



Changing the Way The World Solves Problems

# Keep Investigating and No One Explodes: Defusing Bombs With The Right Questions!

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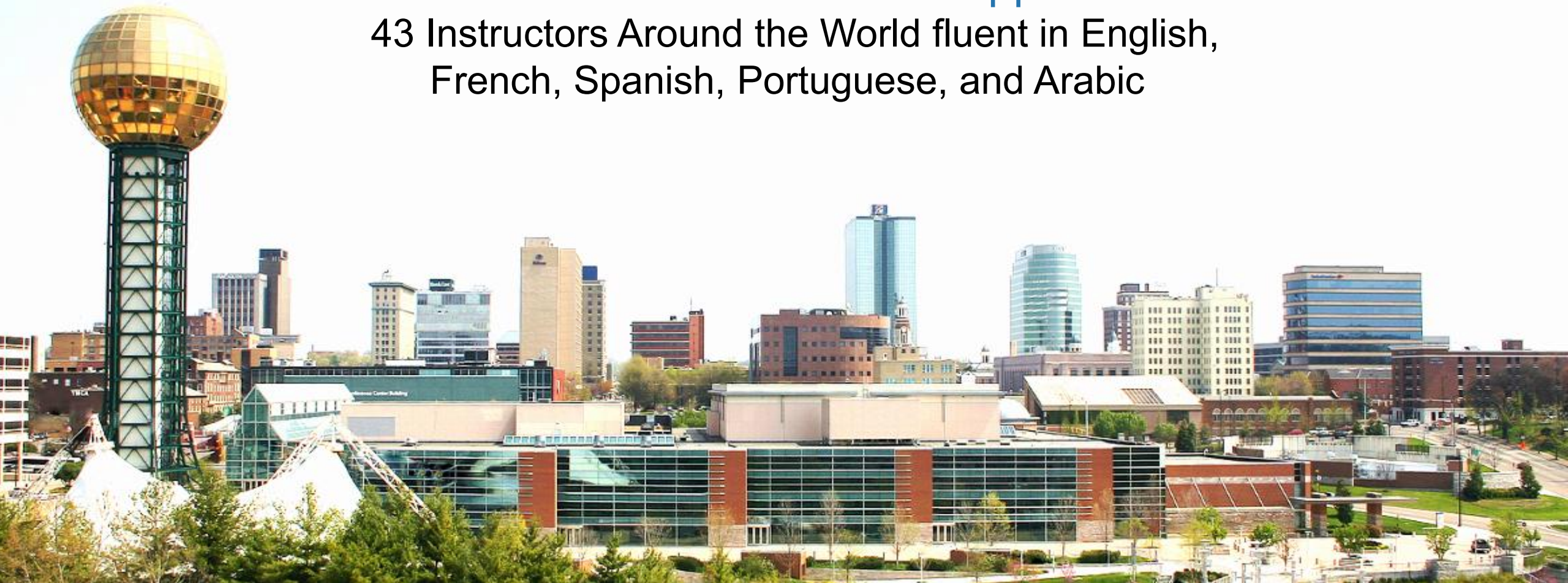
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# Corporate Offices

Knoxville, Tennessee, USA

## Instructors Provide Worldwide Support

43 Instructors Around the World fluent in English,  
French, Spanish, Portuguese, and Arabic





Our Corporate Mission Statement:

**“Changing the way the world solves problems”**

*Our underlying goal is to help leaders ensure their employees come home safe, the environment remains healthy, they produce quality products, and their businesses are successful.*

# Where Can You Use TapRoot®?

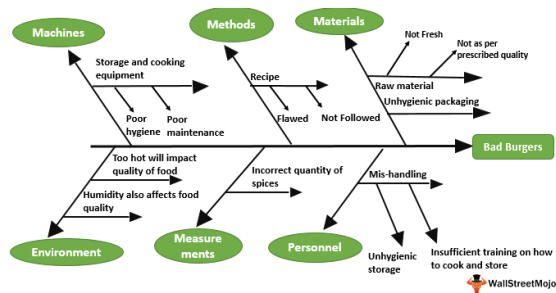
- Health & Safety
- Quality
- Environmental
- Process Safety
- Equipment
- Customer complaints
- Security



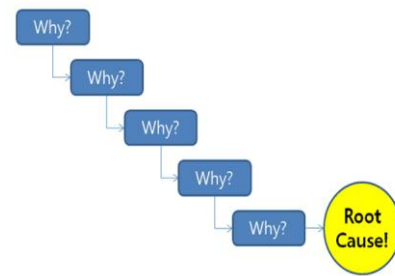
**Anytime people make mistakes**

# Problems With Bias-Based RCA Methods

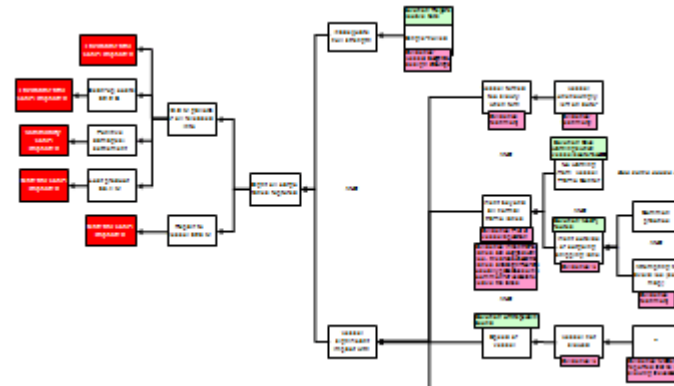
## Fishbone Diagrams



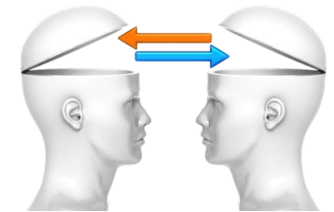
## 5-Whys



## Cause Maps



## Learning Teams



These techniques do not get you beyond what you already know

Do your investigators know what questions to ask?

## TapRoot® Root Cause Tree®

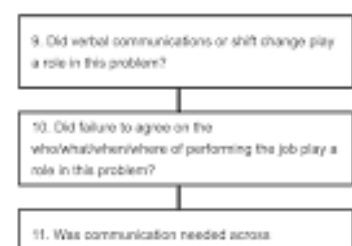
- **Expert Guided System** to Remove Investigator **Bias**
- Focus on the **Gaps in the System** instead of **Blaming** Individuals
- Stress **Facts** and **Evidence** instead of Subjectivity



### Individual Performance



### Team Performance



All items are defined in the **Root Cause Tree® Dictionary** promoting consistency from person to person

# The best a human can do...

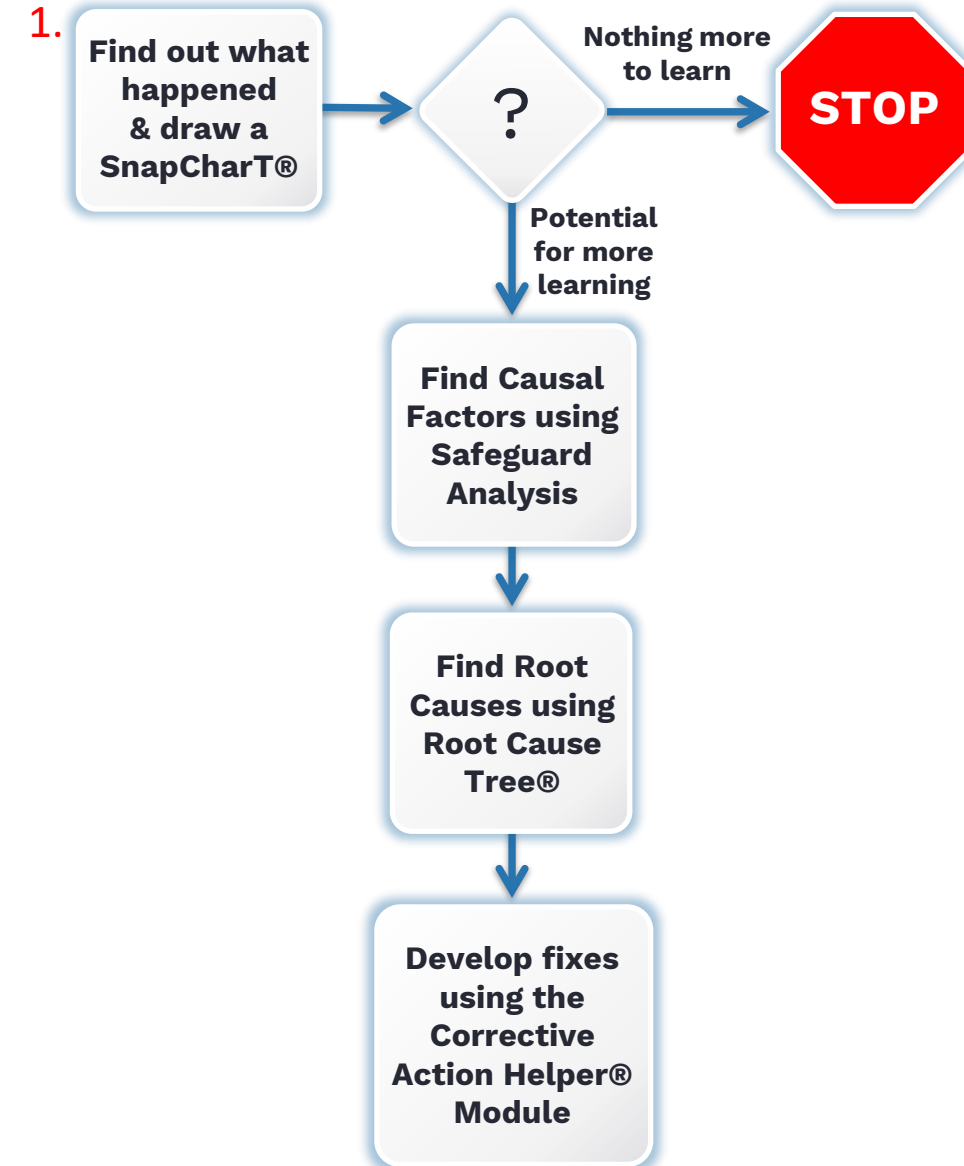
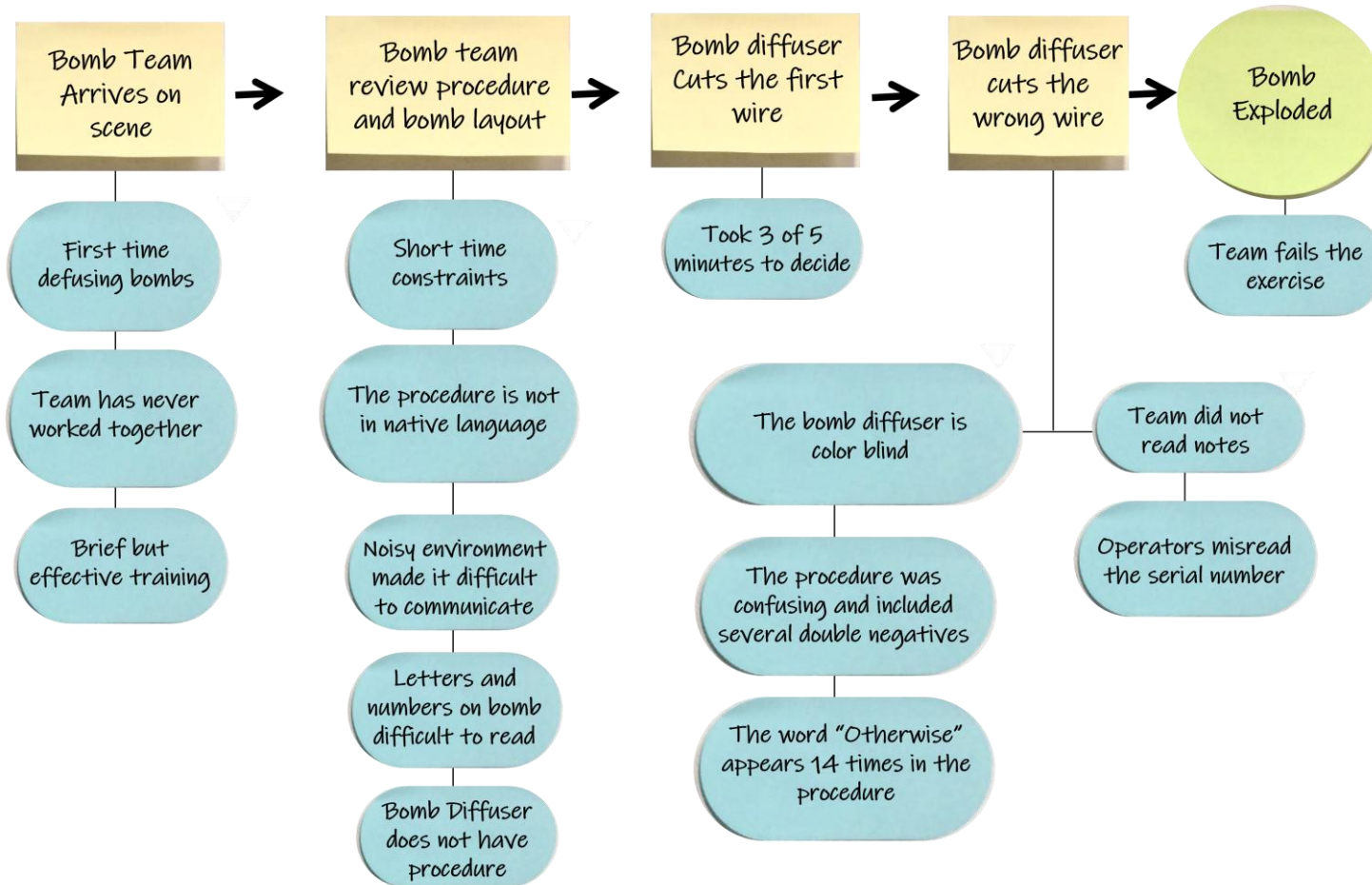


- *Average* well-trained worker:  
1 mistake every 100 to 1000 times
- Worker under *stress*:  
1 mistake every 10 to 100 times
- *Poorly trained* worker in an *emergency*:  
50/50 Chance (or less)
- *Well-trained worker/excellent systems*:  
1 mistake every 10,000 times

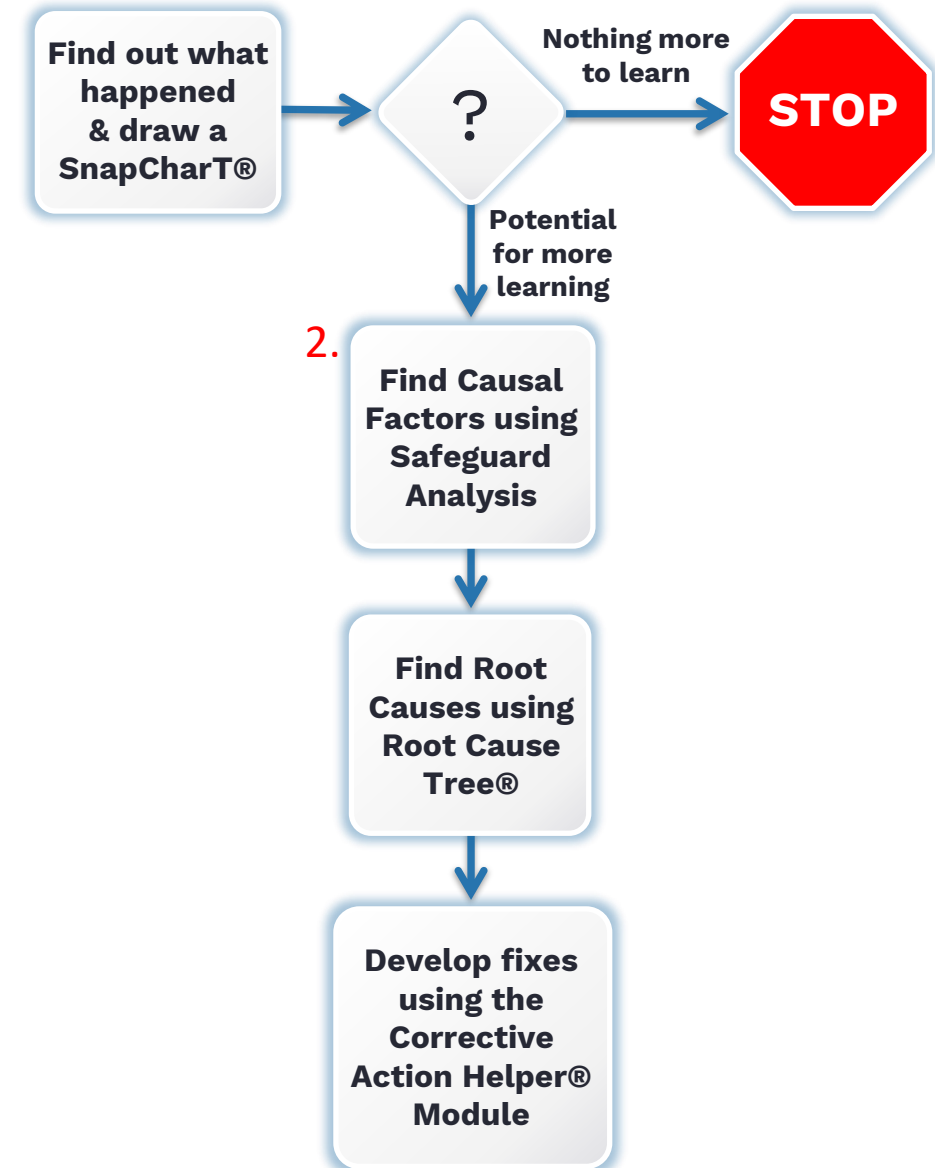
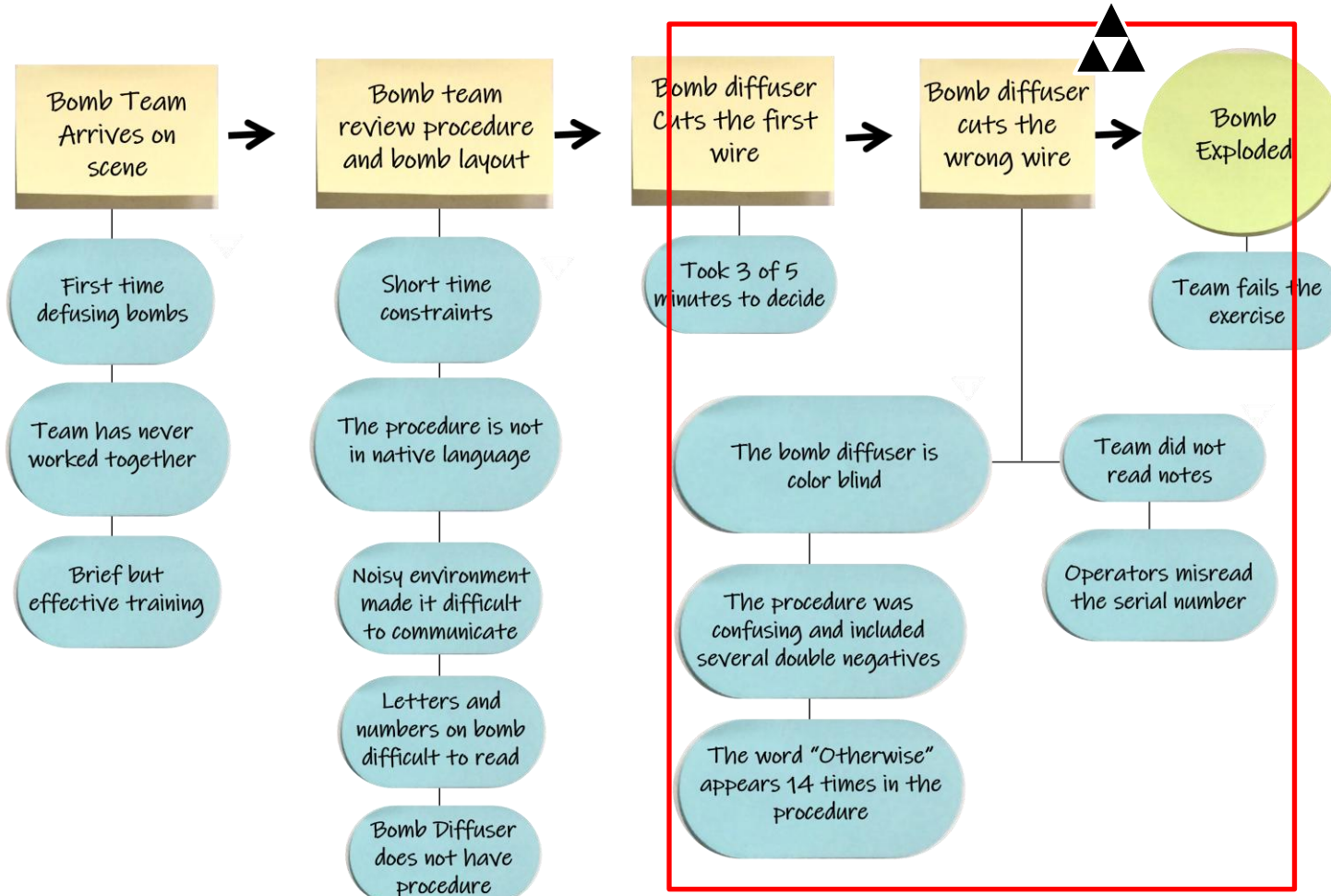
What reliability do you **need**?

What do you need to know to achieve  
excellent human performance?

# The TapRoot® Process



# The TapRoot® Process



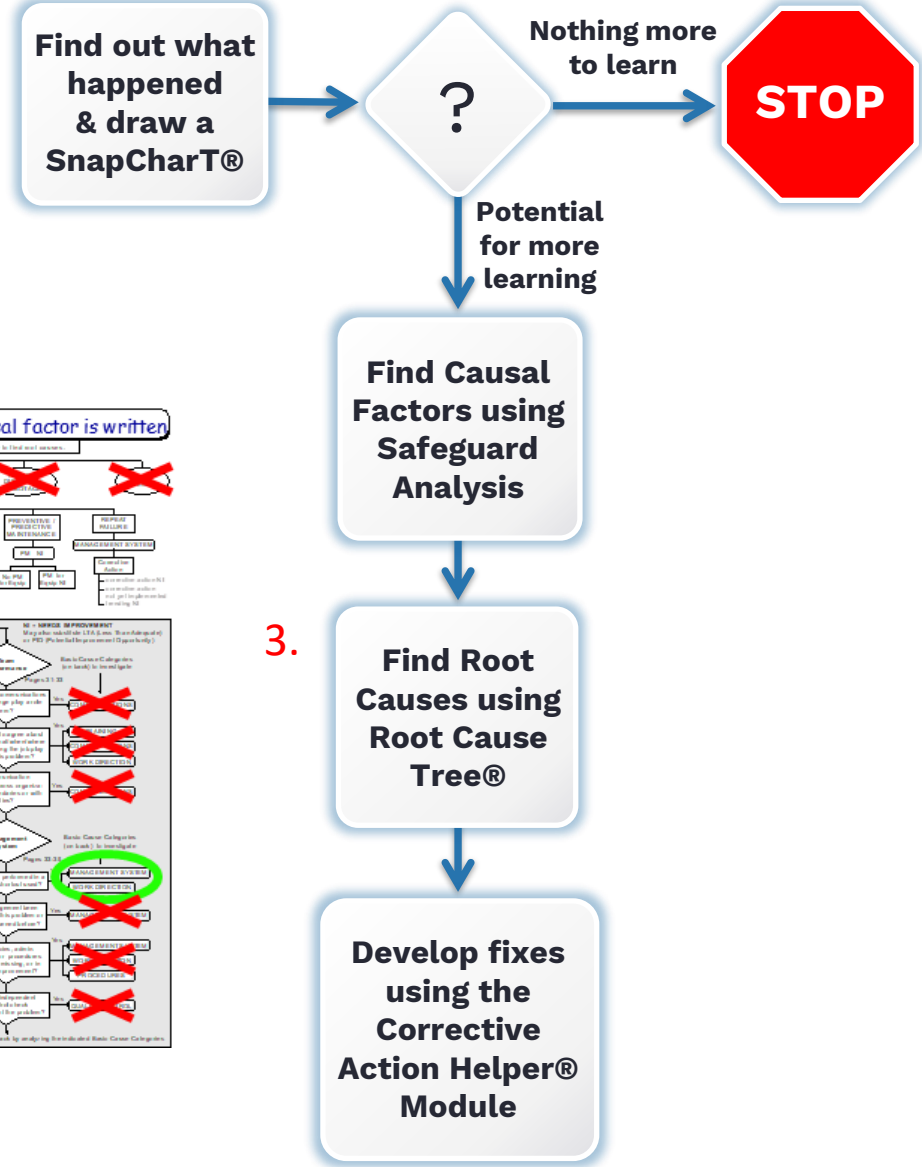
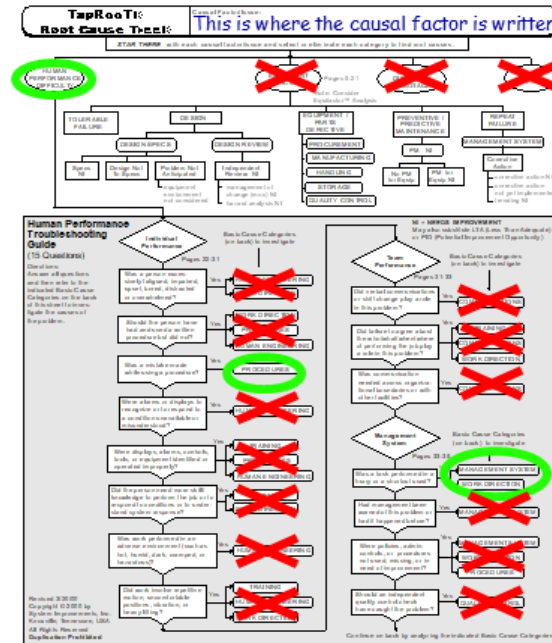
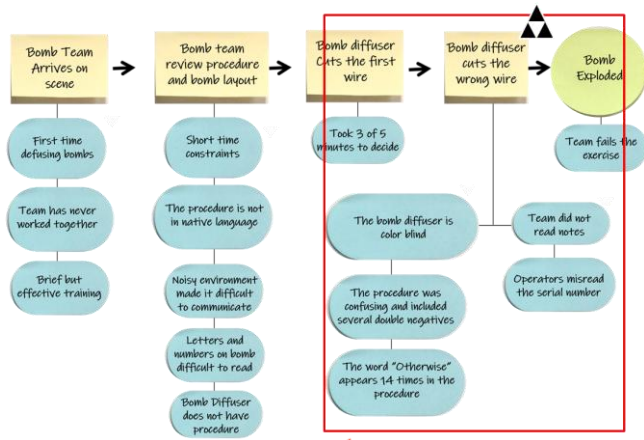
## 1. You cut the wrong wire

Circle the line where you made a mistake in the procedure

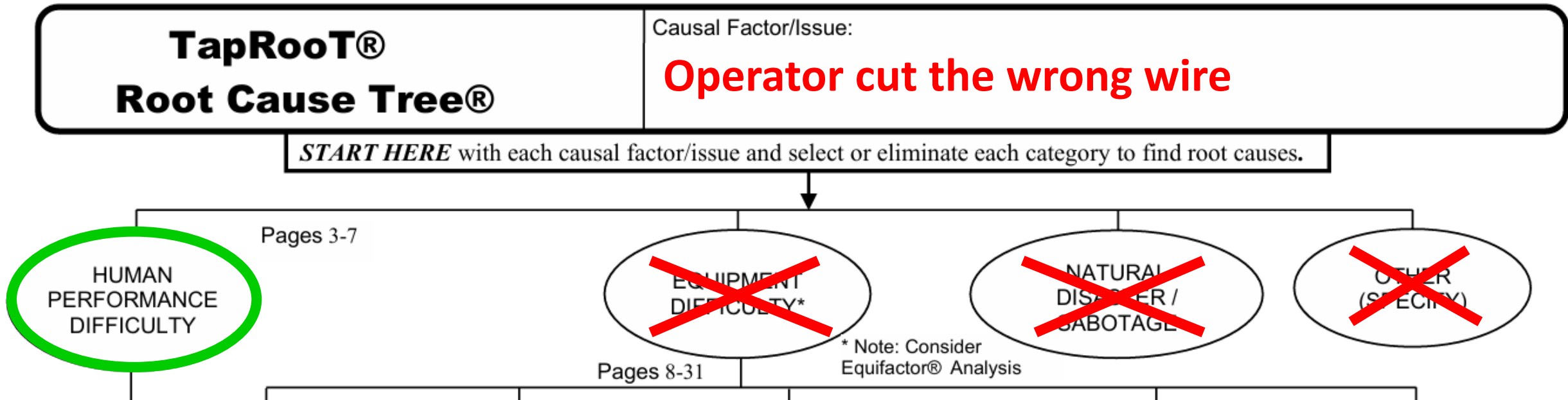
## 2. Did not cut all the wires in time

Circle the part you struggled to understand the most

# The TapRoot® Process



3.

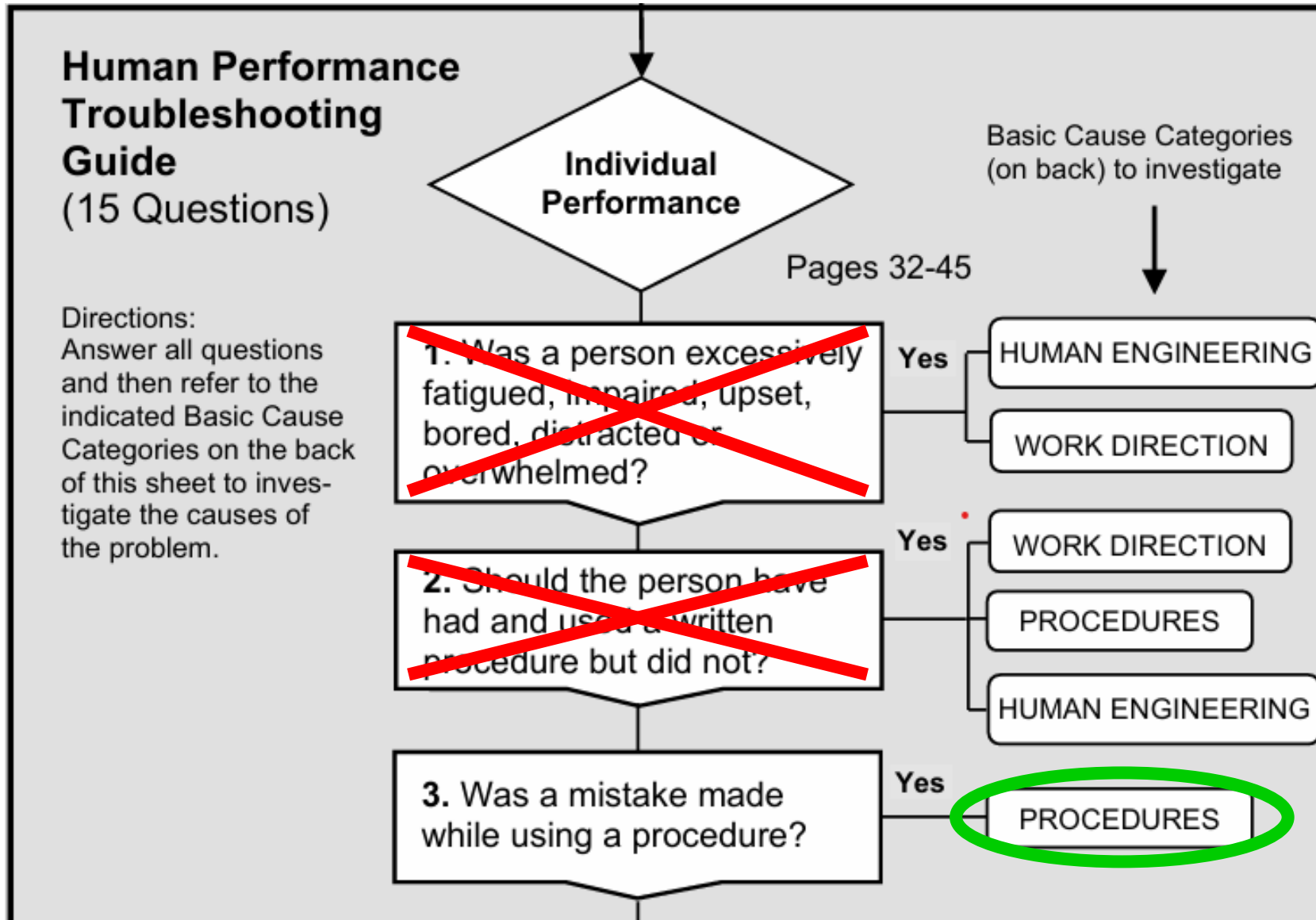


## Question #2:

**Was the issue caused by a:**

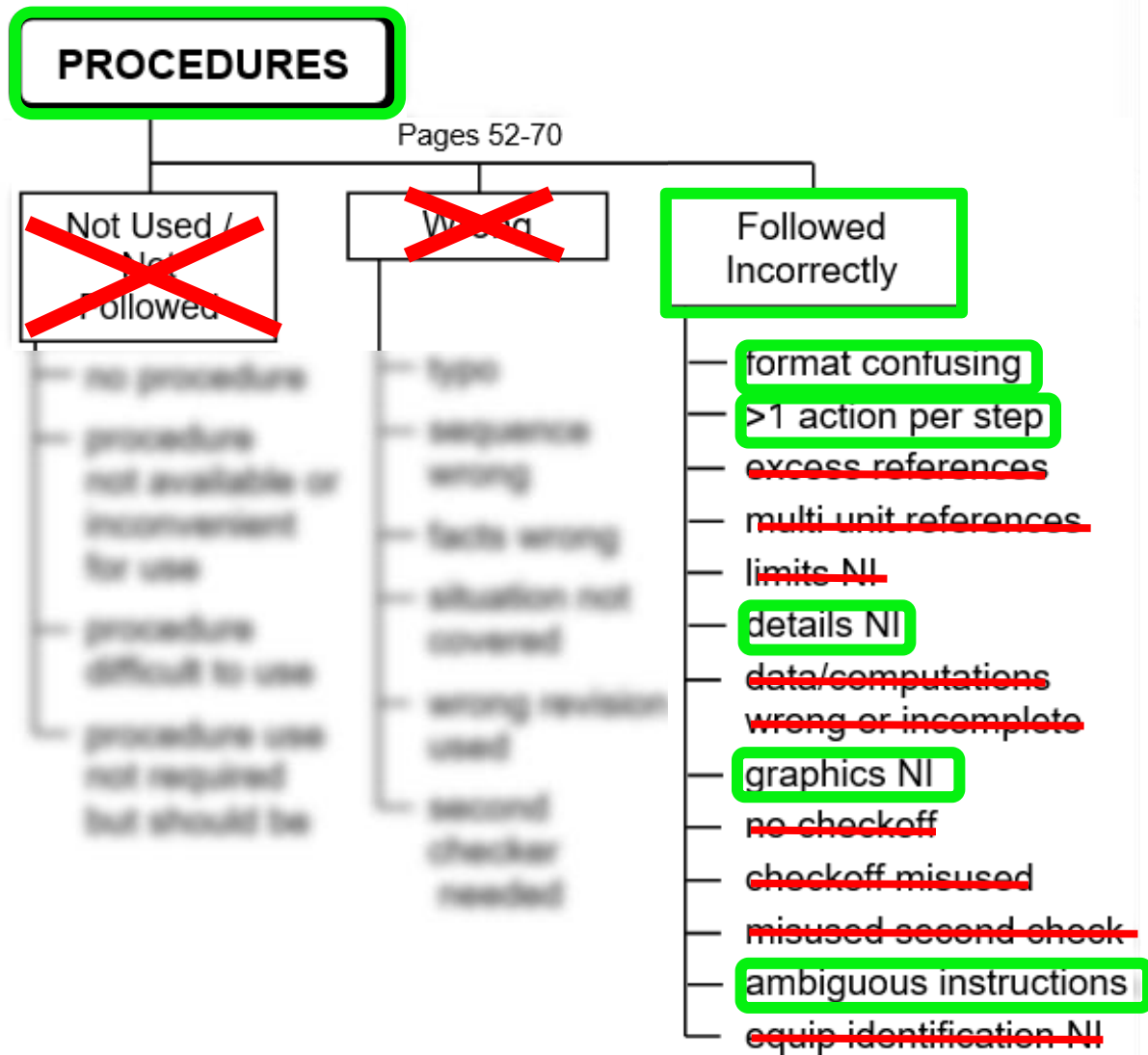
- Simple mistake;
- Human error;
- Situational awareness issues; or
- Slip, lapse, or rule violation?

**Yes or NO?**



We use 15 Human Performance Troubleshooting Questions to guide us to the relevant categories of Human Performance best practices

# Examining Procedures

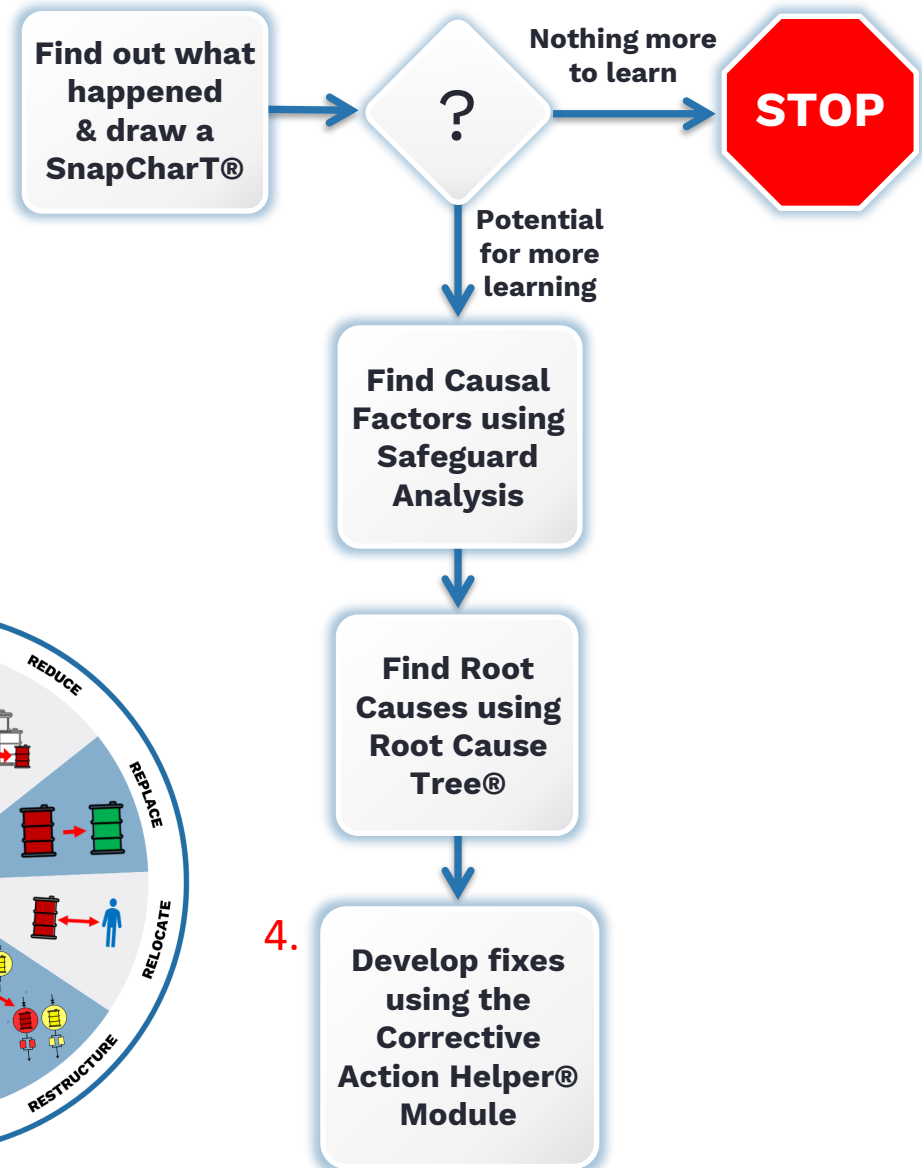
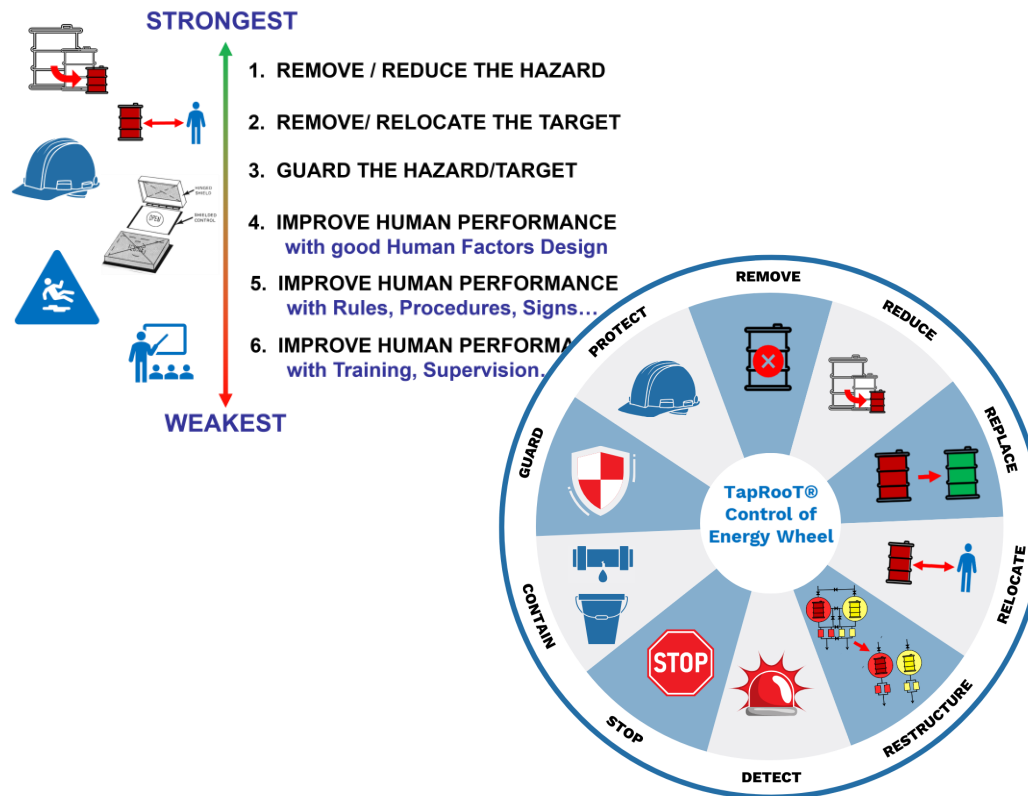
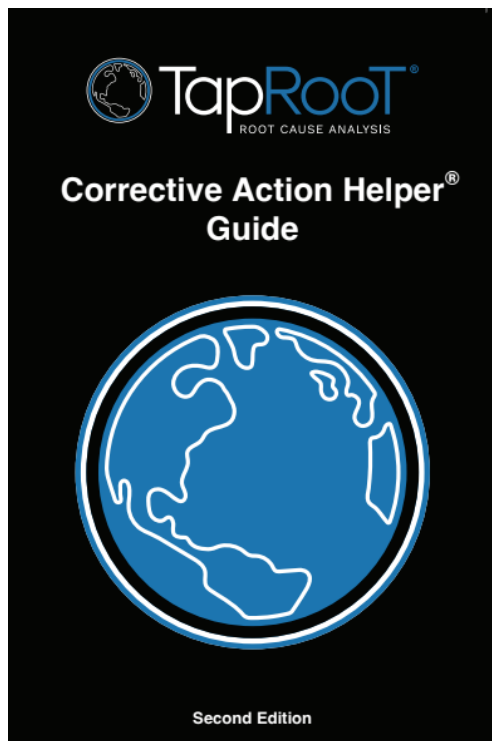


We use the evidence in the investigation to answer the questions in the TapRoot® Dictionary and document on the Root Cause Tree®

# The TapRoot® Process

Develop **SMARTER** Corrective Actions using the **Corrective Action Helper®**

Develop **STRONGER** Corrective Actions using the **The Safeguard Hierarchy & Control of Energy Wheel**



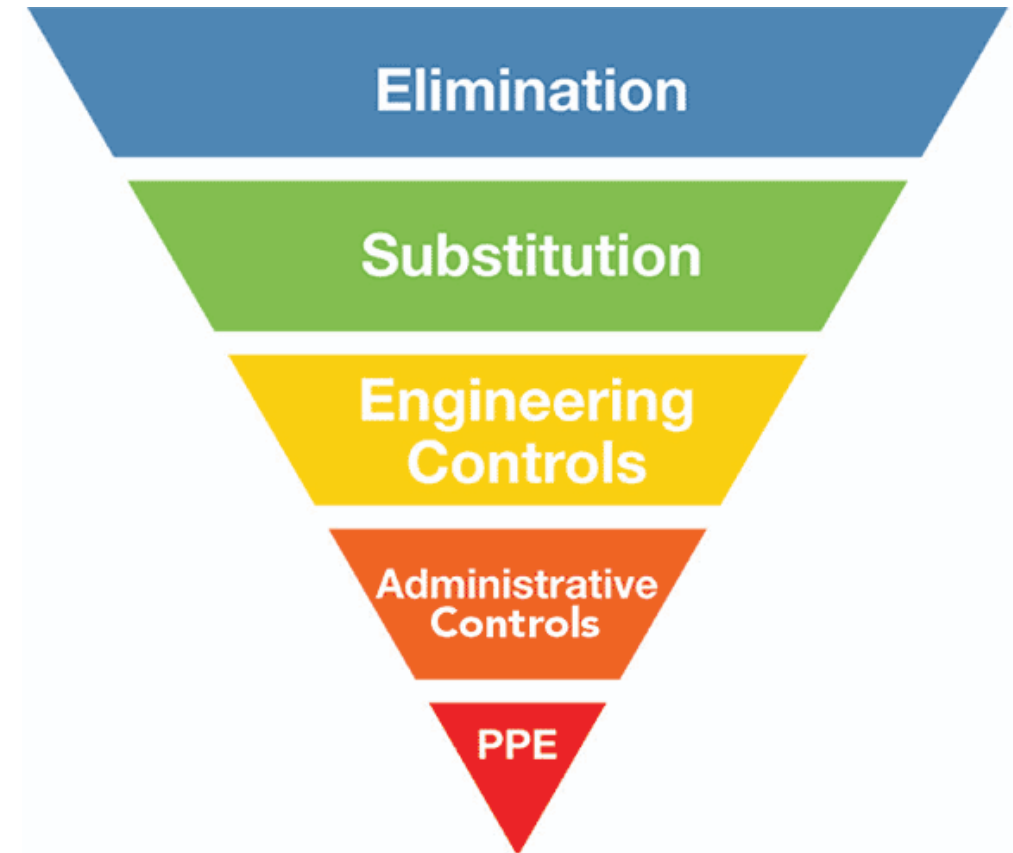
# Safeguard Effectiveness vs Controls

**STRONGEST**

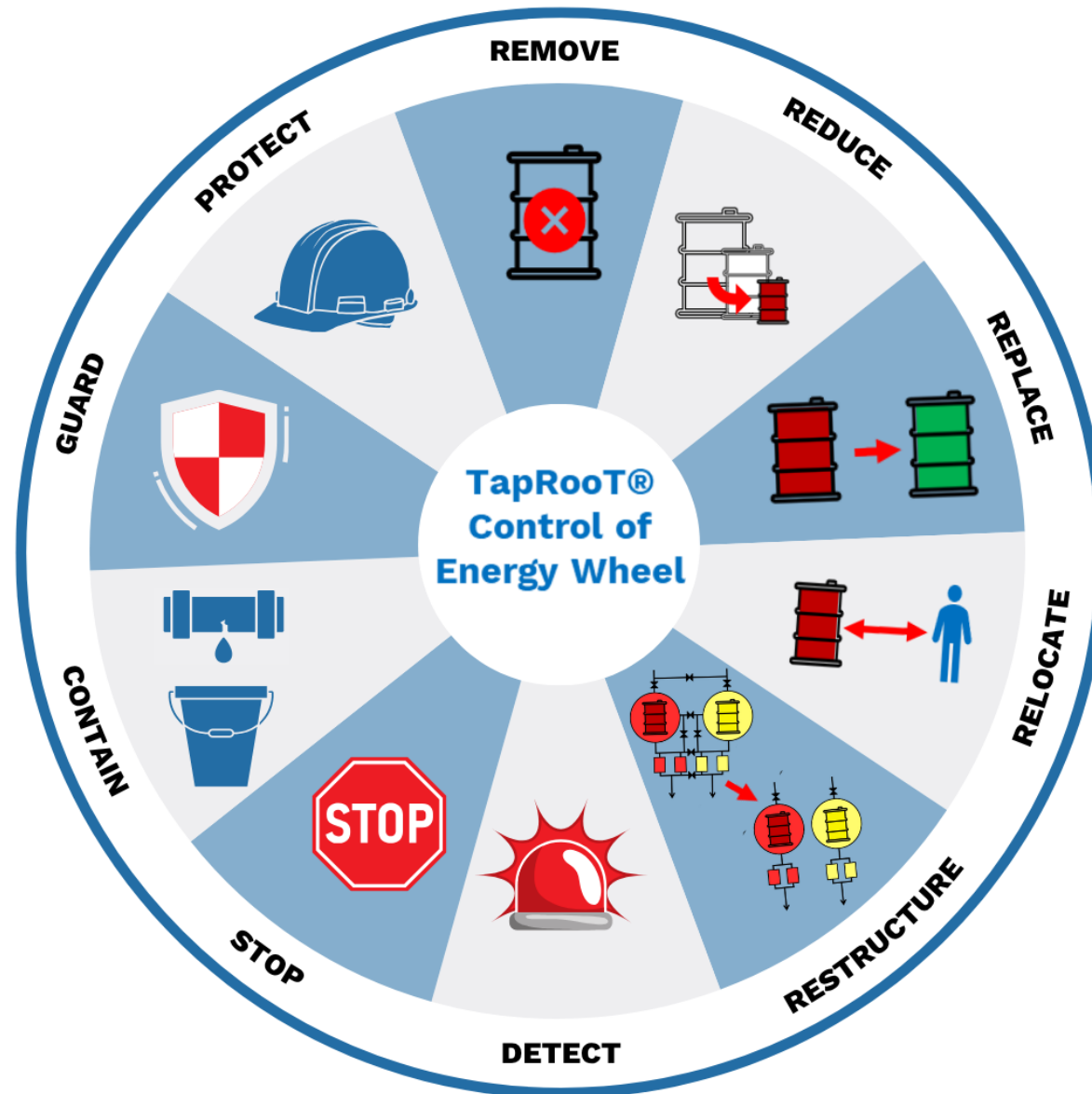
1. REMOVE / REDUCE THE HAZARD
2. REMOVE / RELOCATE THE TARGET
3. GUARD THE HAZARD / TARGET
4. IMPROVE HUMAN PERFORMANCE  
with good Human Factors Design
5. IMPROVE HUMAN PERFORMANCE  
with Rules, Procedures, Signs...
6. IMPROVE HUMAN PERFORMANCE  
with Training, Supervision...

**WEAKEST**

## Hierarchy of Controls



# Know What Controls Energy

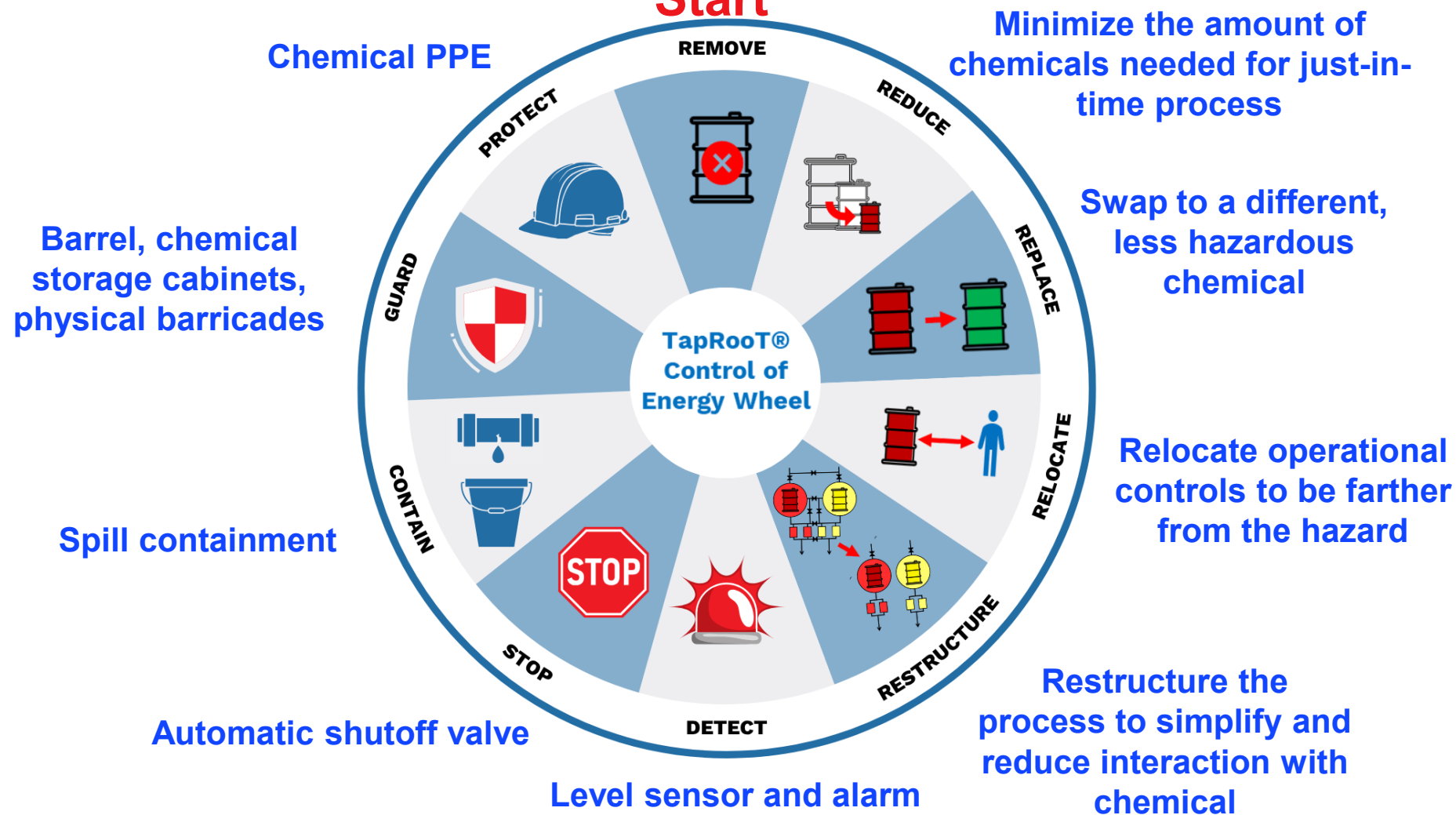


# Control of Energy Wheel

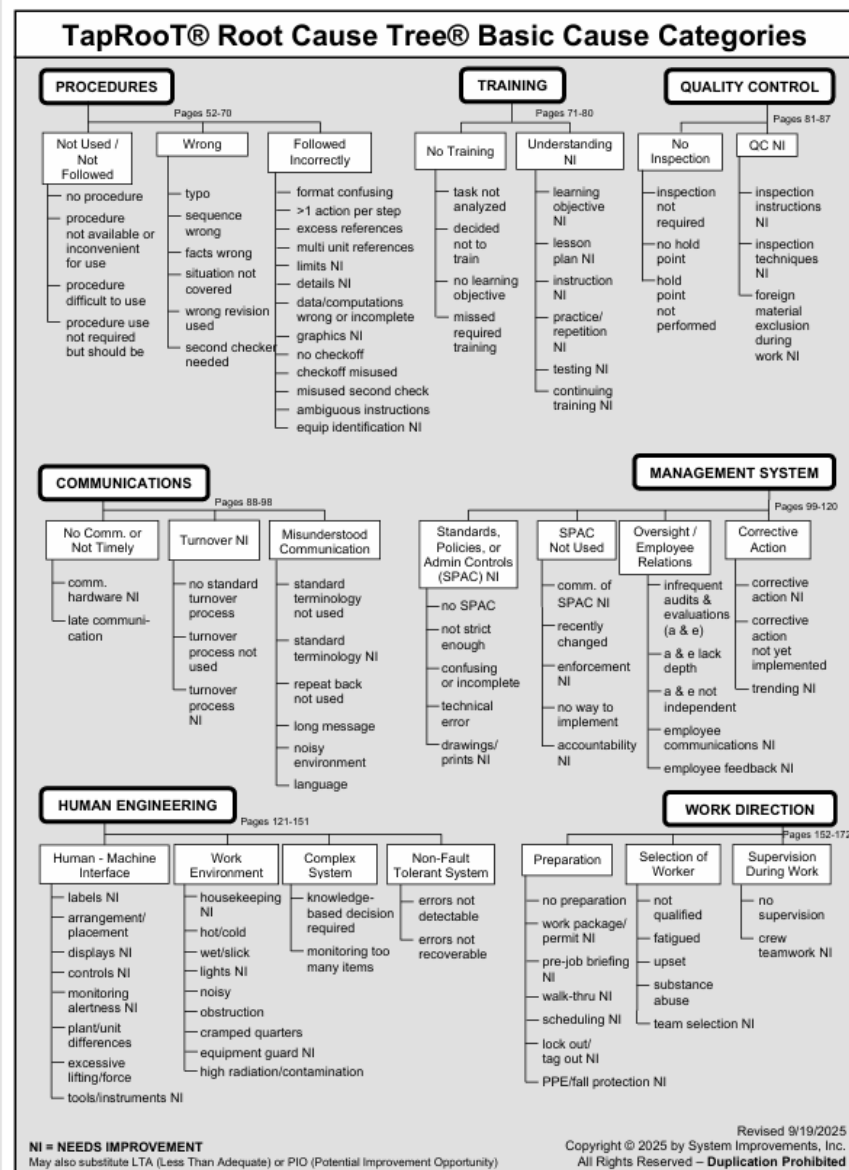
Hazard? Harmful Chemical

Eliminate the chemical from the process

**Start**

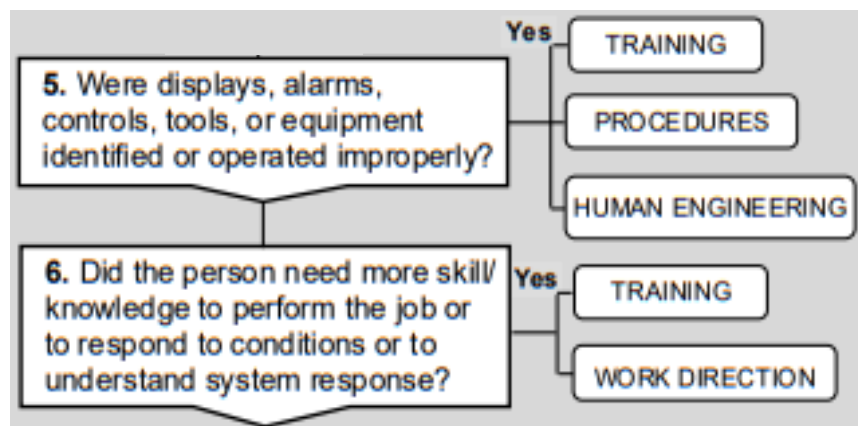


# Real Human Performance Knowledge

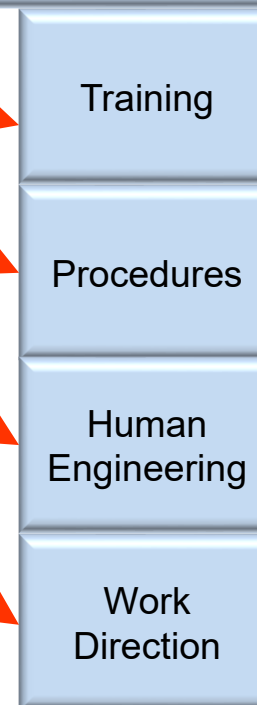


- Better **Training** to understand the task
- Improve **Human Engineering** to make it easy to do right, hard to do wrong
- Clearer **Communications, Work Direction, and Quality Control** to prevent misunderstandings and catch defects
- A robust **Management System** to set clear standards/values, ensure they are working as intended, and fix problems as they are discovered

# Balance with Basic Cause Categories



## Level of Performance



teach them how to do it ... **Training**  
 write it down ... **Procedures**  
 make it easy ... **Human Engineering**  
 tell/show them how to do it ... **Work Direction**

People use **Training** to cover for Bad Procedures, Human Engineering, and Work Direction

# Simulation Based Training

What kinds of tasks do you need to drill or practice?



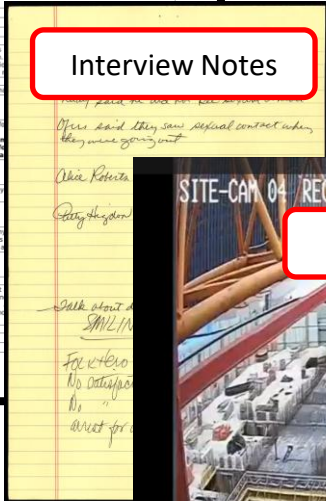
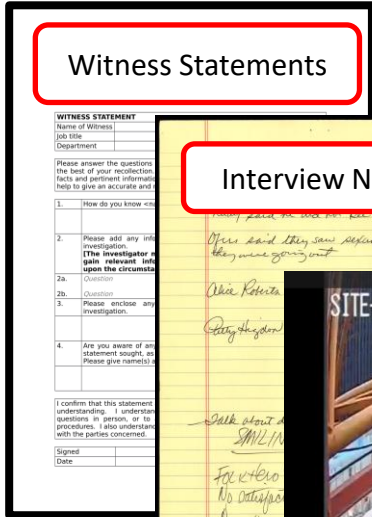
- As Complexity increases, on-the-job training does not work
- You can't teach in an emergency (when complex decisions are made)
- Handling uncertainty requires hands-on repetition and practice

# Future of Investigations

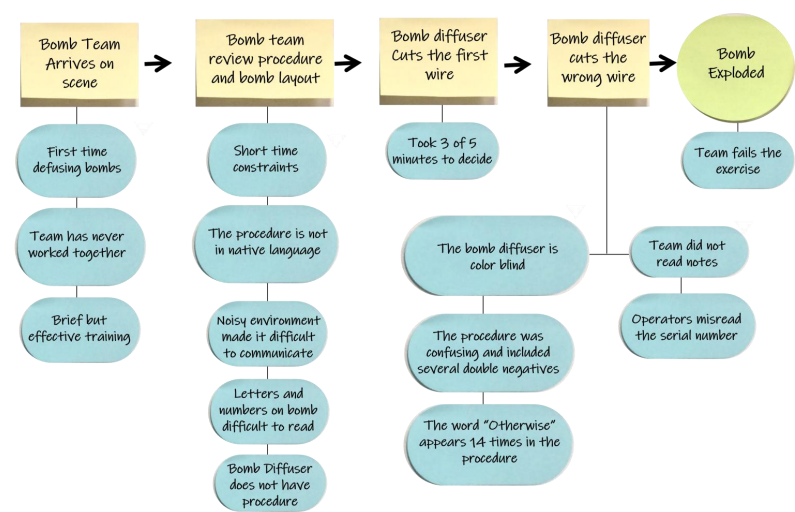
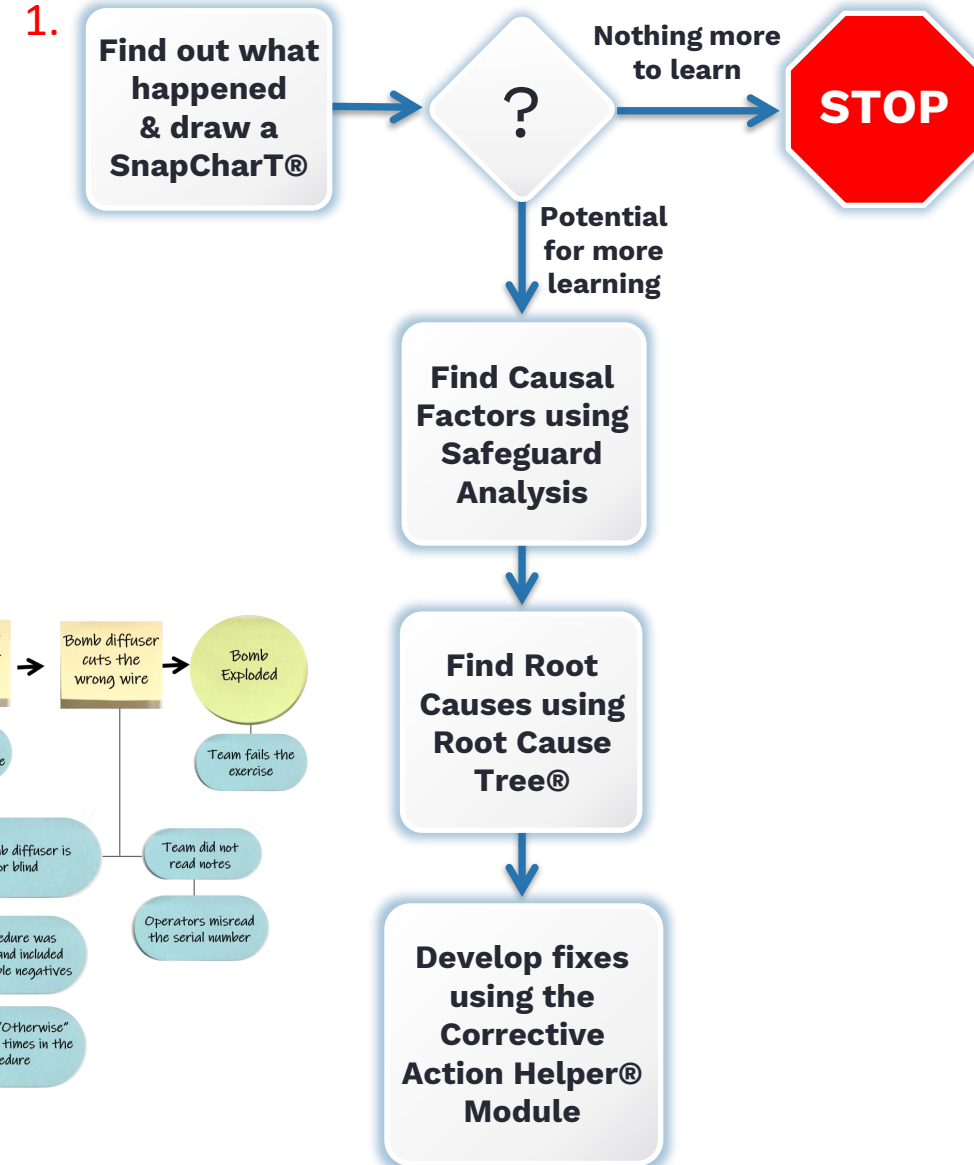


**VS.**

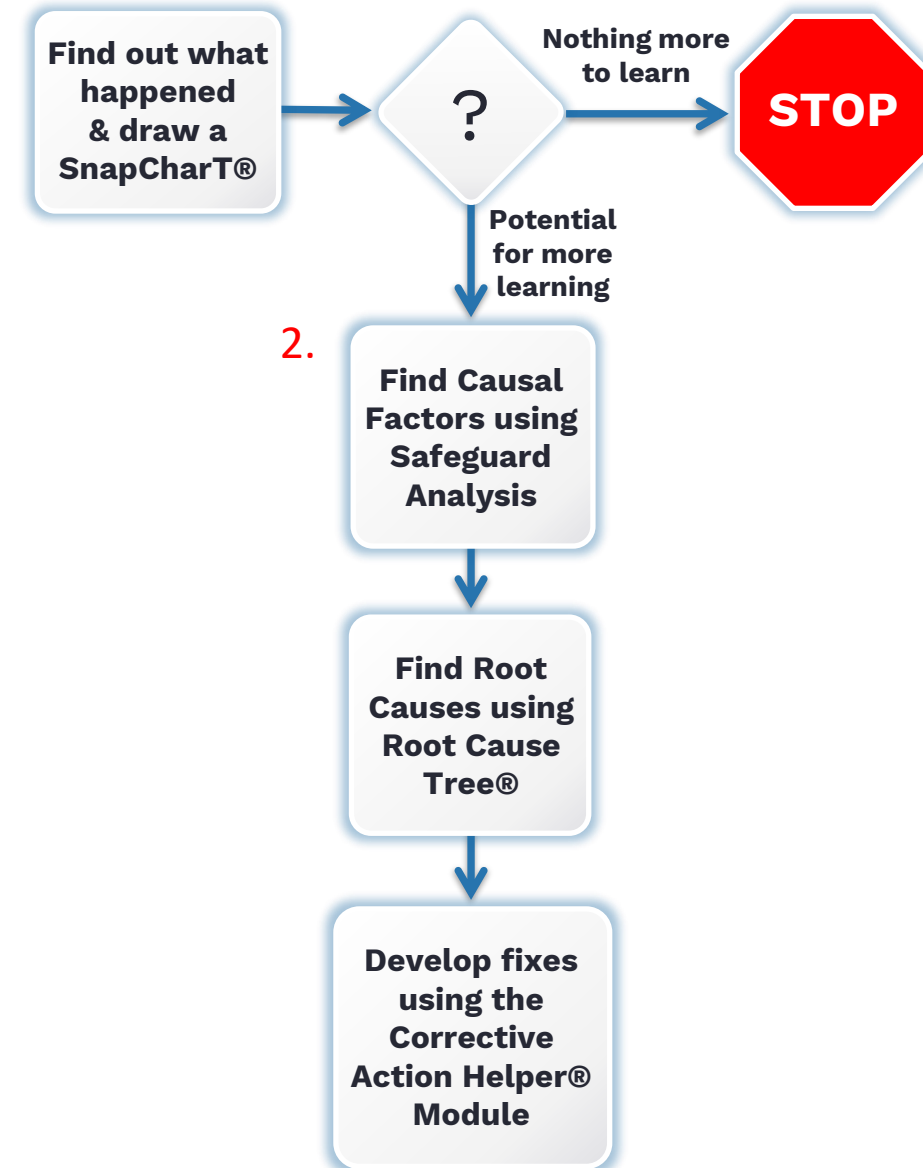
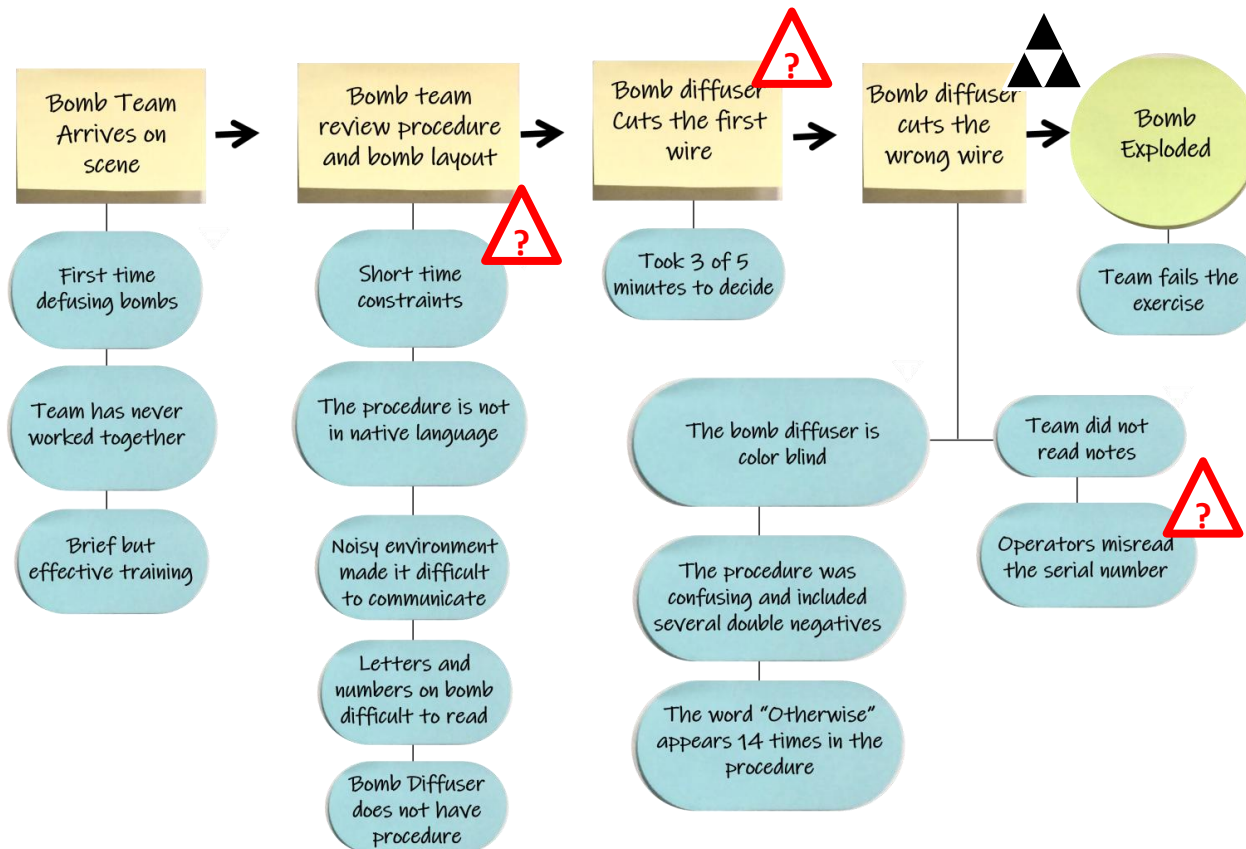


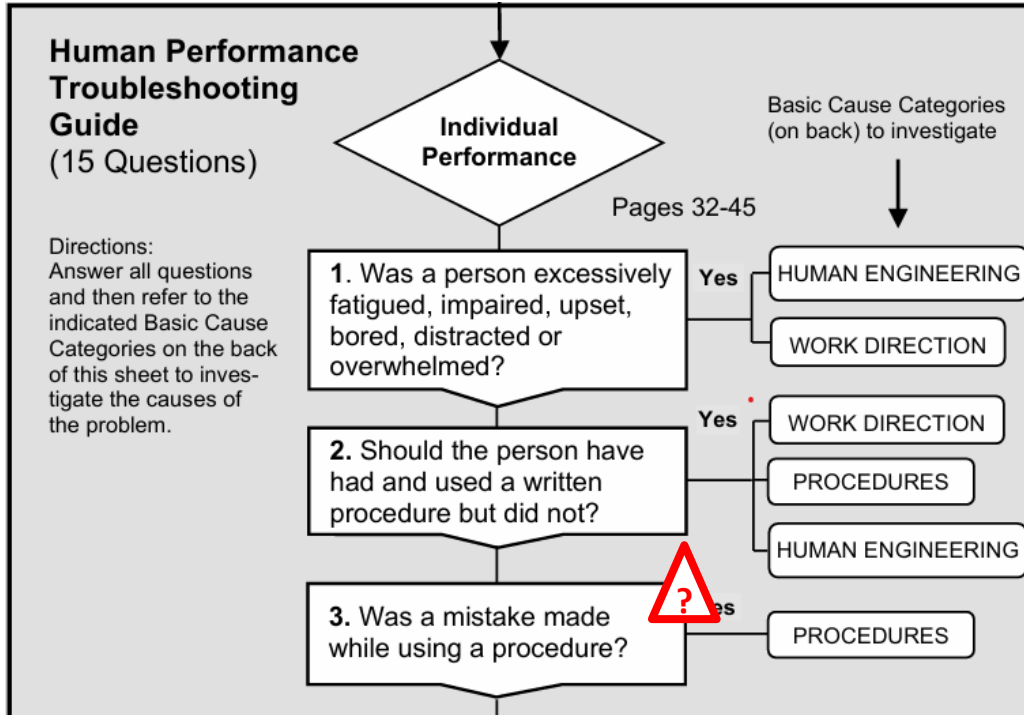


Takes the evidence you collect and builds your initial SnapCharT®



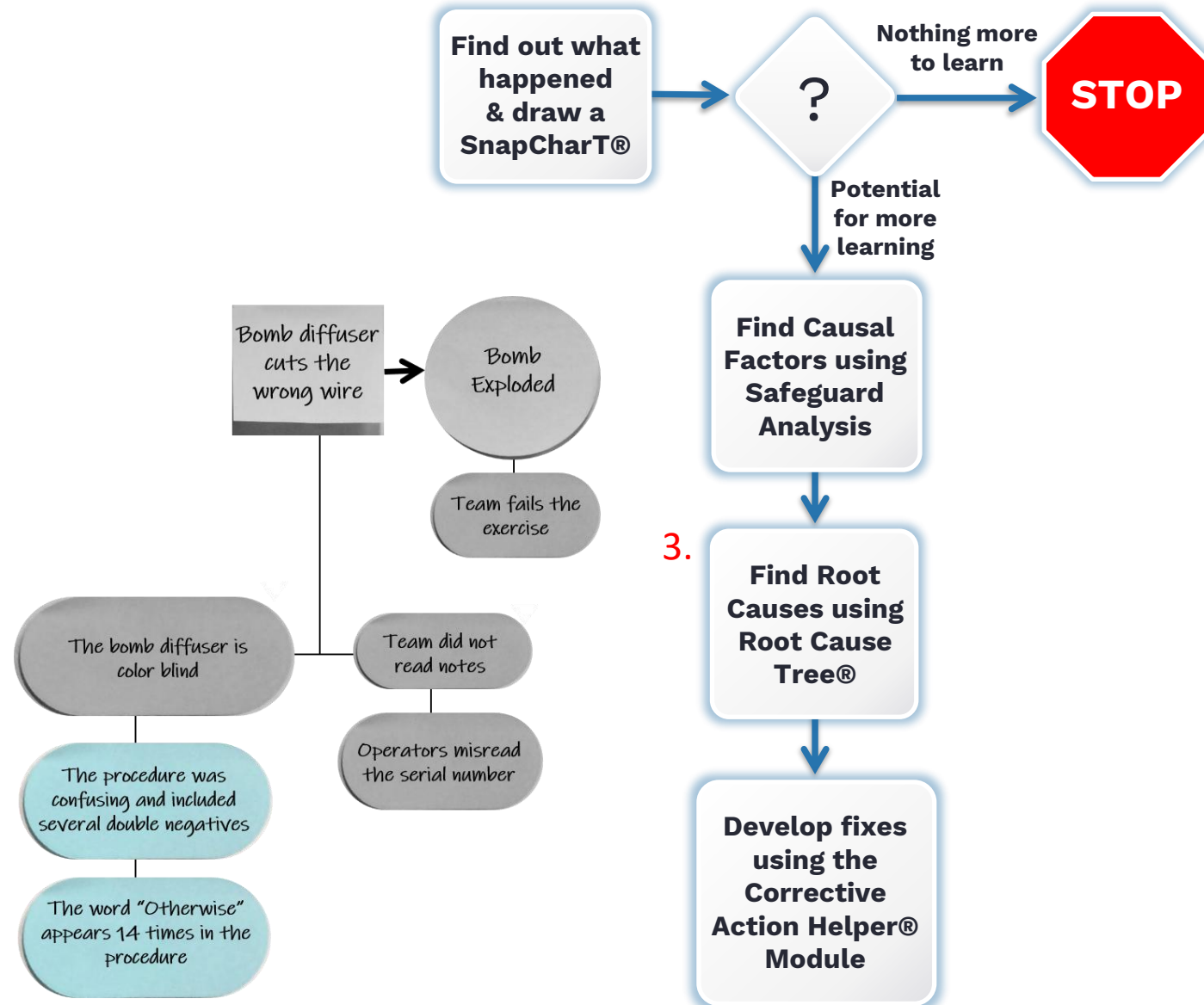
## Helps Identify Potential Causal Factors and Missing Information





Mark potential Yes questions and highlight evidence connections

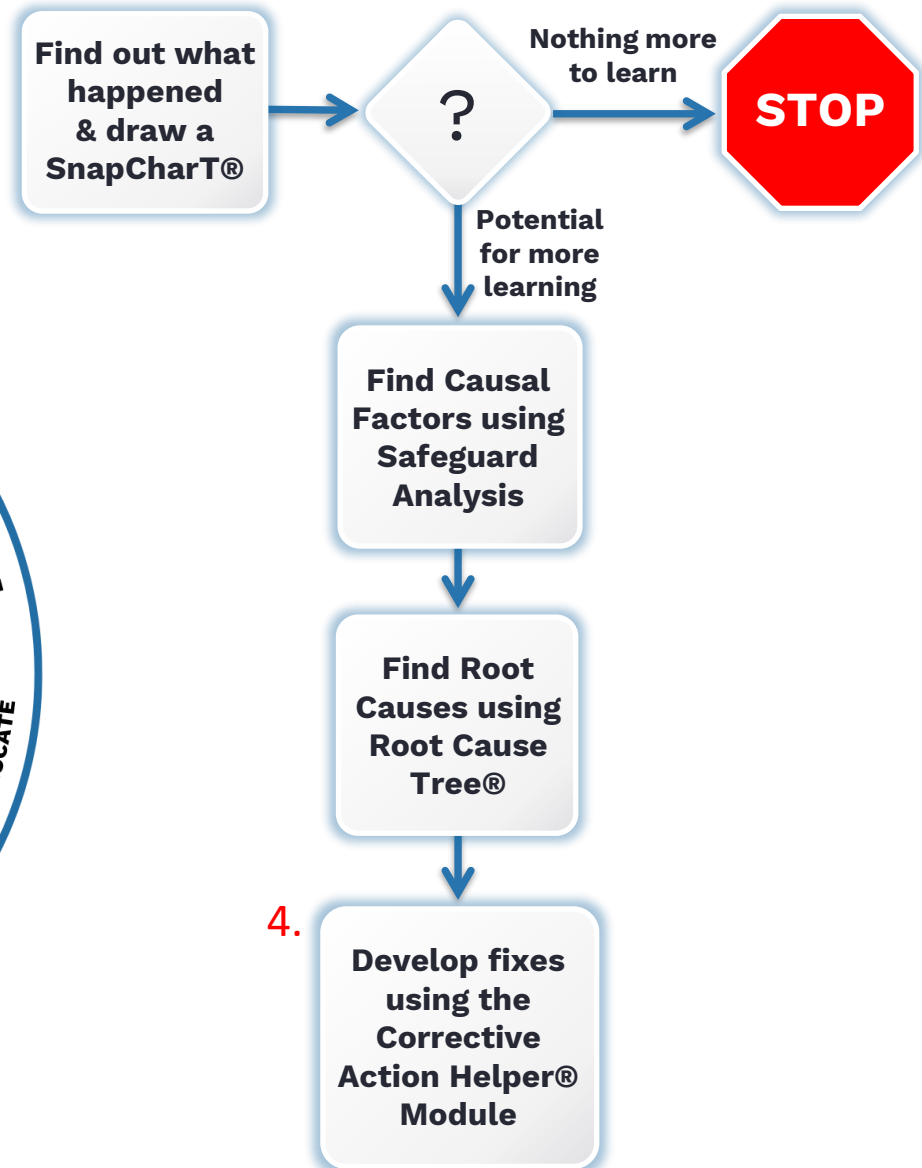
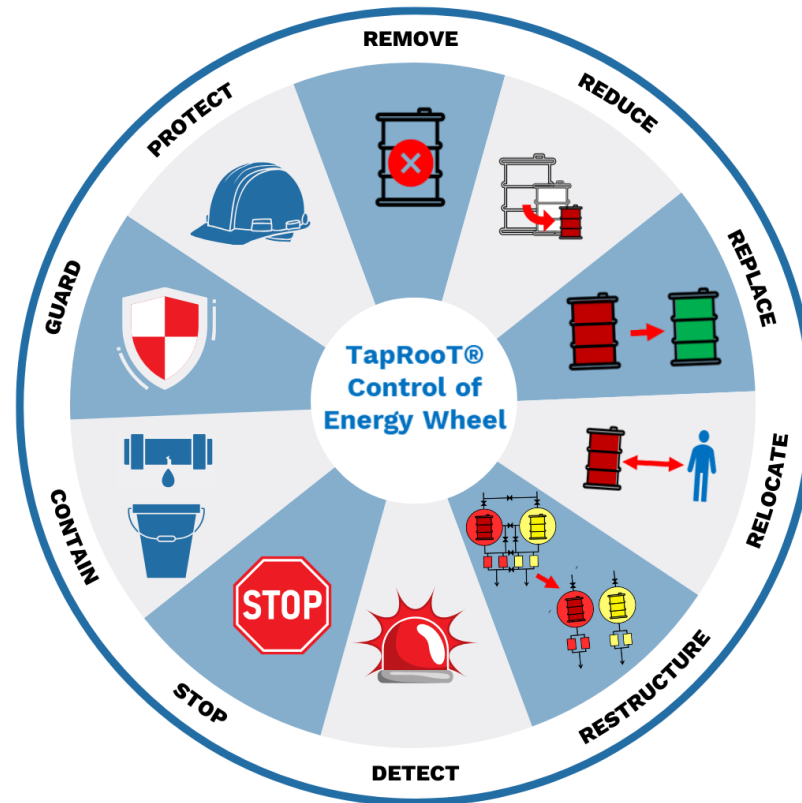
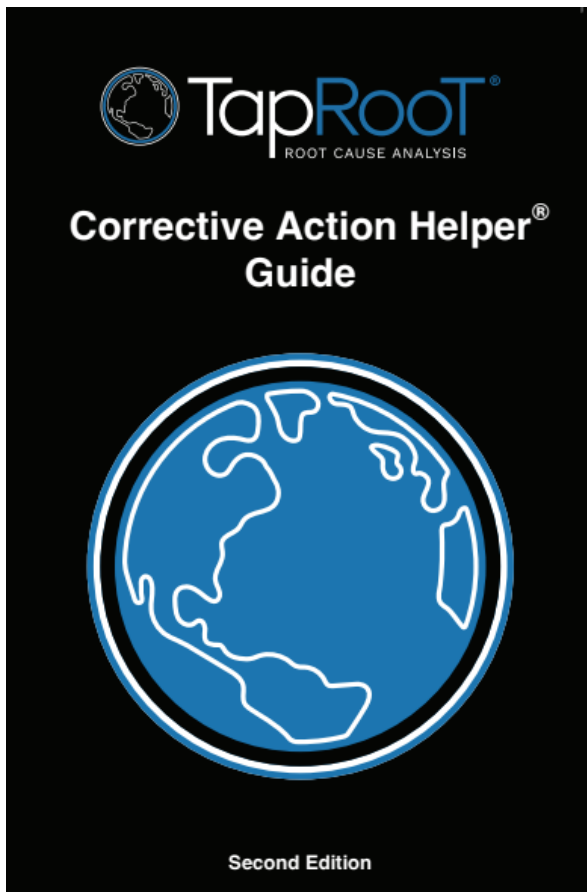
**Evidence**



Testing ideas against proven best practices

**SMARTER**

**STRONGER**



## Automatically Generated Reports & 1 Pagers

For More Information visit [www.TapRoot.com](http://www.TapRoot.com) or email: [info@taproot.com](mailto:info@taproot.com)

### Root Cause Analysis

Causal Factor	ROOT CAUSE
Someone had removed the propane tank	Enforcement of Gas Tank Policy Needs Improvement No Standards for turning on lights
Shift supervisor does not assign or turn on dock lamps	Arrangement / Placement of the Lights made it difficult to turn on Controls for lights were not easily accessible Better crew teamwork could have quickly turned on all lights
Employee walks behind 14 door immediately against bollard poles	No policy or safe work practice to walk close to bollards Overflow from bay area forced worker to walk close to bollards No designated walking area for pedestrians
Forklift Operator backs into Employee	Enforcement of Driving Policy Needs Improvement Back up lights need improvement No communication between driver and walking employee

### Corrective Actions

**Action Plan 1- Install steel Lockout Hasps**, mfr model 236919, Grainger item 489L83 on all forklifts. Lock with 2 inch vertical shackle clearance locks all keyed the same. Grainger model 8UT32 or similar. **Install master padlock key on 8' wire cable at propane storage station** at the end of the dock. **Issue a master key to each supervisor to place on their facility key ring**

Root Causes Addressed	Causal Factors
Management System L SPAC Not Followed L Enforcement Needs Improvement (Root Cause)	Someone had removed the propane tank

**Tasks For Action Plan 1**

**Implementation:** Create purchasing orders and maintenance work orders for steel Lockout Hasps, propane storage station. Roll out new policy and audit schedule to all forklift drivers and supervisors. Training records to be turned into HR.

Responsible Person: Tim Diggs Due Date: 05/31/2023

**Verification:** Verify Locks are installed and keys works at station. Supervisors have key on hand. All operators records have been turned into HR.

Responsible Person: Alex Paradies Due Date: 08/21/2023

**Validation:** Add forklift propane tanks locked to the shift turnover audits currently completed at the end/beginning of each shift by the outgoing and incoming Shift Supervisor. Shift Supervisors correct any unlocked tanks or replace missing locks before handoff audit is complete.

Responsible Person: Tim Diggs Due Date: 09/30/2023

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### TapRoot® Forklift Injury Investigation

For More Information visit [www.TapRoot.com](http://www.TapRoot.com) or email: [alex@taproot.com](mailto:alex@taproot.com)

#### SnapCharT® - Simple Timeline of What Happened

**Incident Details:** Employee hit by reversing forklift on night shift. The employee suffered a broken leg and has been placed on short-term disability.

The SnapCharT diagram illustrates the following sequence of events:

- 00:00:** Employee finds assigned forklift with no propane tank at start of shift. Someone had removed the propane tank.
- 00:01:** Employee gets hand truck to get a full propane tank. Employee cannot drive forklift to get new tank without propane.
- 00:02:** Employee was aggravated that someone had taken the tank for his forklift. All other forklifts are being used. Propane cages are at the end of the dock passed 96 door.
- 00:03:** Primary dock lights go out due to power failure. Service issue from power company goes. Primary dock light system is not on emergency generator.
- 00:04:** Emergency generator system comes on. Supervisor is just getting shift work started. Shift has a large workload this night. Needs all dock workers working today.
- 00:05:** Employee picks up full propane tank starts heading back to forklift. Forklift Operator in a hurry. Load scheduled to depart in 1 hour. Last load of the night for this destination.
- 00:06:** Forklift Operator backs into Employee. Employee hits forklift, broke leg.
- 00:07:** Employee 1 trips to "hear" the forklift. Employee is pushing hand truck with full propane tank in front of him. Employee does not see high light coming on floor as forklift approaches. Forklift Operator cannot see Employee. It was dark. Forklift light was working. Forklift driver does not sound horn per policy. Forklift drivers do not often sound horn because they are backing out of trailers consecutively.
- 00:08:** Employee 2 notices Street Supervisor calls 911. Employee is transported to ER by ambulance. Employee requires surgery on left leg. Forklift Operator is terminated by Corporate HR. Constant horn of all forklifts sounding makes dock too noisy to hear anything else.
- 00:09:** Will be out on short-term disability.

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# For More Information

Reach out and connect with Us on **LinkedIn** 



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- Beneficial tips
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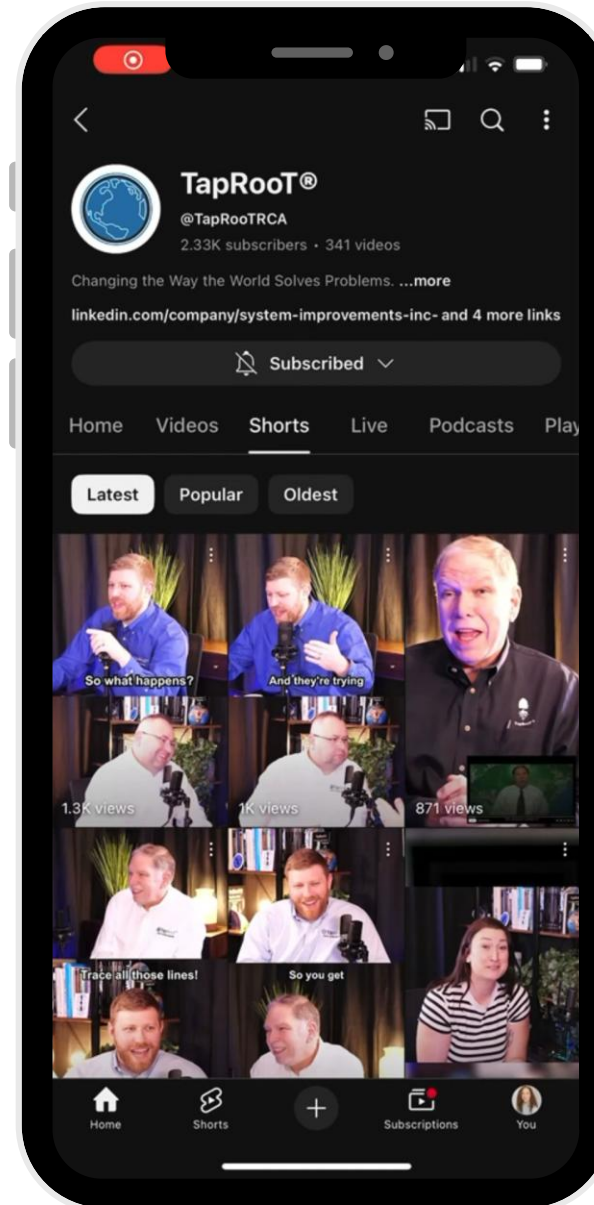
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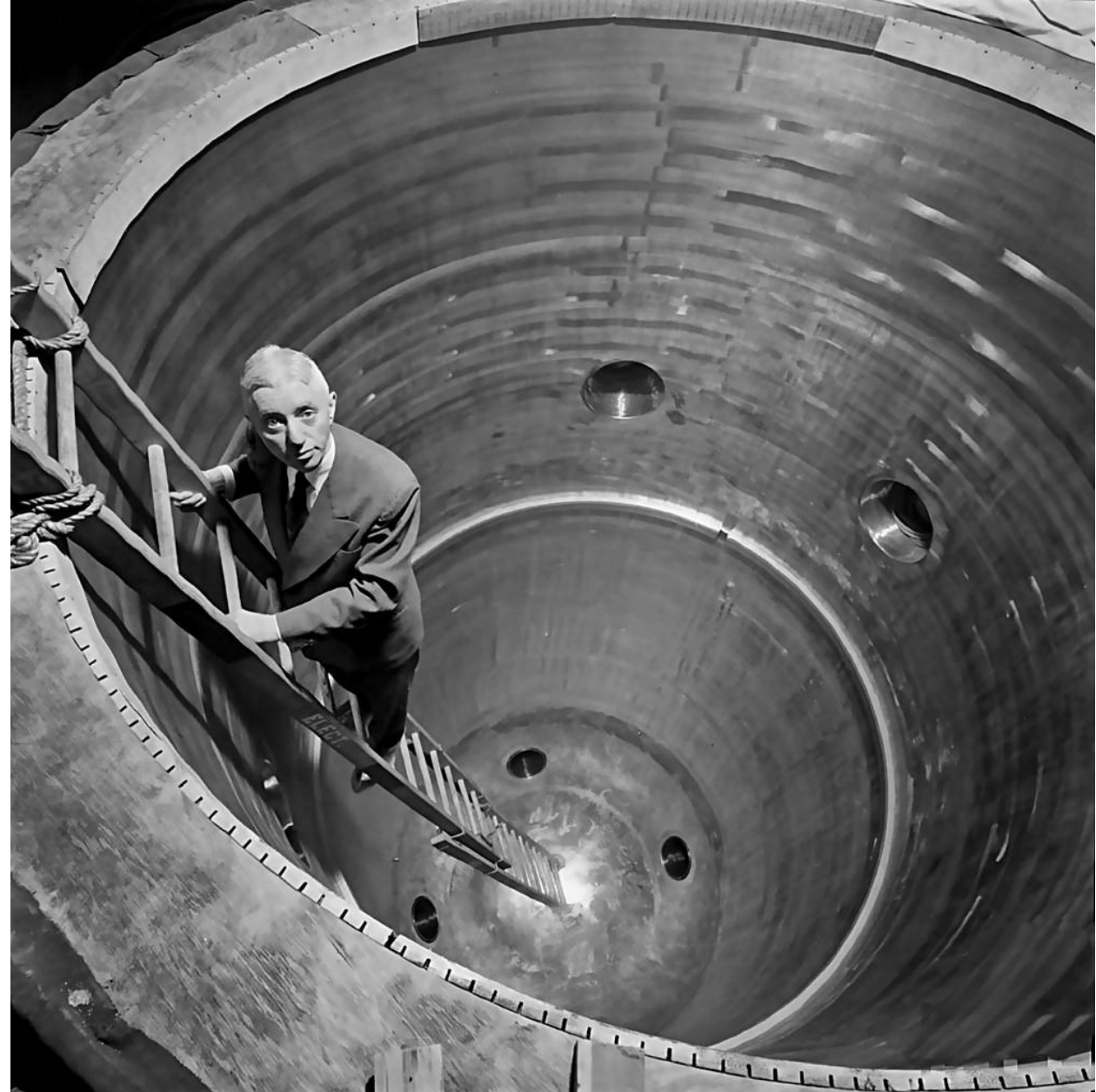
SCAN HERE!



# Questions?

You get what  
you inspect.  
Not what you  
expect.

*Hyman G. Rickover*



# Can I get TapRoot® Training at my site?

## 2-Day TapRoot® RCA Course

Investigate Low to  
Medium Risk or  
Precursor Incidents.

3-Day Virtual available  
for spread out groups

## 5-Day Advanced TapRoot® RCA Course

Investigate High  
Potential or Complex  
Incidents.

Learn Advanced Proactive  
Techniques with more  
practice and case studies.

## TapRoot® Executive Leadership

Management needs to  
understand how to  
strengthen RCA  
investigations

- 4hr Course
- 8hr Course

Virtual or In person

## TapRoot® Refresher

Refresh skills and get  
practice coaching  
investigations

- 4 hour
- 1-Day with  
investigation review

## Stopping Human Error Course

Learn specialized  
tools to prevent /  
reduce human error

2-Day Course or Custom  
Training Available

## Evidence Collection Training

Detailed training on  
collecting information  
and interviewing

- 2-Day Full Course
- 1-Day add-on training
- Online self-guided  
training on Pathways

## Equifactor® Equipment Troubleshooting Course

Understand and repair  
equipment failure and  
reliability issues faster.

- 2-Day Equipment RCA
- Add 1 Day onto 2-Day  
TapRoot® RCA