Using TapRooT® Root Cause Analysis to Investigate Precursor Incidents and Major Accidents

By Mark Paradies and Barb Carr

TapRooT® Root Cause Analysis is a systematic incident investigation process to find and fix the root causes of precursor incidents, major incidents, and audit findings.

This white paper describes how the TapRooT® System can be used to find the root causes of a medium-risk environmental incident at a chemical plant. We will compare the solutions developed using TapRooT® Root Cause Analysis to the real corrective actions applied after a similar incident at a commercial facility. Plus, we will provide an overview of how TapRooT® Root Cause Analysis is used by companies and the results achieved solving their toughest problems.

Why Do You Need Advanced Root Cause Analysis?

You can use TapRooT® Root Cause Analysis to investigate a major accident, but no one wants to investigate a:

- Fatality
- Serious injury
- Regulatory issue
- Major environmental damage
- Major quality issue or product recall
- Serious production outage

That's why we need to stop major accidents before they happen.

How can you find and fix the problems that may lead to a major accident before it happens? By fixing the root causes of the precursor incidents that warn us of impending failures.

I've never seen a major accident that didn't have several, or perhaps a dozen, precursor incidents that could have been investigated and used to solve the problems and, thereby, stop the major accident. Why do major accidents happen? Because people ignore the warning signs. They don't invest the effort, or they don't have the knowledge, to find the root causes of the problems and fix them before the next major accident occurs.

That's why we developed the TapRooT® Root Cause Analysis System. To help people go beyond their current knowledge to find and fix the root causes of incidents with a guided method. TapRooT® Root Cause Analysis helps companies learn from their experiences and prevent incidents using one of two processes.

Two TapRooT® Processes

The TapRooT® System is documented in a series of books[1,2,3,4,5,6,7,8,9,10].

To keep the TapRooT® System as easy to use as possible, we created two separate processes: one for precursor incidents and one for major accidents.

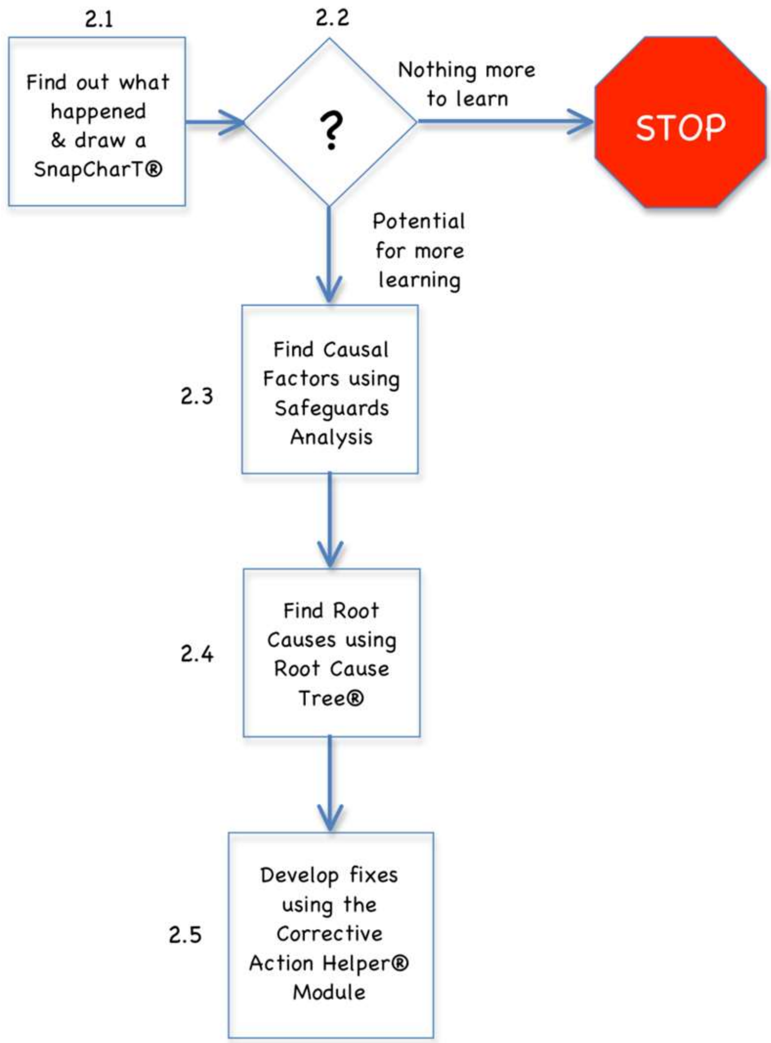
TapRooT® Root Cause Analysis for Precursor Incidents

What is a precursor incident? You might think it is the same as a near-miss but we define it a little differently.

Precursor Incident

Minor incidents that could have been a major accident if one or two more Safeguards would have failed.

Investigating precursor incidents and implementing corrective actions minimize the risk of a major accident occurring. The simple process, shown below, was designed to make root cause analysis as easy as possible (less time-consuming) while still guiding investigators to the real root causes.



The process starts by applying the SnapCharT® Diagram (example shown later) to discover what happened. When you understand what happened, you are ready to decide if there is something important to learn. If not, you stop the investigation. Stopping the investigation once you understand the incident isn't worth investigating can save time and avoid the wasted effort of implementing unnecessary corrective actions.

If a precursor incident is worth investigating, the next step is to identify the incident's Causal Factors. A Causal Factor is:

<u>Causal Factor</u>
A mistake, error, or failure that, if corrected,
would have prevented the incident or mitigated its consequences.

An incident may have several Causal Factors. Each Causal Factor needs to be analyzed to find its root cause(s). Identifying the Causal Factor's root causes is the next step.

The Root Cause Tree® Diagram is used to guide investigators to root causes. The process is explained later in this white paper.

Finally, the Corrective Action Helper® Guide/Module is used to help investigators develop effective fixes (corrective actions) for the root causes.

That's the simple TapRooT® Process.

TapRooT® for Major Accidents

TapRooT® 7-Step Major Investigation Process

Phases	Steps	Tools
Plan	1. Plan Your Investigation	**SnapCharT®** *Root Cause Tree®* *Equifactor®*
Investigate	2. Determine What Happened (Sequence of Events)	**SnapCharT®** *Equifactor®* *CHAP* *Change Analysis*
Analyze	3. Define Causal Factors	**SnapCharT®** **Safeguard Analysis**
	4. Analyze Each Causal Factor's Root Causes	**Root Cause Tree®**
	5. Analyze Each Root Cause's Generic Causes	**Corrective Action Helper®**
Fix	6. Develop Fixes	**Corrective Action Helper®** *Safeguard Analysis* **SMARTER**
Report	7. Present/Report for Approval	**SnapCharT®**

The second process, the TapRooT® 7-Step Major Investigation Process, is shown above.

Note the similarities in this process and the 5-step for precursor incidents.

So, what are the differences between the 5-step investigation process and the 7-step major investigation process?

1. **More steps.** The major investigation starts with planning and looks for Generic Causes.
2. **Optional techniques.** The major investigation process includes the Equifactor®, CHAP, and Change Analysis optional techniques to help in the evidence collection phase of the investigation.
3. **No option to stop.** In the simple investigation, we can stop if there isn't anything important to learn. But for a major accident, you need to complete the investigation. Stopping isn't an option.

For more about the TapRooT® 7-Step Major Investigation Process and investigating major accidents, read: *Using TapRooT® Root Cause Analysis for Major Investigations.*[4]

Example: Environmental Incident at a Chemical Plant

The following is an example of the use of the TapRooT® System to analyze a medium-risk, environmental incident (fish kill) at a chemical plant. Please note that this incident is not intended to represent an actual event at any particular location.

This investigation was performed using the simple (low-to-medium risk) investigation process shown on page 2.

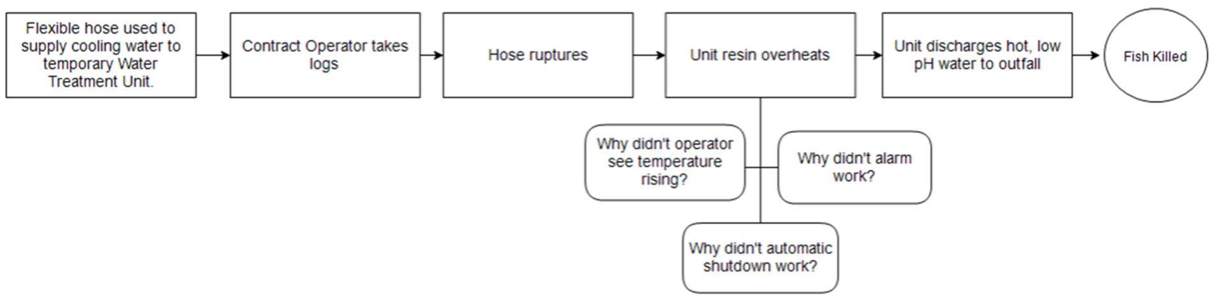
To shorten this example, the information collection portion of the investigation is not shown. Rather, use of the TapRooT® System is only demonstrated for the evidence organization (what happened), root cause analysis (why it happened), and the development of corrective actions (how to improve performance). The three main tools in this example are the:

- SnapCharT® Diagram
- Root Cause Tree® Diagram
- Corrective Action Helper® Module

Step One: Find out what happened and draw a SnapCharT®.

A SnapCharT® is a timeline of events that led to the incident but it is also an information collection tool and a central repository for data collected. Let’s see how this tool was used in our example incident.

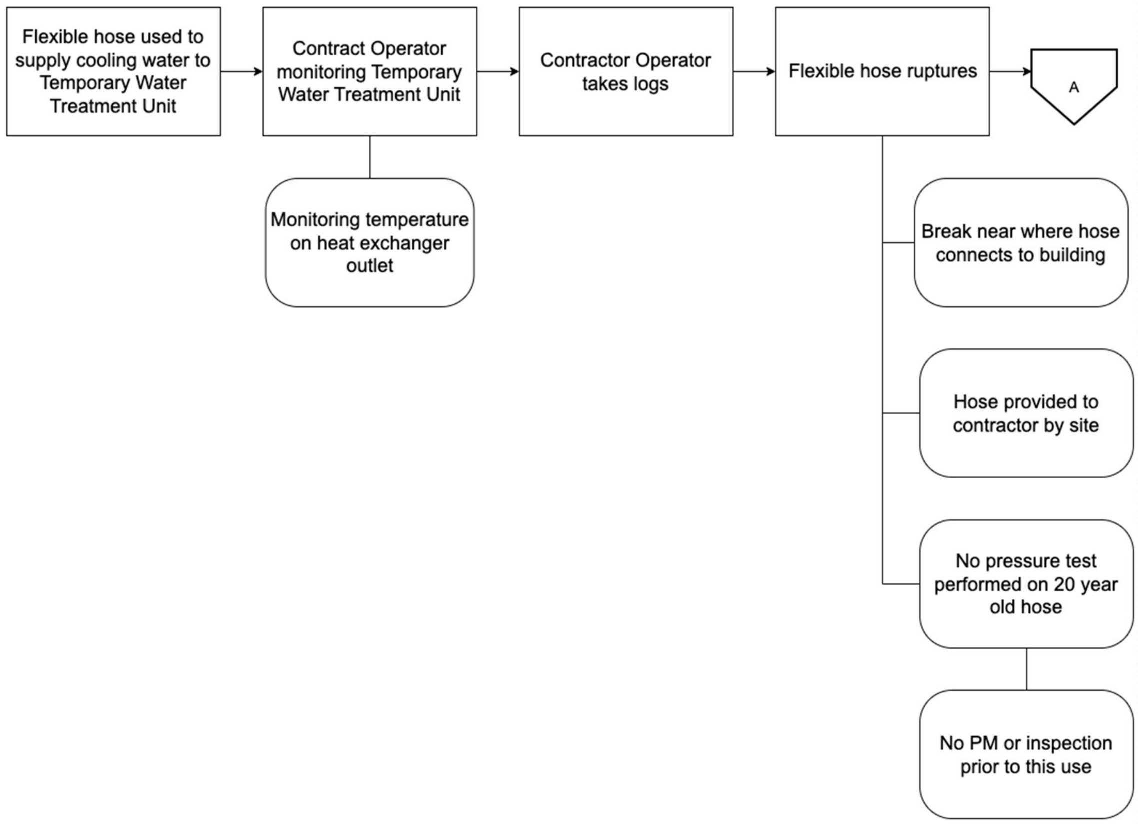
During a normal night shift at a process plant, fish were killed when a temporary water treatment unit overheated and released hot, low pH water to one of the plant's outfalls. An investigation that included a contractor representative (contract personnel were operating the rented temporary water treatment unit) was conducted using the TapRooT® System. The preliminary sequence of events is shown on the following SnapCharT® Diagram.

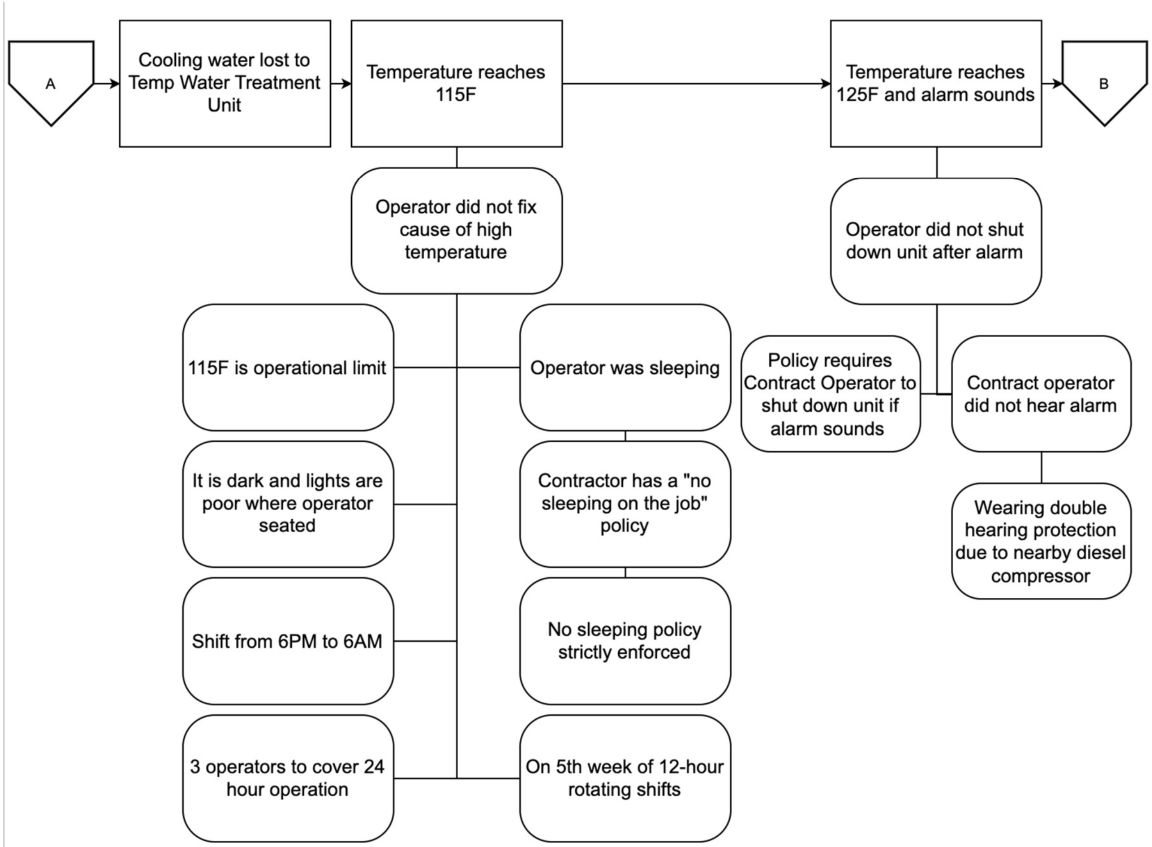


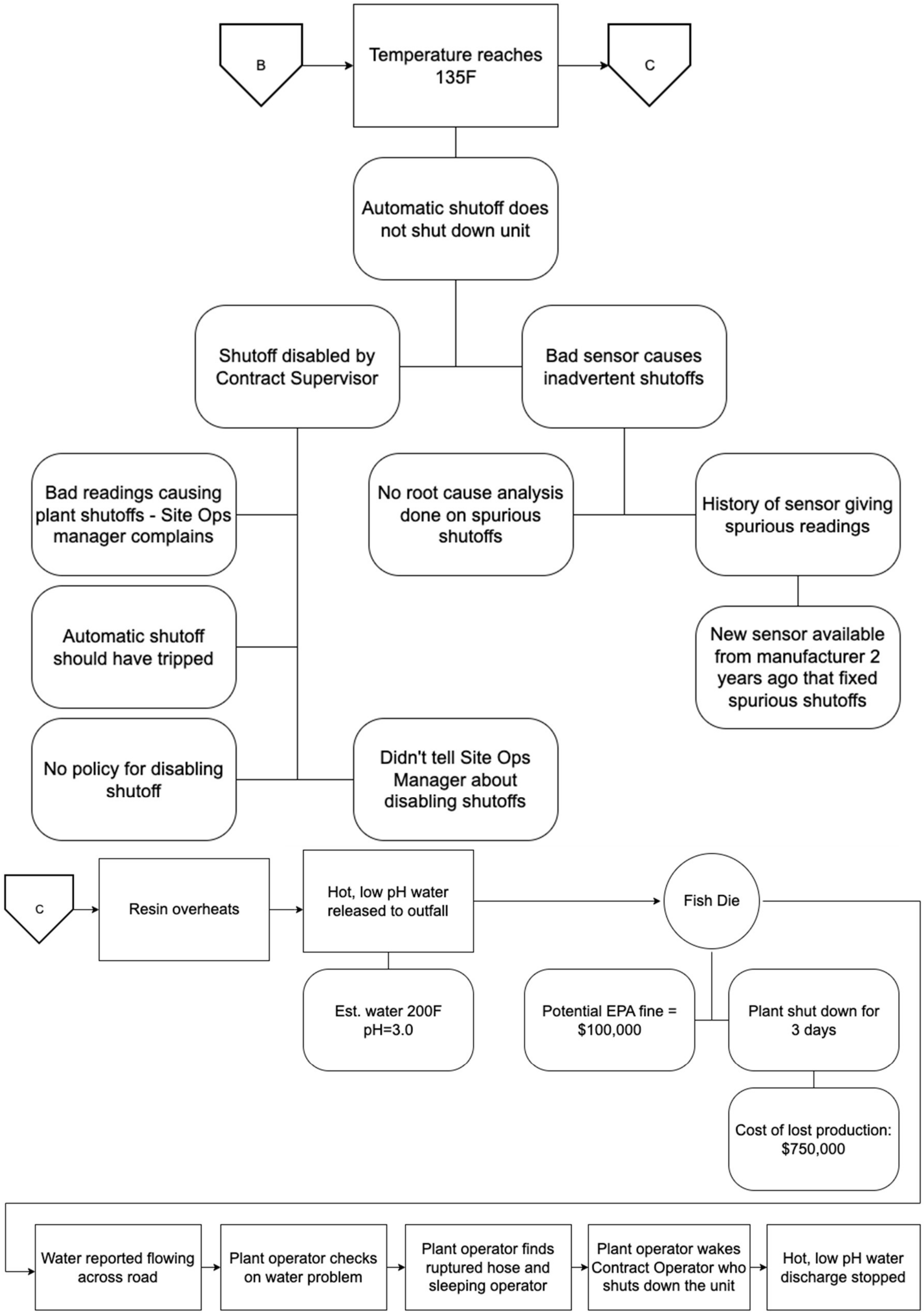
After the preliminary SnapCharT® was completed, the investigation team planned evidence collection and collected information to further document the SnapCharT® from:

- interviews with all contract operators and their supervisors, plant personnel at the process plant unit, procurement personnel, and operations management
- collecting policies and procedures, timekeeping records, activity-specific paperwork, information about the flexible hose and the automatic shut-off
- walk through of the work environment
- examining PPE

With this information, a more detailed SnapCharT® (shown below) was developed.


Flexible hose used to supply cooling water to Temporary Water Treatment Unit
Contract Operator monitoring Temporary Water Treatment Unit
Contractor Operator takes logs
Flexible hose ruptures
A
Monitoring temperature on heat exchanger outlet
Break near where hose connects to building
Hose provided to contractor by site
No pressure test performed on 20 year old hose
No PM or inspection prior to this use


A
Cooling water lost to Temp Water Treatment Unit
Temperature reaches 115F
Temperature reaches 125F and alarm sounds
B
Operator did not fix cause of high temperature
115F is operational limit
Operator was sleeping
It is dark and lights are poor where operator seated
Contractor has a "no sleeping on the job" policy
Shift from 6PM to 6AM
No sleeping policy strictly enforced
3 operators to cover 24 hour operation
On 5th week of 12-hour rotating shifts
Operator did not shut down unit after alarm
Policy requires Contract Operator to shut down unit if alarm sounds
Contract operator did not hear alarm
Wearing double hearing protection due to nearby diesel compressor


B
Temperature reaches 135F
C
Automatic shutoff does not shut down unit
Shutoff disabled by Contract Supervisor
Bad sensor causes inadvertent shutoffs
Bad readings causing plant shutoffs - Site Ops manager complains
No root cause analysis done on spurious shutoffs
History of sensor giving spurious readings
Automatic shutoff should have tripped
New sensor available from manufacturer 2 years ago that fixed spurious shutoffs
No policy for disabling shutoff
Didn't tell Site Ops Manager about disabling shutoffs
C
Resin overheats
Hot, low pH water released to outfall
Fish Die
Est. water 200F pH=3.0
Potential EPA fine = $100,000
Plant shut down for 3 days
Cost of lost production: $750,000
Water reported flowing across road
Plant operator checks on water problem
Plant operator finds ruptured hose and sleeping operator
Plant operator wakes Contract Operator who shuts down the unit
Hot, low pH water discharge stopped

Step Two: Is there anything else to learn?

The next step in the TapRooT® Root Cause Analysis Process is to determine from the documented SnapCharT® if there is anything else to learn. If there is nothing more to learn from this investigation or the risk presented does not match the company investigation criteria, we would stop the investigation. Review the example SnapCharT® above. To avoid equipment failures and mistakes made by the operator going forward, the answer to that question would be "yes" – we have more to learn!

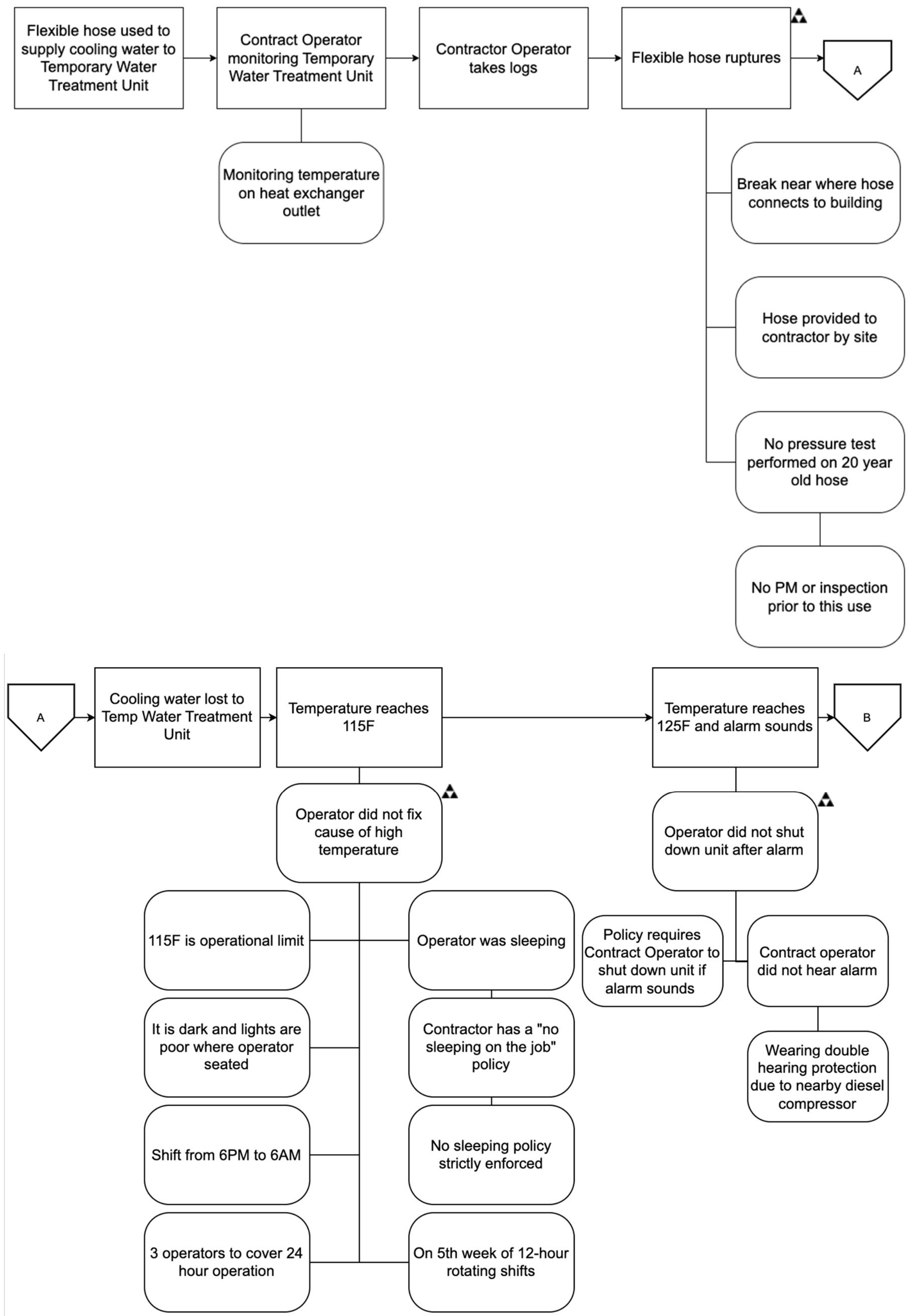
Step Three: Find Causal Factors Using the Causal Factor Worksheet

As mentioned, a Causal Factor is a mistake, error, or failure that, if corrected, would have prevented the incident or mitigated its consequences. To help investigators determine the Causal Factor(s) with ease, TapRooT®'s Guided System includes the Causal Factor Worksheet. The Causal Factor Worksheet helps the investigator perform a safeguard analysis by asking questions the investigator answers with information from the SnapCharT®. The Causal Factor Worksheet also helps the investigator identify human errors and equipment failures that might be missed otherwise. All new information gathered on the worksheet is added to the SnapCharT®. Errors, failed catches, and missing safeguards often lead the investigator to the Causal Factors.

[See example on next page.]

TapRooT® Safety Causal Factor Worksheet Review the sequence of events on your SnapCharT® and answer these questions:
1. INCIDENT: What was the Incident? **Fish Die**
2. HAZARD: What was the Hazard (source of energy)? **Hot, low pH water released to outfall.** Could the Hazard be eliminated or reduced? Yes or No How? **Supplying cooling water to temporary water treatment facility or shutting down the unit when cooling water was lost.**
3. TARGET: What was the Target? **Fish** Could the Target be removed? Yes or No How?
4. STARTING ERRORS: What mistakes, errors, or equipment failures started a sequence of events that led to the Incident? **Flexible hose that supplies cooling water to temporary water treatment facility ruptured.**
5. FAILED CATCH: What mistakes, errors, or equipment failures failed to catch or stop the sequence of events that led to the Incident? **Operator didn't fix cause of high temps or shut down until after alarm.** **Automatic shutoff did not shut down unit.**
6. MISSING SAFEGUARDS: What mistakes, errors, or equipment failures caused a safeguard to be missing or fail? **Automatic shutoff disabled by contract supervisor.**
7. EQUIPMENT FAILURE CATCH: What mistakes or errors failed to notice or prevent an impending equipment failure? **None**
8. MADE OUTCOME WORSE: What mistakes, errors, or equipment failures made the outcome of the Incident worse? **None**

Below is an example of what a SnapCharT® would look like after all of the information is collected and documented, and after all new information from the Causal Factor Worksheet is added. Causal Factors have been identified by the triangle symbol.


Flexible hose used to supply cooling water to Temporary Water Treatment Unit
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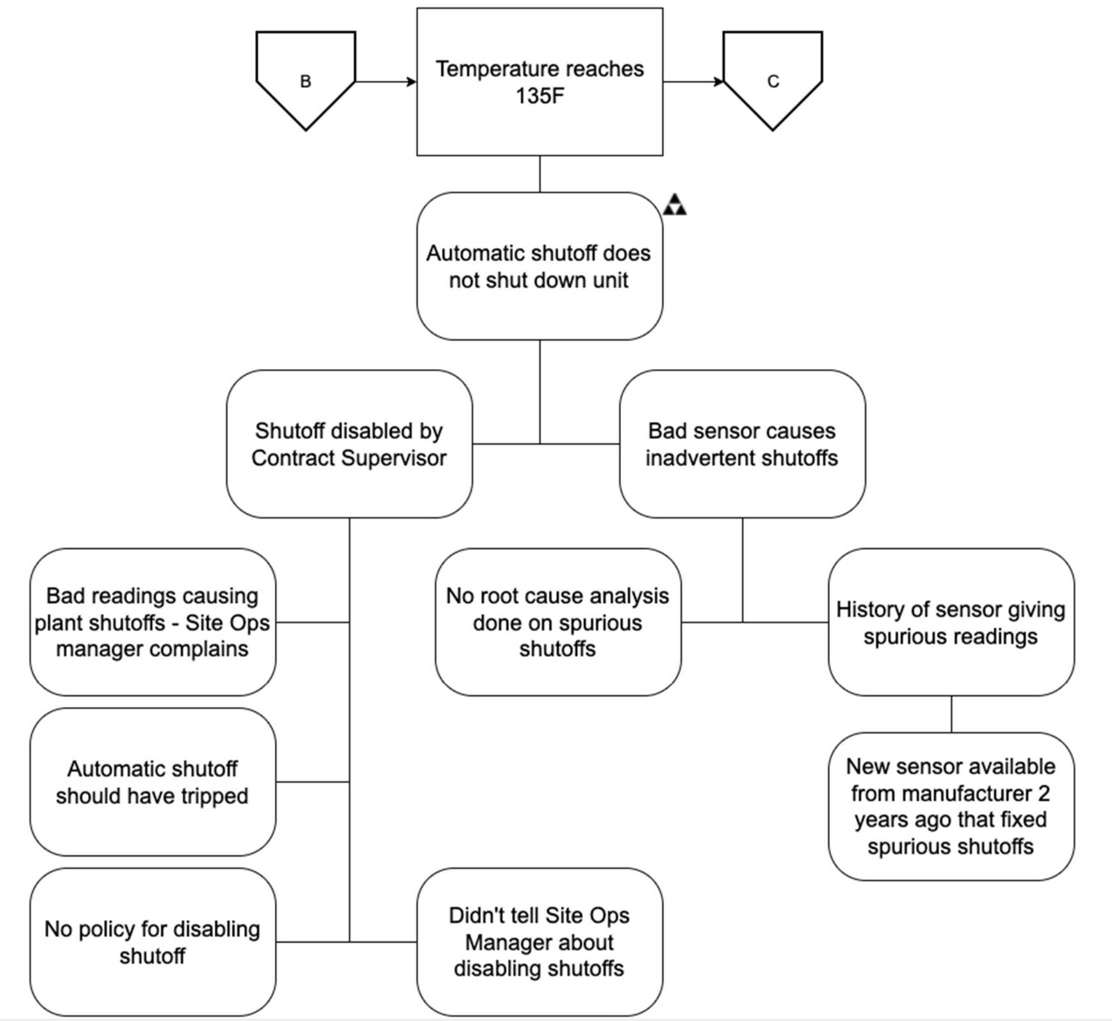
B
Temperature reaches 135F
C
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Shutoff disabled by Contract Supervisor
Bad sensor causes inadvertent shutoffs
Bad readings causing plant shutoffs - Site Ops manager complains
No root cause analysis done on spurious shutoffs
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New sensor available from manufacturer 2 years ago that fixed spurious shutoffs
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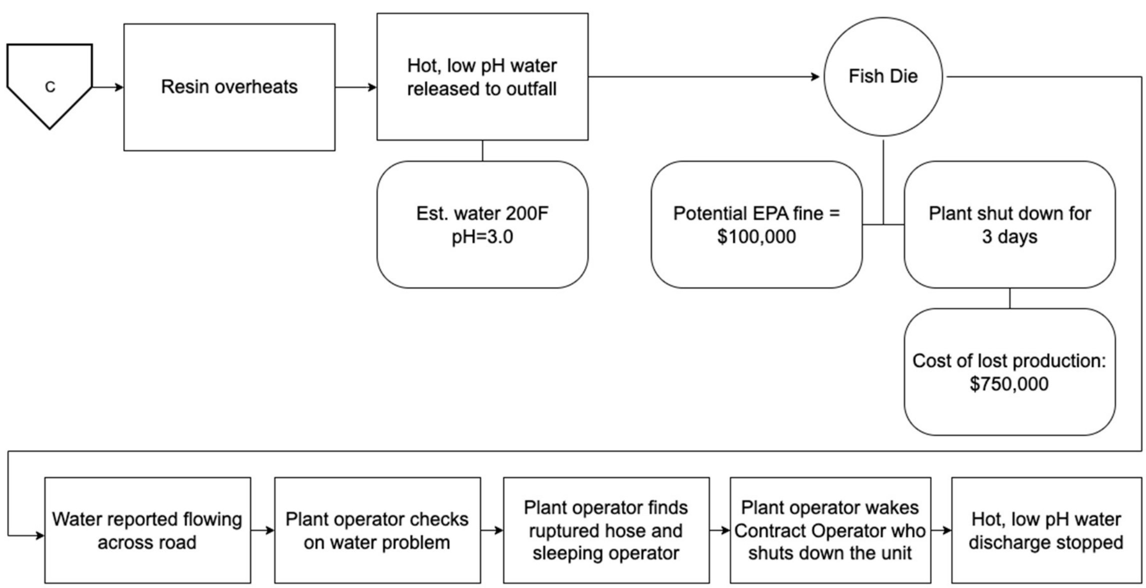
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Resin overheats
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Est. water 200F pH=3.0
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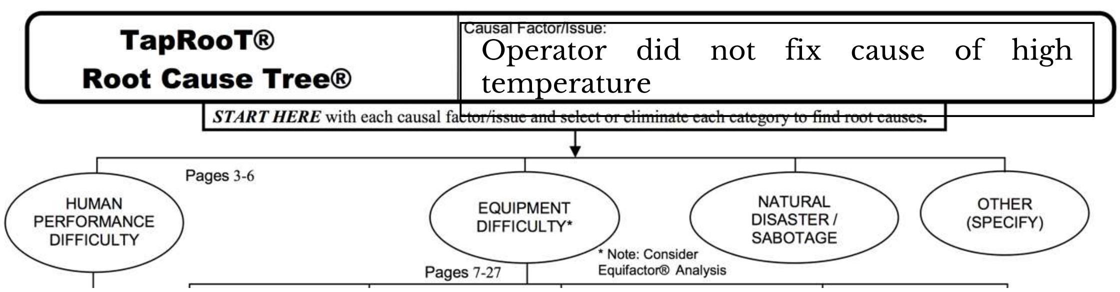
Cost of lost production: $750,000
Water reported flowing across road
Plant operator checks on water problem
Plant operator finds ruptured hose and sleeping operator
Plant operator wakes Contract Operator who shuts down the unit
Hot, low pH water discharge stopped

The four Causal Factors are marked with a triangle and include all the attached information. Each of the Causal Factors were analyzed for root causes using the Root Cause Tree® Diagram and Root Cause Tree® Dictionary. The following is an analysis of the Causal Factor: "Operator did not fix cause of high temperature."

Step Four: Find root causes using the Root Cause Tree® Diagram

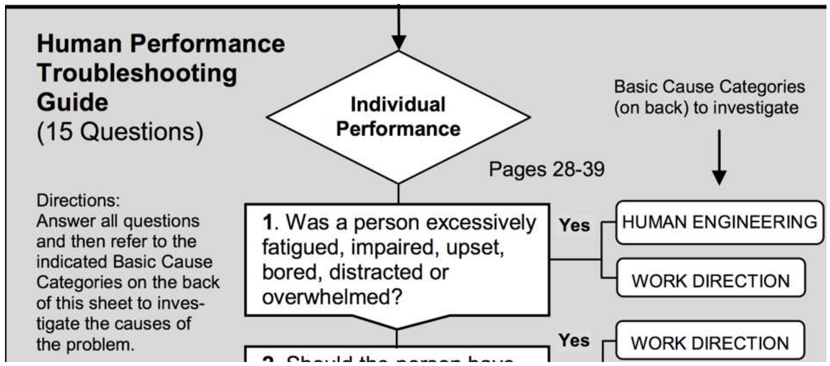
In an actual investigation, all the Causal Factors would be analyzed to find their root causes. However, to keep this white paper short, we will only explain the analysis of a single Causal Factor – "Operator did not fix cause of high temperature."

The investigator starts at the top of the Root Cause Tree® Diagram (shown below, the complete Root Cause Tree® Diagram is available in *Using the Essential TapRooT® Techniques to Investigate Low-to-Medium Risk Incidents*[3]) and works down the Tree using a process of selection and elimination. The investigator thus asks and answers questions to identify the specific root causes for this Causal Factor.



In this case, the Causal Factor "Operator did not fix cause of high temperature" was identified as a Human Performance Difficulty (one of the four major problem categories at the top of the Root Cause Tree®) and the other three difficulty categories were eliminated.

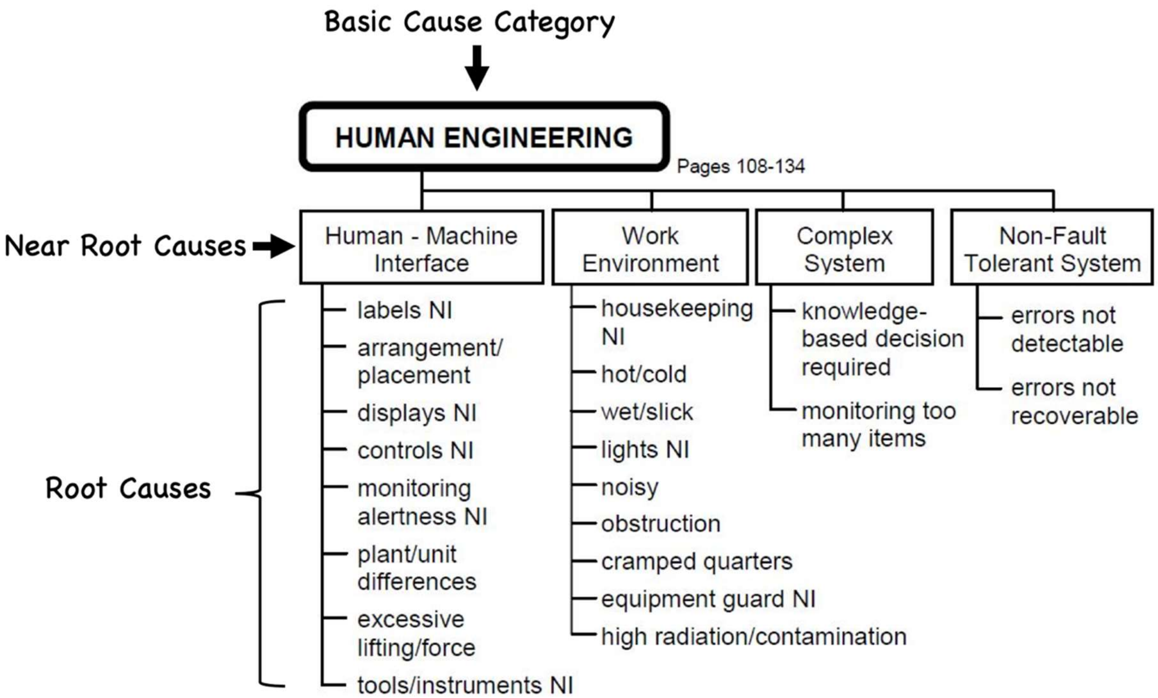
When the Human Performance Difficulty was identified, the Tree guided the investigator to a set of 15 questions called the Human Performance Troubleshooting Guide (part of the Tree's embedded intelligence). The first of the 15 questions of the guide is shown below.



A “yes” to question 1 guides the investigator to look for root causes in the Human Engineering and Work Direction Basic Cause Categories on the back side of the Root Cause Tree® Diagram. The complete list of Basic Cause Categories on the back side of the Tree are:

- Procedures
- Training
- Quality Control
- Communications
- Management System
- Human Engineering
- Work Direction

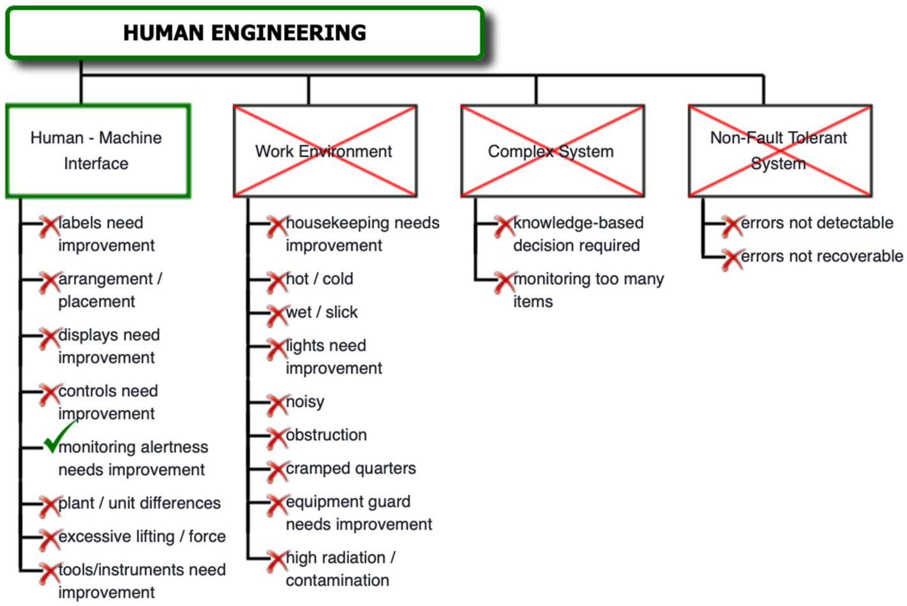
Each category indicated by a "Yes" answer to the questions in the Human Performance Troubleshooting Guide was investigated further to see if it could be eliminated or if one or more Near-Root Causes and related Root Causes contributed to the problem (and thereby "caused" the incident). The Human Engineering Basic Cause Category is shown below.



For the "Operator did not fix cause of high temperature" Causal Factor, four of the 15 questions were answered "Yes." The 15 questions guided the investigator to review the following Basic Cause Categories:

- Human Engineering
- Management System
- Work Direction
- Procedures

A screen shot (from the TapRooT® VI Software) of one of these categories (Human Engineering) with the analysis completed is shown below.



When the analysis of all the Basic Cause Categories (not shown here - Work Direction, Procedures, Management System) for this Causal Factor were completed, the following root causes were identified:

1. Monitoring alertness needs improvement.
2. Shift scheduling needs improvement.
3. Selection of fatigued worker.
4. The "no sleeping on the job" policy needs to have a practical way to make it so that people can comply with it.

That's four root causes (or ways to improve performance) for this Causal Factor.

Step Five: Develop fixes using the Corrective Action Helper® Module.

Once the root causes for all of the Causal Factors are analyzed, the investigator uses the Corrective Action Helper® Module of the TapRooT® Software to help develop the corrective actions for the root causes. The Corrective Action Helper® Module helps investigators:

1. Verify that they are addressing the real causes of the incident.
2. Develop corrective actions to fix the specific cause of the problem by applying best practices and missing knowledge.

3. Develop corrective actions for the generic (or systemic) causes (if applicable) for the problem.
4. Develop additional implementing actions needed to make the corrective actions successful.
5. Find references to study the problem in detail and learn more about potential strategies to eliminate the problem.

The following is an example of the guidance provided by the Corrective Action Helper® module of the TapRooT® Software for the root cause “Monitoring Alertness Needs Improvement” that was identified for a Causal Factor of the Fish Kill Incident:

Check:

You have decided that the problem was related to loss of performance over time while monitoring. (The job was too boring.)

Ideas:

1. You should consider recommending the following options: (Order does not indicate preference.)

    a. Provide an alarm to alert the worker and relieve the boredom of monitoring.

    b. Provide an automated monitoring and response system to replace human monitoring and response. NOTE: this will probably leave the worker in supervisory control. You will need to consider ways to keep the worker informed as to what the automation is doing and to clearly indicate why it is doing it. You should also consider ways to keep the workers involved in the process so that they maintain their situational awareness and maintain their manual control proficiency.

    c. Rotate the person monitoring more frequently. (Experiment to find out how long they can monitor reliably and then rotate people so that they only monitor for less than that time.)

    d. Redesign the job to provide other tasks that don't compete with the monitoring task to keep the person alert and involved. (For example, playing the radio while driving.) Do not provide tasks that compete for the same resource. (For example, reading a book while driving.)

    e. Provide false signals to keep the worker involved. However, you should also consider that people may ignore real signals if they become accustomed to receiving only false signals.

f. Consult the workers to see if they have ideas that would make the task more interesting without conflicting with the monitoring requirements.

2. Fatigue can also combine with monitoring alertness problems. Consider training supervisors to understand that fatigued personnel should not be assigned to tasks that require a high degree of monitoring alertness.

3. Also, consider testing individuals for their alertness before assigning them to a monitoring task.

4. Once changes have been approved, consider training the workers about the changes and their intended impact.

Ideas for Generic Problems:

1. If monitoring alertness is a generic problem, consider recommending a review of the jobs to redesign them and add more active tasks.

References:

For more information about vigilance and monitoring alertness, consider reading:

The Psychology of Vigilance by D. R. Davies and R. Parasuraman, 1981. Published by Academic Press, New York.

Engineering Psychology & Human Performance by C. D. Wickens, 1992. Published by Harper-Collins, New York.

Again, the Causal Factors were:

1. Flexible hose ruptures
2. Operator did not fix cause of high temperature
3. Automatic shut-off does not shut down unit
4. Operator did not shut down unit after the alarm

After reading all the Corrective Action Helper® Modules for all the root causes that were discovered and after considering the seriousness of each, the potential for future problems, and the systemic (generic) nature of each cause, the following corrective actions for all Causal Factors/root causes were developed.

1. Replace the old, flexible hose with a new, tested hose. (Causal Factor 1)

2. Develop policy on testing and use of equipment in temporary situations. (Causal Factor 1)
3. Remove the jumpers and place the automatic trip feature back in service. (Causal Factors 3 and 4)
4. Update automatic trip feature with new module to prevent spurious failures. (Causal Factors 3 & 4)
5. Negotiate contract revision so that contractor must notify and get approval from the facility prior to disabling any alarm or automatic safety feature. (Causal Factor 3)
6. Move diesel driven compressor away from temporary water treatment unit so that the alarm on the unit can be heard. (Causal Factors 2 and 4)

Note that all the Causal Factors are addressed.

The corrective actions were reviewed to ensure they were SMARTER. The SMARTER review is part of the development of corrective actions in the TapRooT® System. When developing corrective actions, they should be:

Specific – Specifically what must be done?
Measurable – Can we measure that it was effective?
Accountable – Who does it?
Reasonable – Is it worth doing (cost/benefit)?
Timely – Will it be accomplished soon enough for the risk involved?
Effective – Will it solve the problem?
Reviewed – Does it have unintended consequences?

As time passes and data is accumulated, the root cause data should be reviewed using Pareto Charts to detect potential areas for generic improvements. Also, data could be reviewed using Process Behavior Charts (either rate charts or interval charts, depending on the trends to be observed) to detect negative trends or verify that improvement has occurred. For more information about these advanced trending techniques, see: *TapRooT® Performance Measures and Trending for Safety, Quality, and Business Management*.[8]

Comparison of Results

A real incident similar to the Fish Kill incident was reported in an industry trade magazine. A 5-Why analysis had been performed. It found that the root cause was the sleeping operator. The magazine reported the operator had been fired because they had violated the company's no sleeping policy. Compare the "fire the operator" corrective action with the corrective actions presented using the TapRooT® System.

Corrective Action Comparison

Real Incident	TapRooT® Analysis
1. Fire the operator.	1. Replace the old, flexible hose with a new, tested hose.
	2. Develop policy on testing and use of equipment in temporary situations.
	3. Remove the jumpers and place the automatic trip feature back in service.
	4. Update automatic trip feature with new module to prevent spurious failures.
	5. Negotiate contract revision so that contractor must notify and get approval from the facility prior to disabling any alarm or automatic safety feature.
	6. Move diesel driven compressor away from temporary water treatment unit so that the alarm on the unit can be heard.

The real incident corrective action of firing the contract operator who was asleep:

1. Is easy.
2. Provides an example to others that they need to be alert.
3. Is consistent with the company policy.
4. Seems effective in that no other operators are found sleeping for several weeks after the contract operator is fired.

However, what factors were missed and left uncorrected and what problems were created by the “fire the operator” corrective action?

1. No actions were taken to improve the equipment reliability (either the reliability of the fire hose or of the automatic shutoff and alarm).
2. No effective corrective actions were taken to improve monitoring alertness. At best, only a temporary improvement in

alertness was achieved. In fact, the results of spot audits could be nonrepresentative because operators may be "covering" for each other to ensure that no one else gets fired. The moving of the diesel (so that the operator hears the alarm) and the fixing of the auto shutoff feature make the sleeping problem moot. Neither of these were addressed by the “fire the contract operator” corrective action.

3. After a contract operator is fired, other operators will view future investigations with suspicion and will be less likely to be fully cooperative. For example, would an operator admit that they had nodded off? Would another operator "tell" on a fellow operator if he or she found the other operator sleeping? Or would they just "handle it on-shift" and not tell anyone? Would covering up mistakes get in the way of effective learning from mistakes?

Even though:

- advanced root cause analysis and developing corrective actions is more difficult than blaming those involved, and
- the TapRooT® Investigation suggests more thorough and potentially more difficult to implement corrective actions than the "fire the operator" answer,

If the problem really needs to be solved (to improve industrial or process safety, quality, or productivity), then advanced root cause analysis and implementing effective corrective actions is worthwhile.

Will TapRooT® Work for Your Incidents and Accidents?

The TapRooT® System was developed to help investigators find root causes of safety, process safety, and quality issues. It was not developed from a fault tree nor is it used like a checklist. Instead, the TapRooT® System combines both inductive and deductive techniques with ***embedded intelligence*** to guide a systematic investigation to find the fixable root causes of problems. The system can be used either reactively (as in the example provided in this white paper) to prevent the recurrence of precursor incidents or major accidents, or the TapRooT® System can be used proactively to find ways to improve performance before a major accident occurs.

The TapRooT® System goes beyond the simple techniques of "asking why," cause and effect, fishbone diagrams, or fault tree diagrams. The TapRooT® System has embedded intelligence to guide investigators to find root causes that they previously didn't have the knowledge to identify. As Albert Einstein said:

"It's impossible to solve significant problems
using the same level of knowledge that created them."

The embedded intelligence allows the TapRooT® System to be simple to use by people in the field for investigation of low-to-medium risk incidents and yet robust enough for even the most complex major accident investigations.

Unlike other common root cause techniques, the TapRooT® System is an investigation system. This means the tools and techniques in the TapRooT® System are used in all phases of an investigation - from initial planning through the collection of information and root cause analysis to the development of corrective actions and the presentation of an investigation to management or other interested parties. The system is supported by patented TapRooT® Software that:

- makes presenting information easy and logical,
- provides trendable incident/root cause data, and
- includes a corrective action management database.

The TapRooT® System is used in a wide variety of industries, including:

- Oil & Gas
- Mining
- Pipelines
- Aerospace
- Healthcare
- Pharmaceuticals
- Food and Beverage
- Mass Transit
- Airlines
- Utilities and Nuclear Power
- Refining and Chemicals
- Telecommunications
- Aluminum and Steel
- Pulp and Paper
- Manufacturing
- Construction
- Railroads
- Shipping
- Government Facilities and Contractors

These industries use the TapRooT® System to:

- Improve industrial/occupational safety,

- Improve process and nuclear safety,
- Improve transportation safety,
- Improve product and service quality,
- Achieve excellent regulatory performance,
- Reduce environmental releases,
- Reduce human errors, and
- Increase service and equipment reliability.

A limited survey conducted in 2001 by the Center for Chemical Process Safety[11] showed that more CCPS Members used the TapRooT® Root Cause Analysis System to investigate process safety incidents than any other technique/process.

Over the years, TapRooT® Users have submitted many success stories that are documented in the Success Story topic of the TapRooT® Blog (www.taproot.com/blog).

Thus, we believe that the TapRooT® System will work for the problems you need to solve. That is why we can offer a money-back guarantee for TapRooT® Training:

Guarantee

Attend the TapRooT® Training. Go back to work and use what you have learned to analyze accidents, incidents, near-misses, equipment failures, operating issues, or quality problems. If you don't find root causes that you previously would have overlooked and if you and your management don't agree that the corrective actions that you recommend are much more effective, just return your course materials and we will refund the entire course fee.

The guarantee proves how confident we are that TapRooT® Root Cause Analysis will work for your company's incident investigations and problem-solving efforts.

The best way to learn more about finding root causes using the TapRooT® System is to attend a public or an on-site TapRooT® Course. These courses will get you started:

- 2-Day TapRooT® Root Cause Analysis Course for investigating low-to-medium risk precursor incidents
- 2-Day Equifactor® Troubleshooting and TapRooT® Root Cause Analysis Course for people interested in finding the root causes of equipment failures.

- 5-Day TapRooT® Advanced Root Cause Analysis Team Leader Course for people who may be called upon to investigate major accidents or precursor incidents.

There is also an annual Global TapRooT® Summit for networking, advanced topics, continuing learning, and refresher training.

Don't allow human errors and equipment failures to repeat. Find and fix the real root causes and prevent major accidents by using the TapRooT® Root Cause Analysis System.

References

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