a good analogy for problem solving. If you don't get to the root, the weed grows back. Root cause analysis digs into the details (beneath the surface) to provide a thorough explanation, so better solutions can be found.



"The Weed"

- above the surface
- obvious, easy to see
- the symptom

"The Root"

(root system)

- underlying causes
- below the surface
- not obvious

Definition of analysis:

Break down into parts

Problem-Solving Mental Models

Being Right vs. Being Accurate

A common error people make is applying a right-answer mentality on a system problem.

Right-Answer Approach (School)

What is 2 x 7?

What is the capital of Texas?

One question. One right answer.

Language:

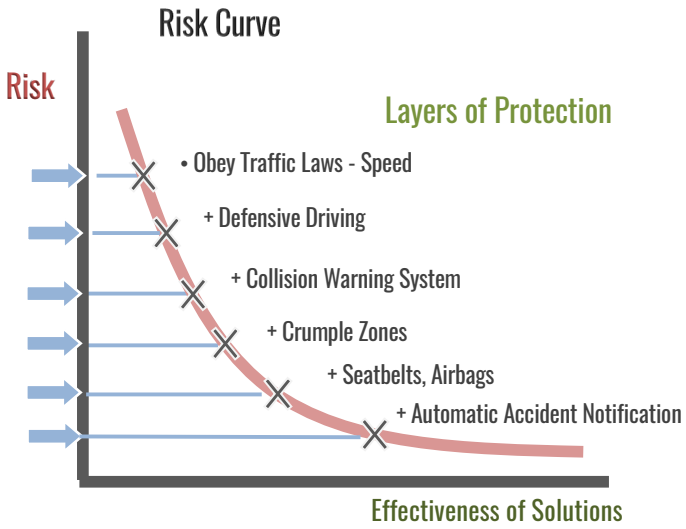
"Right or Wrong"

Systems Approach (Work)

Why did the Titanic sink?

How do you prevent automobile fatalities?

One question. Different answers.



Problem Solving = Reducing Risk

Developing a Prevention Culture

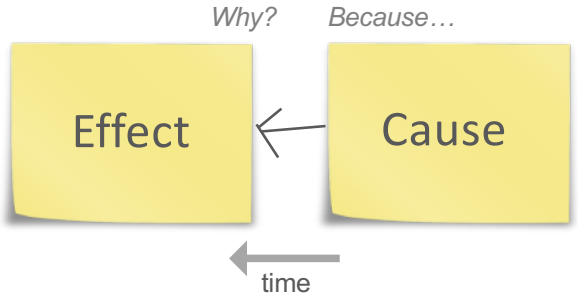
Every single step performed within a company is part of some work process. High-reliability organizations engage those on the frontline in the problem-solving process by focusing on fixes within the work process.

Blame right-answer approach	Prevention system approach
✗ Looks for "the cause" (person or group)	✓ Looks for multiple causes – system
✗ Asks, "Who did it?"	✓ Asks, "Why did it happen?"
✗ Focuses on the individual that failed	✓ Focuses on the task that broke down
✗ Utilizes top-down problem solving	✓ Problem solving close to the work
✗ Ignores the work process	✓ Manages by work process

Cause-and-Effect Basics

1-Why Logic

Cause and effect explain why a particular incident, problem or event occurred. Cause-and-effect relationships build backward through time because of Why questions. Here is the basic building block for building a Cause Map™ diagram, a visual representation of cause-and-effect relationships.



Questions for Revealing Causes

In Series

A straight line where each cause-and-effect relationship links together.

Why? Why did this happen?

This question builds to the right. Why questions add more causes to the right of the map in a linear fashion. This is the easiest way to start and serves as the foundation for capturing cause-and-effect relationships.

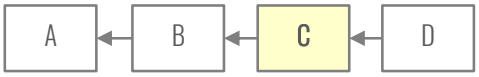
Why did *B* happen? Because of *D.*

How? How did this cause produce the effect?

This question builds in-between. How questions can be used to drive a more specific discussion around the causes. This question allows you to reveal more detail in between an existing cause-and-effect relationship.

How did D cause B?

Well, D resulted in C, which then caused B.



In Parallel

More than one cause for the same effect (splits).

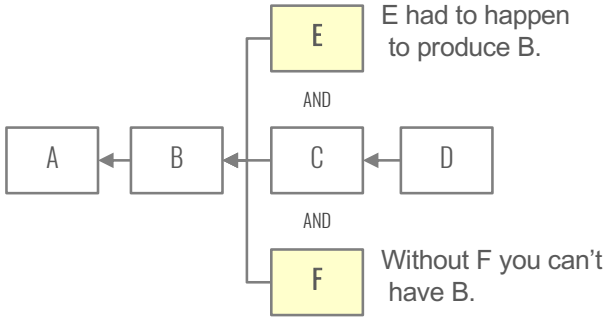
Required? What was required to produce the effect?

This question builds in parallel. More than one cause for the same effect (splits). A thorough cause-and-effect relationship identifies what is necessary and sufficient.

Variations of the same question:

- What was necessary?
- What had to happen?
- What was needed?
- What was essential?
- What must have occurred?

What else is **required** to produce B?



ThinkReliability® Approach

Problems reveal where work processes need to change.

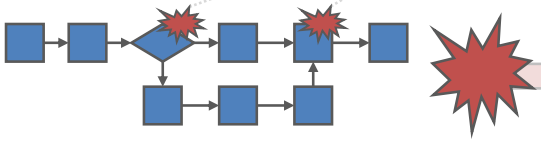
To prevent recurrence, solutions change the way work process is performed.

Process

Task, Job

A problem investigation pinpoints specific breakdowns within your work process.

Failure, Error, Defect, Complaint, Injury, Outage, Release



The work process defines how the organization would like to conduct its business every day.

Problem

Cause Mapping® Method of Root Cause Analysis

1. Problem

What's the problem?

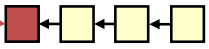
- What?
- When?
- Where?
- Impact to the GOALS?

A problem is any negative deviation from the ideal state of the organization (the goals).

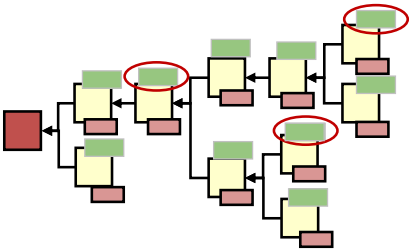
2. Analysis

Why did it happen?

Why?



Start simple.



The cause-and-effect analysis begins by asking why the overall goals were negatively affected. It starts as a simple, single path then expands into as much detail as needed to thoroughly explain the issue. Evidence validates causes.

3. Solutions

What will be done?

- Find possible solutions
- Select the best solutions
- Create an action plan (implementation)

No.	Solution	Cause	Work Process	Owner	Date Due
1					
2					
3					

The best solutions (one or more) are selected from the possible solutions that were proposed to control individual causes.

Step 1. Define the Problem

The problem outline takes the place of the problem description. It works like an information checklist for the investigation instead of a long description. This simple format quantifies how every issue affects each of the organization's overall goals.

WHAT Is the Problem?

Different answers here are normal and expected. If there are multiple different explanations of the problem, write each one down, separated by a comma and move on. This question should only take 30 seconds or less.

When people give you their perspective on the problem, they are providing one of the causes for the analysis. The best response when someone has a problem is, "Got it." Then, add all responses to the "Problem" line. They are all causes, so capturing these on the *Cause Map* diagram allows you to manage the dialogue and details more effectively.

WHEN Did It Happen?

This section captures information related to the timing of the incident, including the date, time and anything that may have been different or unique about this issue.

Problem Outline

What	Problem(s)	
When	Date	
	Time	
	Different, unusual, unique	
Where	Facility, site	
	Unit, area, equipment	
	Task being performed	

Impact to the GOALS

Safety	
Environment	
Customer Service	
Regulatory	
Production, Schedule	
Property, Equipment	
Labor, Time	

WHERE Did It Happen?

This section captures the specifics of where the incident occurred geographically as well as the step in the work process (or task) within a given incident.

Impact to the Goals

Specific impacts and losses for groups may be captured within each goal, but the overall goals are the same for the entire organization. This ensures a consistent approach across different departments or groups.

Be Specific and Quantify (if possible)

The question for each goal is "What was the negative impact to this goal?" Quantify the impact next to that goal (be specific). If there is no impact or potential impact (risk or near miss), then write "none" in the space.

DID, COULD HAVE (near miss)

The impact to the goals section captures what DID happen and what COULD HAVE happened. What *did* happen has a specific impact to one or more of the organization's goals. The *could have* question captures what almost happened but did not (also called a near miss).

Frequency

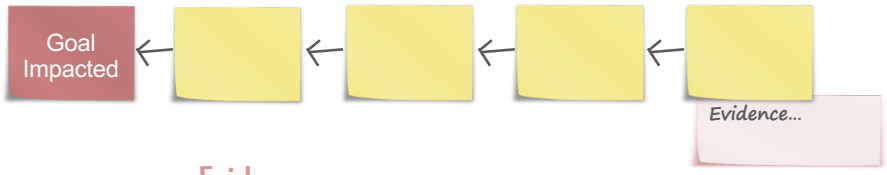
Frequency asks, "How often has this issue occurred and/or how likely is it to occur?" Frequency is a multiplier that normalizes the magnitude of an issue on an annualized basis. It helps determine the total cost of a problem. When you capture and quantify the impact to the goals and then multiply by the frequency, you represent the total cost of the problem for the organization.

Step 2. Conduct the Analysis

Write one of the impacted goals in the red box and begin asking Why questions. The 5-Why mentality provides a baseline and must be accurate (validated with evidence). However, the initial 5-Why is not complete (partial explanation). Additional causal paths added will reveal more solutions.

Impacted Goals

The analysis starts with a goal that was negatively affected. Remember, people will often debate the problem, rarely do people argue if a goal is impacted.

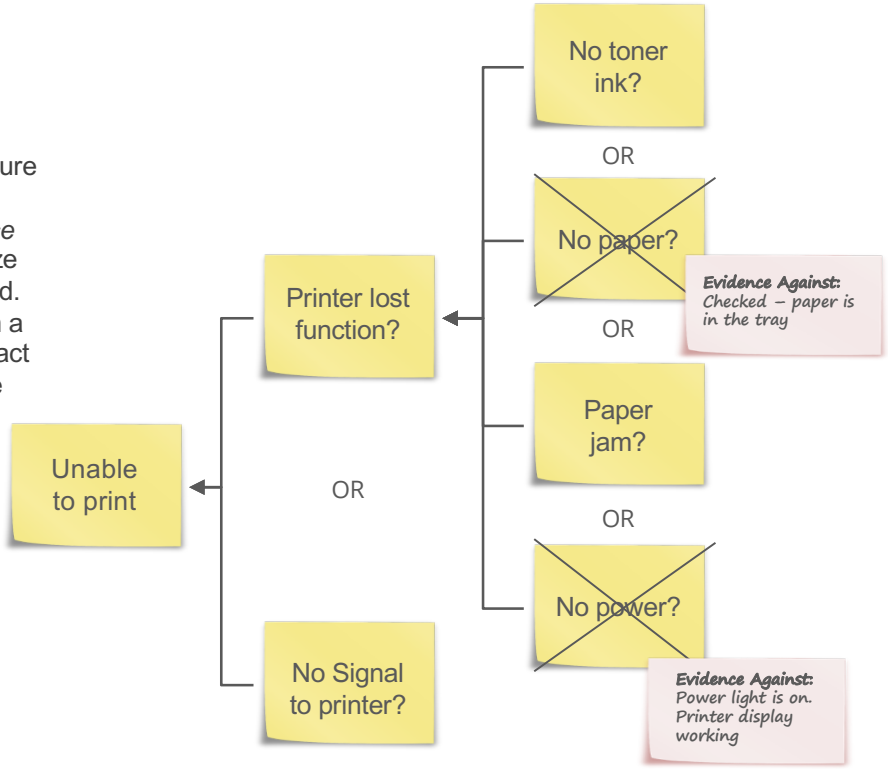


Evidence

Causes are supported with evidence and placed beneath the cause box.

Troubleshooting

Missing evidence means we aren't sure that the cause occurred. When troubleshooting a problem, the *Cause Map* diagram can be used to organize possible causes as they are identified. Possible causes are designated with a question mark. The question marks act as action items showing where more information is needed.



Timeline

A timeline, also known as a sequence of events, defines the chronological order of occurrences for a given issue. While simple to capture, it can be helpful tool to organize detail when discussing when something happened versus why.

The simplest way to create a timeline is in a table format with the headers: date, time and description. Each entry on a timeline corresponds to a specific date and time. The descriptions are easier to read if they are captured as ort phrases instead of long sentences.

Date / Time	Description

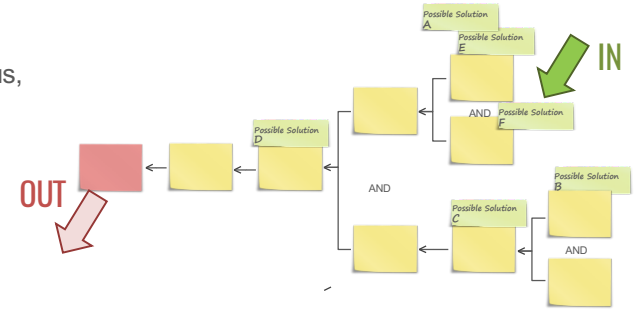
Step 3. Solutions

There are three basic parts to the solutions step in the *Cause Mapping* method.

- Consider what is possible
- Evaluate and select the best solutions
- Define the action plan

Brainstorm Possible Solutions

Consider what's possible. Some solutions may seem obvious, but don't overlook other areas of the analysis. Excellent solutions may initially seem unusual.



Tips for revealing creative solutions:

- Involve the people closest to the work.
- Look at the causes one-by-one and ask if there are any ways to control, change, eliminate or prevent it.
- Write down solutions that seem obvious.
- When proposing possible solutions, worry about limits, boundaries, schedules or financial constraints.
- Don't evaluate possible solutions as they are proposed.

Evaluate and Select the Best Solutions

Once possible solutions have been proposed, the next step is to evaluate and select the best solutions for implementation.

Effort In

The effort and cost to implement the solution.

- The cost to design the solution
- The cost to implement the solution
- The resources required
- The timing or window of opportunity

Results Out

The expected benefit for a particular solution.

- The reduction of risk to overall goals
- The potential of unintended consequences or side effects

Define Action Plan

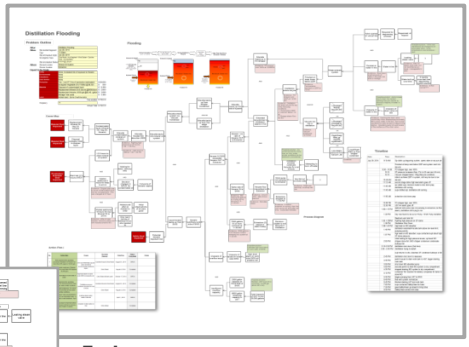
Once the best solutions have been selected, they must be documented in an action plan to ensure a coordinated and effective implementation.

No.	Solution	Cause	Owner(s)	Date Due
1				
2				
3				

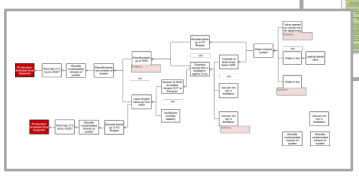
Consistent Approach to Problems

Regardless of the magnitude or type of the problem, every investigation and *Cause Map* diagram begins with a 5-Why.

The severity of a problem dictates the degree of explanation needed. Within the *Cause Mapping* method, severity is captured based on the impact to the goals. For high impact problems, a more detailed analysis will reveal a larger solution set across multiple work processes. More solution options provides a greater opportunity for risk reduction.



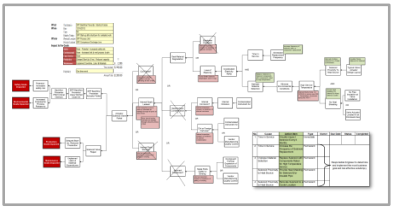
End



Middle

HIGH
Critical / Catastrophic Event
Serious Injury, Major Outage, Significant Loss

Start

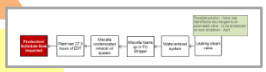


End

MEDIUM
Serious Event
Minor Injury, Outage

Start

LOW
Minor Event
Process Deviation, Minor Error

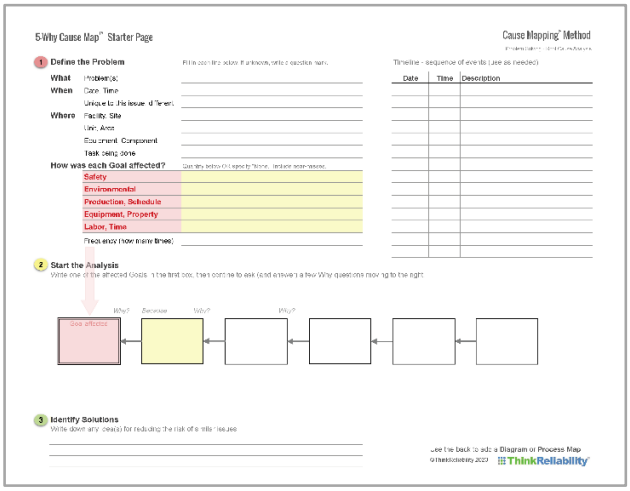


Start / End

5-Why Cause Map™ Starter Page

This one-page investigation sheet is a simple way to immediately begin collecting and organizing information in an investigation. The boxes on the *Cause Map* diagram are already laid out linearly, but additional causes and evidence can be added as it becomes available.

This can be used as an investigation checklist to get someone started. As the investigation progresses into a larger effort, the information can then be transferred to a *Cause Mapping* workbook in Microsoft Excel.



5-Why Cause Map™ Starter Page

Cause Mapping® Method

1 Define the Problem

What (Problem(s))
When Date, Time
Unique to / Pervasive of Time?
Where Facility, Site
Unit, Area
Equipment, Component
Task being done
How was each Goal affected?
Safety
Environmental
Production, Schedule
Equipment, Property
Labor, Time
Repeating? (how many times)

Timeline - sequence of events (use as needed)

Date	Time	Description

2 Start the Analysis

Goal affected | Why? | Because | Why? | Why?

3 Identify Solutions

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5-Why Takeaways

These are five benefits of establishing a 5-Why baseline within your organization

Simple — It's easy to begin with 3- to 5-Why questions

Accurate — Even though the analysis starts simple, it is accurate, and it remains accurate as the analysis becomes more detailed.

Quick — With basic information, a 3 to 5-Why can be laid out in less than a minute.

Engaging — When people with knowledge of a particular issue see a simple 3- to 5-Why they can easily pinpoint what is missing from that analysis. They will make the analysis more thorough by identifying what is deficient.

Preventive — Large incidents foreshadow their arrival hours, days and sometimes even years ahead of time. But these forewarnings, which are contained in smaller problems, are often overlooked. A simple 5-Why analysis on a small problem provides a lesson that can be used to prevent large problems.

Multiple 5-Whys come together to produce a catastrophic incident.

5-Why DOs and DON'Ts

DOs	DON'Ts
- DO ask 3- to 5-Why questions.	- DON'T limit the investigation to only 5 Whys.
- DO write the causes in boxes (visual).	- DON'T write complete sentences.
- DO build the analysis backwards through time.	- DON'T confuse chronology with causality.
- DO start linear, keep cause-and-effect simple.	- DON'T think there's only one causal path.
- DO know that 5-Why is a phase of the analysis.	- DON'T think the 5th Why is the "root cause."

Online Resources

thinkreliability.com — Examples, case studies, Microsoft Excel tips, webinars

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This online learning guide is for attendees of a *ThinkReliability* instructor-led workshop.