

# ROOT CAUSE ANALYSIS

## IDENTIFYING THE ROOT CAUSE



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**On behalf of the Business Leadership and Administrative Services Office Technical Training and Development Section and the Strategic Environmental Management Program, I welcome you to today's webinar. I am Atwood Davis, of Apex Companies and I will be presenting this webinar on Root Cause Analysis.**

**Please mute your phones during the presentation. If you have any questions, you may type them in the chat and we will have several points during the presentation for discussion and answers programmed.**

## AGENDA

- Root Cause Analysis discussion
- Examples
- Exercise
- Questions and Answers

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Today's agenda will include a discussion of Root Cause Analysis, including what is Root Cause, and two methods for how to evaluate a problem to identify the root cause.

We will provide a hypothetical example and an actual example of a corrective action and we will discuss how root cause could be determined in each.

Since today's webinar is being held across all the Maintenance Districts and we do not know how many individuals are logging in directly versus how many are attending in groups we have not provided an exercise for you to discuss today. We will provide each District's SEMP Manager with an exercise that they can deliver at a time of their choosing. The exercise is a real example of a nonconformance/corrective action that occurred at Apex but could just as easily have happened in a PennDOT maintenance or construction project. In our exercise we will review an event in which our contractor hit a buried power line to a parking lot light system while excavating an underground tank.

Finally, we will take several points during the presentation to answer any questions that you may have. You can type in questions at any point during the webinar and we will respond during the programmed Q&A points.

## Why Root Cause is Important

Root cause is a part of the SEMP Corrective Action process:

- SEMP external auditors identified poor root cause analysis
- Recurring nonconformities
- Major nonconformance issued by external auditor
- Not fixing problems costs PennDOT additional \$\$ related to re-work, fines, violations, re-auditing, etc.



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Root cause is important as a part of the Strategic Environmental Management Program because when a nonconformance is identified, a corrective action is issued and the cause of the nonconformance must be identified to correct the conditions and prevent it's recurrence.

We have had recent issues relating to root cause analysis in SEMP. Notably, the external registration auditors have identified root cause analysis as a weakness. We have had occurrences of recurring nonconformance and we have received a Major nonconformance from the registrar due to recurring nonconformance that can be traced directly to insufficient root cause and correction.

Far too often what we see in the root cause description is that the individual assigned to respond to a SEMP corrective action re-states the finding as the root cause.

For example:

Finding: The scale that is used for salt spreader calibration was not calibrated.

Root Cause: The person calibrating the spreader did not know that the scale needed to be calibrated.

Corrective action: Calibrate the scale.

Preventive Action: Train the person calibrating the scale.

Another example:

Finding: The stockpile foreman did not fill out the inspection forms in the Combined Facility Response Plan.

Root Cause: The stockpile foreman did not know that there were inspection forms in the CFRP

Insufficient root cause analysis is evident in CAR/PARs across all Districts both in our internal audit program CAR/PARs and in the responses to CARs generated in the external surveillance audits.

When we do not fix a problem and prevent recurrence it costs PennDOT additional time and money to continually correct and re-correct the same problems within the organization. We also run the risk of losing ISO 14001 registration, major non-conformances require prioritized corrective action and additional external audits are required at added expense. When the issue is a regulatory problem, we can potentially get violations, fines, and be required to do additional or supplemental environmental projects.

So properly identifying the Root Cause is a fundamental element of SEMP's Corrective Action Program that can reduce re-work, help us keep ISO registration, and potentially keep us from receiving Notices of Violation.

## Learning Outcomes

After this webinar, you will be able to:

- Investigate Root Cause in a logical manner
- Identify categories of potential failures
- Identify causes and effects within categories
- Improve your corrective and preventive action process.

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At the end of this webinar, you should be able to better identify the root cause of nonconformance by looking at a number of different potential categories where causes can be identified. Ultimately better root cause analysis will improve your overall corrective and preventive action process.

So let us look at the formal definitions of root cause and root cause analysis from the American Society for Quality.

## WHAT IS A ROOT CAUSE?

**Root cause** is that most basic reason for an undesirable condition or problem, if eliminated or corrected, would have prevented it from existing or occurring.



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According to the American Society for Quality:

Further the American Society for Quality defines Root Cause Analysis as:

## DEFINITIONS

**Root cause analysis (RCA)** is the process of identifying causal factors, whether it be in an informal or structured approach.

*- Root Cause Analysis – A Tool for Total Quality Management – ASQC Quality Press*

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Taken in this context, the root cause is always negative. Root causes are usually defined in terms of specific or systematic factors.

Since, by definition, the root cause is the most basic cause of the problem, root cause is usually described in terms of the least common, organizational, personal, or activity denominator.

In SEMP, we tend to not ascribe problems or nonconformance in personal terms. More succinctly, we want to look for the reasons why it is not the individual's personal performance at issue. The assumption is that the individual person wants to perform their tasks responsibly and properly to protect the environment. As such, we do not want to identify personnel or their work performance as a root cause for a problem. When personnel fail to meet an environmental or SEMP requirement, we want to look at procedures/methods, equipment/materials, time/schedules, manpower and management issues that may relate to the failure. While a person may cause the problem, there should be an underlying cause to why they could not perform properly.

## RCA is the Why Analysis

### **What happened?**

Statement of the problem or nonconformance

### **Why it happened?**

The causes of the problem, using RCA to identify the **root** cause

What can be done to prevent it from happening again is the preventive action

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Root cause analysis has very basic goals. (1-2) If you are interested in finding the core reasons for an operational problem; after determining what happened it is important to focus in on (3-4) why it happened; and (5) what can we do to prevent it from happening again. If you keep this in mind it will help you identify the true cause. Don't make the process hard, just think about WHY a problem really happened. Without making an accurate assessment of what happened, or why it happened it is likely that the corrective action applied will be ineffective or will not prevent the problem from recurring.

## WHERE DID RCA BEGIN?

RCA originated in safety systems (c. 1940s) and quality systems (c. 1950s)

Why?

- Accidents or procedural failures can result in significant costs from fines, operational shutdowns, or injuries.
- Large organizations want to prevent the reoccurrence of issues at other locations.

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Root Cause has its formative beginnings as part of a safety and quality assurance/quality control systems that were intended to progressively reduce operational failures. Root cause analysis is one of a number of tools that have been developed in order to statistically reduce operational failure in production facilities.

Root cause analysis is a learning process that allows us to assess incidents that have already occurred and prevent their reoccurrence through procedural changes. This is done in order to reduce costs associated from accidents or operational failures. These could include workplace injuries, fines, shutdowns, delays in project completion, additional costs of rework, cleanup, etc. Root cause applies to all segments of operations.

Root cause analysis is conducted for a many reasons. A large organization, like PennDOT may also want to utilize this learning process to ensure that an operational failure that occurs at one facility will not reoccur at another or share solutions to common problems across facilities, counties, or districts.



## RESOLVING ROOT CAUSE

If we do not resolve the root cause of a problem:

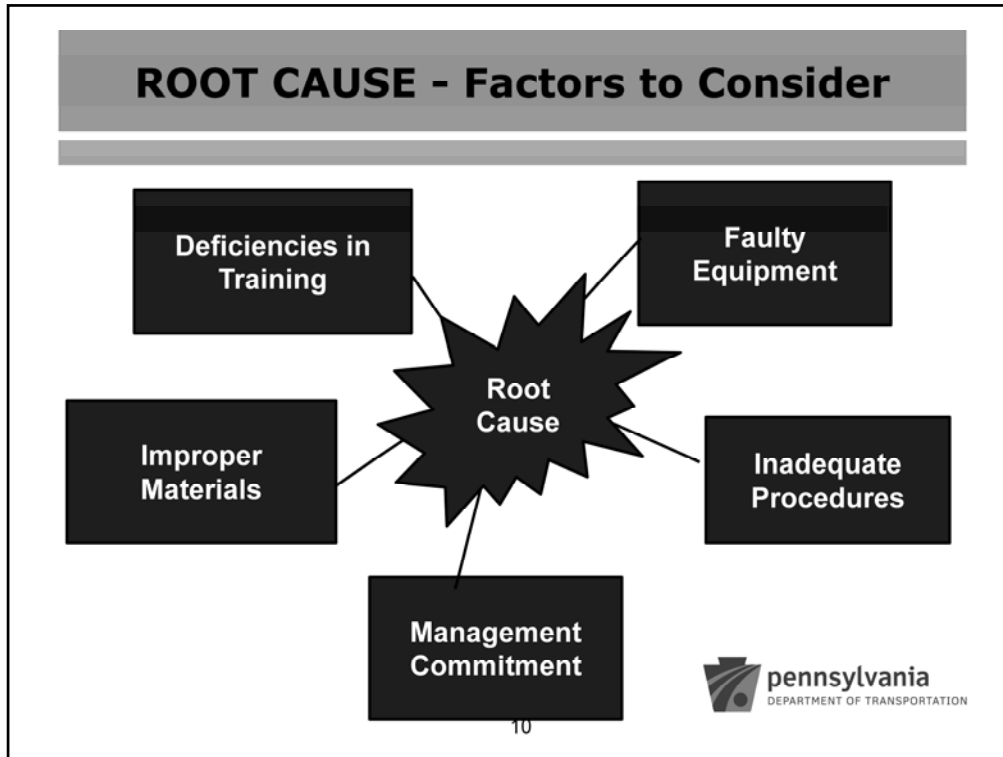
- We will ONLY temporarily correct problems;
- Problems will reoccur because the factors that fundamentally cause them will not be addressed.

***"Those who do not learn from history are doomed to repeat it." – George Santayana***

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Another quote related to repeating problems comes from Einstein who said "We cannot solve our problems with the same thinking we used when we created them." Organizations, like people have to learn from the issues that they face to prevent failures from recurring.



There are a number of factors to consider when identifying a root cause. For example:

- (1) Deficiencies in personnel training cross all areas of include inadequate training documentation, unclear personnel training requirements and procedures. These could lead to individuals not receiving the training needed, insufficient, or improper training for specific roles and responsibilities.
- (2) Faulty equipment could be derived from insufficient equipment, inspection, recordkeeping, and maintenance practices. These procedures would be in place to ensure that equipment functions properly
- (3) Inadequate procedures apply across all areas of operations, if procedures are confusing, or unauthorized changes can be made personnel may not be able to properly perform the task. If there is a lack of procedures, then personnel may perform the task inconsistently.
- (4) Operations, facilities, and equipment can have issues when management misallocates or does not commit sufficient resources to maintain personnel training, equipment maintenance programs, or define and support roles and responsibilities.
- (5) Improper materials or materials that do not meet specification may make it impossible for the work to be done properly despite the best efforts of the personnel.

These are categories where causal effects may appear. Categories where potential errors may occur and should be considered in the root cause analysis as we will see later in this presentation.

## CONDITIONS

- These Factors are Systematic :
  - Training
  - Mechanical Systems
  - Material Use
  - Operational Procedures
- Until These Conditions are Changed, Problems are Likely to Reoccur

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Operational procedures may mean more than just Standard Operating Procedures, it can be processes or process maps, etc. In the broader sense operational procedures should be understood as the manner in which the activity is accomplished or performed. If a procedure is written, you can review and audit it. If there is no written procedure but through observation and interview, you find that the activity is performed in the same manner by a number of different people over time, then the activity is proceduralized.

## ROOT CAUSE CHARACTERISTICS

We find that when the root cause is identified it:

- is the source of the problem;
- is controllable; and
- its elimination will eliminate or greatly reduce the problem.

There may be a number of apparent causes that contribute to the problem.

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The perspective that arises from Safety and Quality Management is that all operational errors are preventable and emergencies controllable with proper procedures, preventative maintenance and training programs in place. The negative effects from these common situations can be mitigated or minimized with appropriate programs.

As we previously noted, we concentrate on the a number of causal categories that have impact on any task performed. Within these categories, there are individual “apparent” causes. It is even possible that there is more than one root cause for the problem if more than one category contributes to the problem.

Let’s look at two methods that are commonly used to identify root cause, the next slide describes the first method.

## 5 Whys for Root Cause

### For Want of a Nail

- For want of a nail the shoe is lost;
- For want of a shoe the horse is lost;
- For want of a horse the rider is lost;
- For want of a rider the battle is lost;
- For want of a battle the kingdom is lost;
- And all for the want of a horseshoe nail.

- George Herbert

This quote describes a common and most basic method used to identify Root Cause which is called 5 Whys.

## The Concept of 5 Whys

Once we have identified potential causes in the categories, we use another tool to evaluate each individually using the technique called 5 Whys.

why?  
why?  
why?  
why?  
why?

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A key tool for Root Cause is the use of 5 Whys as a technique that explores the cause and effect relationships of underlying problems.

For every effect there is a cause, but the results chain between the two can be long and finer as you move from input to activity to output, outcome and impact.

## FIVE WHYS?

- Continue to ask – Why?
  - Why? To characterize the problem.
  - Why? To find out the proximate cause.
  - Why? To determine the training, procedural, mechanical and material systems involved.
  - Why? To identify the root cause.
  - Why? So that it is not repeated.

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Five whys is the most common method for identifying a root cause that was originally developed by Toyota. The assumption is that by the fifth time that we have asked why we will likely have uncovered the core reason or set of reasons that a problem persists in an organization or business.

Using 5 Whys alone may not get you to the root cause because there is a tendency to stop at symptoms rather than going lower to the actual causes. Other limitations in using this tool alone include isolating a single cause can be difficult because each question could generate different answers leading to different causes.

This is why using two techniques together can help to identify potential causes in categories and then compare the inter-relationships between the various causes....

Lets look at how 5 Whys works....

## **EXAMPLE IMPROPER OIL DISPOSAL**

Joe poured oil down the drain.  
Lets just look at exploring 5 Whys

1. Why did Joe pour oil down the drain?

- He wasn't trained...
- Ok then, train Joe, Problem Solved....Right?

**Wrong !! Next time it will be... Why did Steve Pour Oil down the drain?**

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Often training is identified as a root cause but then the nonconformance is repeated....



## IMPROPER OIL DISPOSAL

2. Why wasn't Joe trained?

- Because he was not included in the last course.
- Then put him in the next course, problem solved?

**Wrong !! Next time it will be another new employee pouring oil down the drain?**

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Let's ask why Joe may not have been trained, because

- 1.) Management did not adequately identify his training requirements
- 2.) Management did not track training or training records against the identified training requirements...(item 4 of the next slide)

## **IMPROPER OIL DISPOSAL**

3. Why wasn't Joe in the last course?
  - Management did not identify the course as a needed training for Joe.
4. Why wasn't it identified?
  - Because management did not have a training matrix for his position.
5. Why was there no matrix for training?
  - Because the training protocols do not require identifying what positions should take the training.

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Items 3, 4 and 5 point toward a management issue that no one has taken ownership to ensure that employees receive proper training. The Training Coordinator may be responsible for tracking but HR and management are responsible for identifying the training needs of the employee. Where is the breakdown occurring?

SO, there isn't an established or properly functioning training protocol...is this the root cause?

How do we fix this?

## No More Oil Down the Drains?

Establish a training protocol that:

- Identifies SEMP training needs for each position
- Trains workers in proper procedures
- Documents training to ensure that everyone is sufficiently trained
- Assigns responsibility, means, and timeframe.

Does this fix the problem?



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Did we fix the problem, will it never occur again? Not necessarily.

Does using 5 Whys get us to the root cause of Joe pouring oil down the drain?

Now lets take a look at a different tool to evaluate causes of a problem called the “Cause and Effect” or “Fishbone” diagram where we categorize causes to try to isolate the root cause.

**Break for Questions**

## Cause and Effect

- Categorize potential causes using a tool called a cause and effect diagram.
- Identify the major categories that could cause a nonconformity or failure.

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Cause and effect diagrams are sometimes called Fishbone Diagrams because their shape resembles a fish skeleton. They were developed by Dr. Kaoru Ishikawa who was a Japanese professor of engineering in the 1960's as a quality management tool to identify root causes.

The typical categories that are used in the diagram are shown as follows:

## Categories of causes

- Manpower (not individual error)
- Materials and Equipment
- Methods and Procedures
- Time and Schedule
- Management

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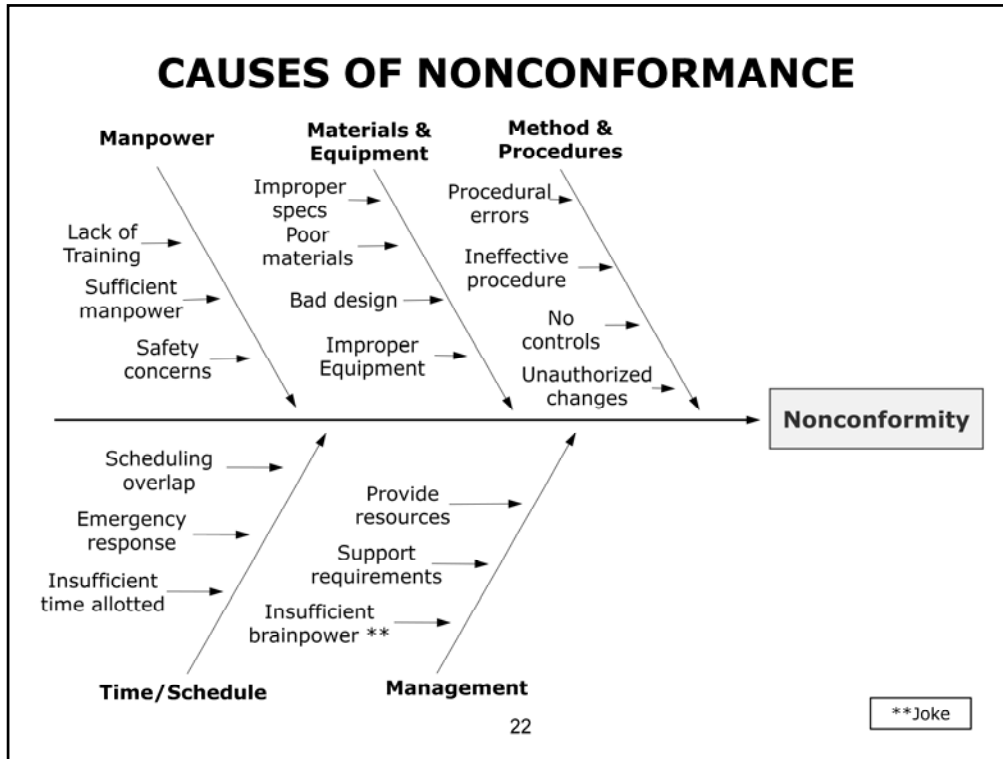
In manufacturing, there are some differences:

Machine (technology)

Measurement (inspection calibration)

Materials

We can group this into Materials and Equipment as a single category and put measurement/calibration into the Methods and Procedures category for most PennDOT SEMP operations.



Looking at the generic Cause and Effect diagram, you can see that within each category there are a number of potential elements that can have causal effects that contribute to nonconformance. Any number of additional elements can be added within these categories based upon the nonconformance investigation.

Each category should be examined to determine if there is a contribution or contributing cause that results in the nonconformity. For example 1—2—3—4—5

Examples of potential causes could be equipment maintenance procedures, preventive maintenance schedules, contracting procedures that are not effective. Many potential causes that can lead to an effect.

Evaluating different categories of causes can help identify the root cause or several roots that could be explored.

## **EXAMPLE IMPROPER OIL DISPOSAL**

Joe poured oil down the drain.  
Lets look at Cause and Effect

Investigating in each of the categories that we have defined, can we find different causes that contributed to oil being improperly disposed?

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So let's return to our example of improper oil disposal and poor old Joe. Using a cause and effect approach we can look at the categories that may have contributed to the oil disposal problem. Remember, we start with the assumption that the individual is not "at fault" and that everyone wants to do their work properly to protect the environment.

## **IMPROPER OIL DISPOSAL**

**Joe poured oil down the drain, we talk to Joe's manager and find out a few details:**

1. Joe did not receive environmental training.
2. After doing an oil change he asked another mechanic where to put the oil and was told to put it in the used oil tank.
3. There is no oil disposal procedure.
4. Tank was full so he put it down the drain.

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As we have seen in many CAR/PARs that have been submitted in the SEMP, (1) training is often identified as a root cause but then the nonconformance is repeated....

So we must look at other causes and the effects. 2—3—4

As the next step in the process we should inspect the actual facility to determine if there are issues with used oil storage.



## **IMPROPER OIL DISPOSAL**

### **So we check the tank:**

1. The tank is still full.
2. The tank has a monitor that only shows half-full.
3. No one knew the monitor was broken.

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Going back into the garage area, we inspect the tank and discover (1) but  
(2) The gauge on the tank registers as half-full.  
(3) It appears that the gauge is broken and no one realized it.

## **IMPROPER OIL DISPOSAL**

### **Interviewing the garage supervisor:**

1. There is no scheduled monitoring of the tank level.
2. The tank does not have a scheduled preventive maintenance program.
3. The supervisor schedules pick up when the tank is full but thought it was only half-full.
4. He contacts the business office to get PO for used oil disposal.

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So where do we go from here? Item 4 would suggest the next step.

## **IMPROPER OIL DISPOSAL**

### **Interviewing the business manager:**

1. They issue a PO when the tank is full.
2. There is currently no used oil contract, it expired a month ago.
3. It takes about 30 days to get a contract in-place.
4. The business manager notified the county manager about the contract but the garage supervisor was not notified.

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Who else should we interview in the chain-of-command?

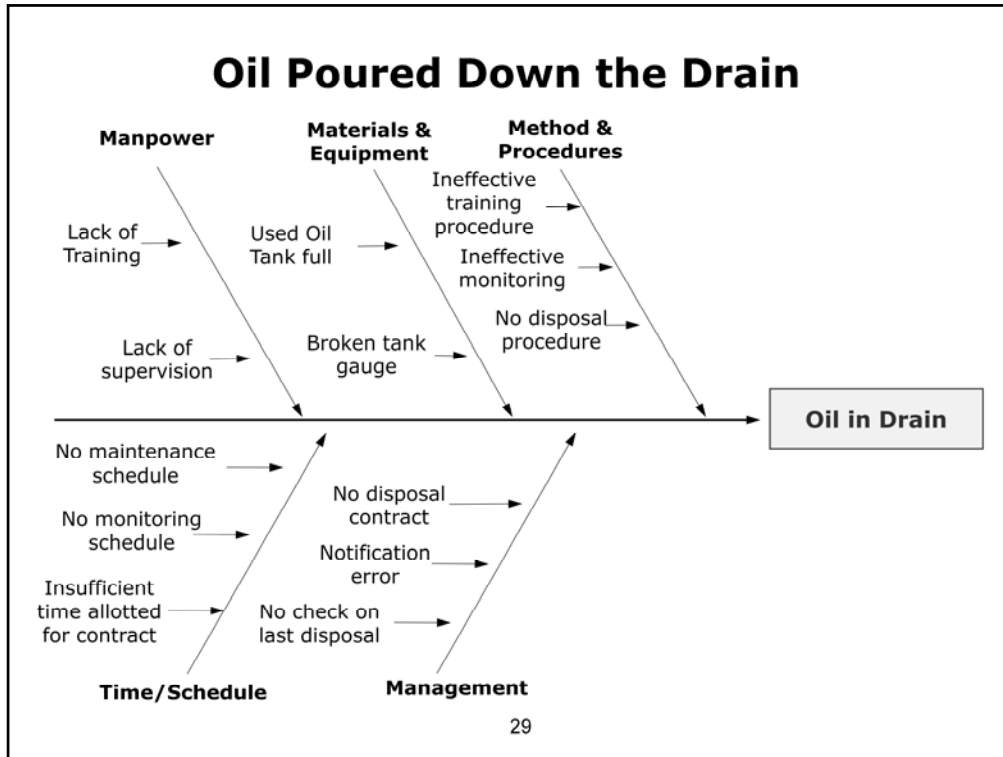
## **IMPROPER OIL DISPOSAL**

### **Interviewing the county manager:**

1. He remembers that the contract expired.
2. He saw no need to rush for a new contract because the garage supervisor said the tank was half-full.
3. Usually the tank is full every three months.
4. County manager did not check the last time the tank was emptied.

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At this point, using the cause and effect diagram a different picture of the root cause and contributing causes of the problem starts to emerge.



Now we start to see an entirely different picture of the errors that caused the problem, it is not as clear cut as we suspected by just using the 5 Whys. Looking at the Cause and Effect diagram that we generate from the interview process we see that there are causal elements in each of the categories.

1 (MANPOWER) Interviewing Joe and his supervisor shows that Joe was not trained and he did not get supervision on what he should do when the tank was full.

2(EQUIPMENT) Inspection of the facility revealed that the tank is still full and that there was a broken gauge.

3(PROCEDURES) Looking at the procedures (including interviews with the supervisor/managers and business manager) reveals that the training procedure was not adequate, that monitoring of the tank was not effective because there is a broken gauge that no one identified nor is there a monitoring procedure, and that there is no specific disposal procedure.

4(SCHEDULES) Through interview and observation we see that there is no preventive maintenance schedule on the tank or gauge, there is no routine monitoring schedule on when to check the tank and that contracting did not build in enough time to issue a new contract upon expiration in the event that the tank was almost full.

5(MANAGEMENT) We see that the disposal contract was expired and management did not prioritize getting a new contract, that the business office notified management about the contract but that there was no check on the last time the oil was disposed (3 months usually for tank to be full), nor a check on the actual tank level when the notification about the contract occurred.

Too often we get bogged down in looking at the personnel and the effectiveness of their training. While training is part of the issue in this nonconformity, clearly just training Joe and everyone in the garage will not prevent recurrence. OK maybe they won't dump oil down the drain, but if there is no where available to put the oil it will likely end up in the trash, mixed into another drum with who knows what, or stashed away in a drum that no one knows about to become a problem later.

## ALTERNATIVE SCENARIO

Why did Joe pour oil down the drain?

- The used oil tank was full.
- Insufficient monitoring and documenting of tank volume - **Methods and Schedule**
- Improperly working tank volume indicator and no PM schedule - **Equipment and Schedule**
- Insufficient training and no procedure- **Methods**

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Bottom line, the used oil tank was full and Joe did not have a proper place to dispose of it. Without training, he put it down the drain.

## ALTERNATIVE SCENARIO

Why did Joe pour oil down the drain?

- **The used oil tank was full.**
- Inadequate Procedures for Training,
- Device Calibration/Maintenance,
- Documentation of Oil Disposal, and
- Contracting and notification.

**Management, Methods, Schedule = ROOT CAUSE**

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To keep this from happening again, we have to ensure that there is sufficient available volume in the tank for the mechanics to dispose of the oil.

To do this, we must ensure that the tank level is monitored, that the measuring device is working and that there is a contract in place for disposal. We need a working process **and** we need to train the personnel in proper disposal procedure.

Root Cause is not a singular identified issue. Sometimes the root cause identifies that there are a number of issues that must be addressed. Root cause may lead to a corrective action for a number of processes or procedures to correct the problem and other processes or procedures that may be corrected or implemented to prevent the problem from recurring.

At this point in time, we see that the personnel who are assigned to corrective action in the program tend to take a simplistic approach to root cause and don't actually go back and investigate what happened that allowed the problem to occur. We now want them to take that extra step, it takes a little more time and effort upfront but it should prevent us from performing the same corrections over and over again.

Don't look for a single thing that went wrong because it is usually a string of occurrences that lead to the nonconformance. We have to fix all of the causes in order to prevent recurrence. It is not as simple as just identifying and individual and training them.

## ROOT CAUSE

In the Oil Down the Drain example there were multiple causes that contributed to the problem.

**But** the main or ROOT reason turns out to be the **county did not provide adequate and appropriate storage for used oil.**

Clearly the 5 Whys did not find root cause.

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So using 5 Whys alone would not have likely lead us to many of the causes that the cause and effect diagram lead us to evaluate because we tend to look first at the individual and whether or not they were trained. Once we have hit on the training issue, we continue down that path toward “enlightenment” because we have taken the symptom of Joe’s lack of training as the root cause.

But we had to actually consider many other causes to identify what actually occurred.

Root cause is not just re-stating the non-conformity, such as:

- Non-conformance statement: Joe poured oil down the drain.
- Root cause: Joe was not aware that he should not pour oil down the drain.
- Corrective Action: Train Joe.
- Preventive Action: Train everyone regularly.

Categorizing the potential causes based on interview and observation leads to the true Root Cause.



## ROOT CAUSE to ISO Clause

We can identify cause against the ISO 14001 clauses for trend analysis. The SEMP Manager can assign clauses for tracking:

- Operation (Clause 4.4.6)
- Maintenance (Clause 4.4.6)
- Communication (Clause 4.4.3)
- Documentation (Clause 4.4.4 or 4.4.5 if a document control issue)

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For the purposes of tracking where non-conformity occurs, we can assign the ISO clause to each of the causal elements and to the Root Cause. This would be done by the District SEMP Manager and the Central Office SEMP Contract Manager. We are not asking the assignee for the corrective action to apply the ISO Clause to the corrective action, but when we have the root cause and the categories that the cause(s) are in, we can then use the ISO Clauses for tracking/trend analysis.

This is classic to the management system Plan – Do – Check – Act cycle for continual improvement. During the course of the year and for issuance of the annual report to Top Management, we can look at trends (check step) and propose actions for improving. These actions can then be placed into the planning process as objectives for the next year for the entire SEMP.

## THINGS TO CONSIDER

- Correcting a nonconformity typically consumes resources.
- When root cause is not fully identified, the nonconformity can reoccur in the same area or an area not previously audited & consume more resources.

Nonconformance review requires more than one individual attempting to assign the cause of what happened. Root cause analysis should be undertaken as a process of interview and observation that, while intensive, can save time and money in the long run by properly identifying the cause of a problem and proposing a realistic and effective solution to fix and prevent the problem from occurring over and over.

## WHAT ROOT CAUSE IS NOT

- Blame Game
- Exhaustive
- Preventative Action



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Remember: Pointing the finger at individuals is not an appropriate means of solving organizational problems. Identifying the Root Cause of a problem instead points to the systemic failures that can be fixed at the organizational level.

## THINGS TO CONSIDER

- Preventing a nonconformity may consume some resources but the magnitude will likely be less than addressing a corrective action.
- Preventing the nonconformity from recurring can take very little resources if the Root Cause was truly identified and corrected.

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Preventing recurrence is the goal of any corrective action process. At most, the preventive measures are ensuring that the correction is applied in all areas/facilities where the nonconformity could occur.

At PennDOT this means that once you have a nonconformity at a Stockpile for example. You must check to see if it occurred at other stockpiles. Whether or not you find the nonconformance at other stockpiles, you must apply the corrective action at all stockpiles to keep it from happening. This is sometimes called Lessons Learned, where the lesson learned in fixing the nonconformance is shared with all (typically this would occur at the quarterly SEMP Manager's meeting, and at County Manager meetings within the District). The preventive measures can then be applied wherever the nonconformance can occur.

Sometimes this is simple when the corrective action is at a central location, like establishing a procedure for the entire District, or a contract that covers the entire District. Other times you have to correct at the individual locations and perform preventive maintenance, inspections, or other processes.

In some cases, identifying root cause may not lead to immediate correction because the correction may require resources or funding to eliminate. Salt staining at stockpiles is an example of the cause is known (must use salt/ no viable alternative) but the only way to eliminate staining on ground is to pave and keep pavement clean. This requires funding and planning to accomplish over a much longer period of time. Until then, we can only mitigate and minimize the problem at unpaved facilities with good management practices and prompt cleanup of spills and stains.

## Questions and Answers

Now it is time to look at any questions that you may have sent to us.

## REAL WORLD EXAMPLES

Let's look at some actual examples of nonconformity and root cause from the Districts and Counties.

# EXAMPLE

**SEMP CORRECTIVE/PREVENTATIVE ACTION REPORT (CPAR)**

1. INITIATED BY (Name & Title) J. Weaver - Auditor (External Co.)		2. DISCOVERED THROUGH External Audit		3. TRACKING NUMBER SA7-CAR000-03	
4. LOCATION District Office		5. DATE OF FINDING 11-02-2010			
6A. FINDINGS Chemical management is not effective in all instances.		6B. ISO 14001 ELEMENT 4.4.6			
7. FINDING REVIEWED WITH (Name & Title) John Smith - SEMP Manager		8. ORG RESPONSIBLE FOR CPAR District 7-D			
9. CPAR RESPONSE ASSIGNED TO (Name & Title) William Jones - District Maintenance Manager		10. CPAR RESPONSE DUE DATE 12-09-2010			
<input checked="" type="checkbox"/> Major Nonconformance <input checked="" type="checkbox"/> Minor Nonconformance <input type="checkbox"/> Opportunity for Improvement					
<b>11. ROOT CAUSE</b> The root cause was due to confusion on the part of garage personnel and the proper containment and disposal of waste material. In the particular instance, the waste was in an area that is used by only one person and only few waste is placed in the barrels. Check only one of the following to categorize why the nonconformance most likely occurred: <input type="checkbox"/> Responsibilities <input checked="" type="checkbox"/> Training <input type="checkbox"/> Operational Controls <input type="checkbox"/> Info on reverse ->					
<b>12. CORRECTIVE ACTION</b> (include identification of responsibilities and action due dates) The SEMP Manager discussed with the County Equipment Manager the problem discovered during the audit and ways to ensure that it does not result in another incident. This was done on November 9, 2010. <input type="checkbox"/> Info on reverse -> <input type="checkbox"/> Check this box if the proposed corrective action requires a Level 1 Procedure Revision (if unsure leave blank)					
<b>13. PREVENTIVE ACTION</b> (include identification of responsibilities and action due dates) The District Equipment Manager will have a meeting with each county equipment manager and their personnel and go over waste disposal and containment with the emphasis on hazardous material. This will be done by January 31, 2011. Reviews of the garage will be performed on their waste containment and disposal using the SEMP checklist for: Hazardous Waste Storage, Residual Waste Storage, Product Drum Storage and Leak Oil Storage. <input type="checkbox"/> Info on reverse ->					
<b>14. CPAR PROPOSED BY</b> (usually Same as Box 7) Name: William Jones Title: District Equipment Manager Date: 11/02/2010					
<b>15. APPROVAL OF CORRECTIVE/PREVENTATIVE ACTION</b> Name: John Smith Title: SEMP Manager Date: 11/22/2010					
<b>16. VERIFICATION OF CORRECTIVE/PREVENTATIVE ACTION</b> (by Initiator or SEMP Manager) Name: John Smith Title: SEMP Manager Date: 1/27/11				<b>17. CLOSED</b> (by SEMP Manager only) Name: John Smith Date: 1/25/11	

Rev 7, 14 Nov 10



Many of you may recognize the SEMP Corrective Action Form shown here, there are a number of examples that we received and we will look at one to illustrate a typical response to a SEMP corrective action. The names have been changed to protect the innocent.

# EXAMPLE

TO BE COMPLETED BY INITIATOR	1. INITIATED BY <i>(Name &amp; Title)</i> J. Weaver – Auditor (External Co.)	2. DISCOVERED THROUGH External Audit	3. TRACKING NUMBER SA7-CAR0600-03
	4. LOCATION Harrisburg County 01		5. DATE OF FINDING 11-02-2010
	6A. FINDING Chemical management is not effective in all instances.		6B. ISO 14001 ELEMENT 4.4.6
	7. FINDING REVIEWED WITH <i>(Name &amp; Title)</i> John Smith - SEMP Manager		8. ORG RESPONSIBLE FOR CPAR District 7-0
	9. CPAR RESPONSE ASSIGNED TO <i>(Name &amp; Title)</i> William Jones – District Maintenance Manager		10. CPAR RESPONSE DUE DATE 12-09-2010
	<input type="checkbox"/> Major Nonconformance		<input checked="" type="checkbox"/> Minor Nonconformance

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An external ISO Auditor identified that at the Harrisburg County 01 that Chemical Management was not effective in all instances. This is a pretty general/vague finding against ISO 14001 Clause 4.4.6 Operational Controls.

The SEMP Manager was escorting the external auditor during the audit and took good notes. In addition, the SEMP Manager kept notes during the auditor’s exit meeting. This finding was based upon observation that one individual had his own “special drum” where he placed waste and the drum was not in a proper containment and was not properly labeled. Thank goodness for good notes and observation by the SEMP Manager.

Well the SEMP Manager assigned this CAR to the District Maintenance Manager (DMM), let’s see what they came up with as a root cause.



## EXAMPLE 1

### 11. ROOT CAUSE

The root cause was due to confusion on the part of garage personnel and the proper containment and disposal of waste material. In the particular instance, the waste was in an area that is used by only one person and only his waste is placed in the barrels.

Info on reverse→

Check only one of the following to categorize<sup>1</sup> why the nonconformance most likely occurred:

Responsibilities

Training

Operational Controls

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So the Root Cause was confusion? Personnel were confused and there was some issue about proper containment and disposal. On top of that... it was one individual. The root cause was categorized as a training issue.

Does this seem to be a well defined root cause?

How does this compare to what we have talked about regarding not identifying it as an individual personnel problem?

What about jumping straight to training as the primary issue? Utilizing the check boxes alone does not give sufficient description to the root cause. These boxes were originally added to the SEMP CAR/PAR system to ensure that there was a way to track or categorize root causes identified not to be used as a root cause in and of itself.

There also seems to be some categorical issues related to containment (equipment/facility), and disposal (contract? Or other potential management issue?)

Let's look at the corrective and preventive actions that came out of the root cause identified.

## EXAMPLE

### 12. CORRECTIVE ACTION *(Include identification of responsibilities and action due dates)*

The District Maintenance Manager discussed with the County Equipment Manager the problem discovered during the audit and ways to ensure that it does not result in another incident. This was done on November 9, 2010.

Info on reverse→

Check this box if the proposed corrective action requires a Level 1 Procedure Revision (If unsure leave blank)

### 13. PREVENTIVE ACTION *(Include identification of responsibilities and action due dates)*

The District Equipment Manager will have a meeting with each county equipment manager and their personnel and go over waste disposal and containment with the emphasis on hazardous material.

This will be done by January 31, 2010. Reviews of the garage will be performed on their waste containment and disposal using the SEMP checklist for: Hazardous waste Storage, Residual Waste Storage, Product Drum Storage and Tack Oil Storage.

Info on reverse→

The DMM talked to the particular County Equipment Manager about ways to ensure that this doesn't happen again. Well that sounds ominous doesn't it? We have to assume that the discussion was more than don't let this happen again, but we do not know if there were any corrective measures taken.

As a corrective action related to a root cause identified training category, it does not appear that any training was done. Nor does it appear that any formal corrective measure was actually performed to fix the actual observed non-conformity. Even if we accept the root cause, we clearly have not documented anything more was done other than the DMM talked to the CEM. Do we have any kind of formal documentation of a meeting that occurred or an agenda? Even more important....What happened to that drum? Do we know what exactly is in it (characterized)? Has the drum been labeled, properly stored and/or disposed?

Let's look at the Preventive Action.

The District Equipment Manager will meet with all CEMs and personnel to review waste disposal and containment. This is a step in the proper direction because we do not want to fix an issue in one county only to see it happen again in a different county. Additionally, there will be reviews of the garages using a specific checklist for a number of storage scenarios. It appears that the meetings will be completed by a specific date but no date for completion of the garage reviews was specified. There is no indication if the garage reviews are a one-time review or will be an ongoing program. And once again, there is no actual training that appears to have occurred. Also note that the preventive action meeting appears to be scheduled **before the corrective action was identified**. Clearly this is a typo but an external auditor would pick this up.

## EXAMPLE

Why? To characterize the problem.

Why? To find out the proximate cause.

Why? To determine the training, procedural, mechanical and material systems involved.

Why? To identify the root cause.

Why? So that it is not repeated.

why?  
why?  
why?  
why?

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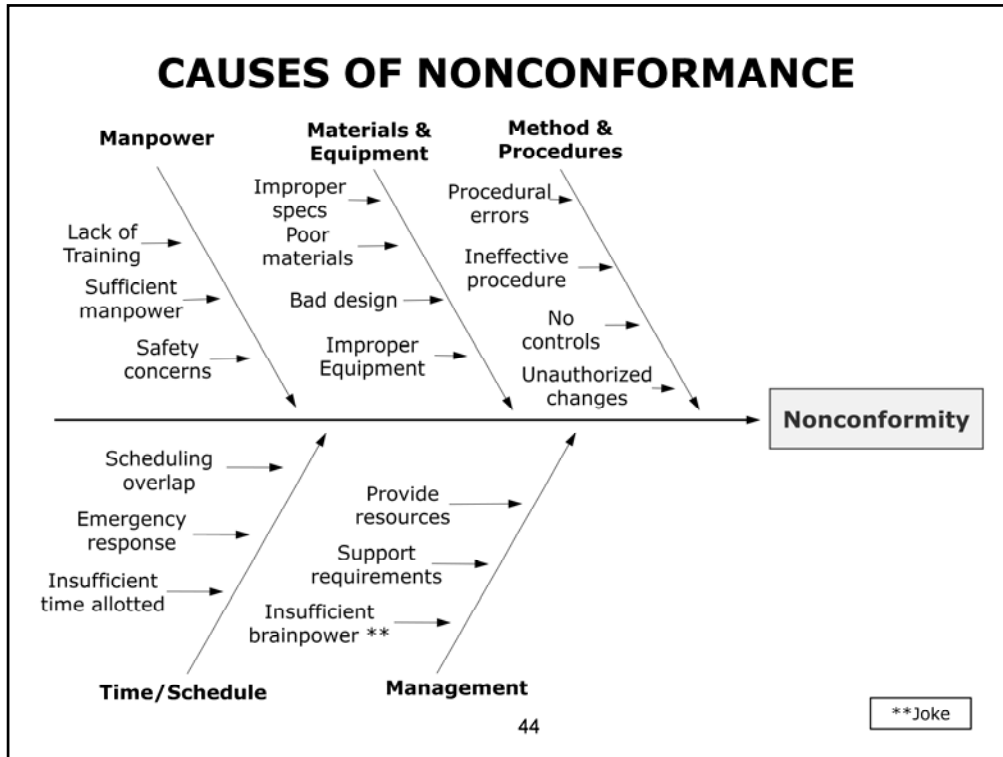
1.) Why did this issue happen? Not identified in the example root cause. We know that the issue identified is an occurrence at one garage where one individual put waste in drums that were not contained and perhaps not properly labeled. Let's assume that the individual was not trained OR did not have the knowledge about proper waste storage and disposal.

2.) Why didn't this person know how to properly store and dispose of waste? Unknown, as you can see without some interviewing and observation we cannot even get through 5 Whys analysis.

But somehow, the root cause is "Personnel were confused and there was some issue about proper containment and disposal. One individual and one storage area. The root cause was categorized as a training issue." How do we get to this conclusion without additional facts?

As previously shown with Joe and the oil, the likelihood is that we will not get a root cause via 5 Whys as the situation and the root cause is very similar. How then do we get a root cause for this occurrence and what kind of corrective and preventive measures are warranted?

The most likely way that we will find root cause is through the "Fish-bone Diagram" and examining the different categories of potential causes.



Again, starting with the five categories Manpower, Materials and Equipment, Methods and Procedures, Time/Schedule, and Management we can look at the causes and effects within each to see if there are clues to the true root cause.

## Manpower

1. We appear to have some lack of knowledge or training as a potential cause
2. Unlikely that there is a staff/manpower shortage for a cause.
3. Safety issues? No reason to improperly store waste due to a safety concern.

Looking at manpower issues we see potential training issues contributing to the problem. But there does not appear to be a manpower/staffing level issue. Nor can we point to a safety issue and a reason not to store waste properly. If anything, not storing waste properly can become a safety issue.

## Materials/Equipment

Need to investigate at the garage:

1. Is there a proper area designated for waste storage?
2. Is there sufficient storage capacity?
3. Are proper labels available?
4. How often are wastes disposed? How is the volume monitored?

Similar to the Joe example, the garage itself should be observed and inspected to ensure that there is no facility or equipment reason why the waste was put in an “alternate” drum or location. 1—2—3--4

## Methods/Procedures

1. Is there a written procedure for waste storage? If yes, review to ensure that it is not confusing or inaccurate?
2. Has there been any unauthorized changes to procedures or to the actual storage area?
3. If there is no written procedure, how do people know what to do? Interview staff to see if everyone does it the same way.
4. How are personnel trained? Records?  
\*\* Potential cause of the noted “confusion”?

One document that should be examined is the Combined Facility Response Plan, the Spill Prevention Control and Countermeasures components should spell out where petroleum and used oil should be stored. The CFRP should describe where waste storage is located at the facility. Is the CFRP accurate?

## Time/Schedule

1. Is there some “time pressure” to get work done? Was the waste improperly stored to “save time” ?
2. Were several jobs going on at the same time and the employee could not access the proper storage area due to others use? Seems unlikely, unless the area was locked and the person controlling it was not there.

Is there any reason that the waste was improperly stored to complete the work quicker? Is it possible that placing proper storage closer to the work area could actually improve efficiency? This could possibly turn a nonconformance into a continual improvement.



## Management

1. Is there a contract for disposal?
2. Who contacts the contractor for pickup?
3. Who monitors waste volumes? Is there a schedule?
4. Does management support proper storage procedures?
5. Are there any routine checks of storage?

Once investigated we may find that there is more than a training issue and a need to conduct a garage “review”.

## Summary

1. Investigation and interviewing of additional personnel appears needed.
2. Generation of a Cause and Effect Diagram based upon the findings.
3. Corrective and Preventive Actions should be based upon the causal elements.
4. Keep it simple, do not generate additional checklists or an inspection program unless absolutely necessary.

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Once investigated it is more than likely that we may find that there is more than a training issue and a need to conduct a garage “review”.

**Break for Questions**

## Questions

Thank you for attending and we hope that today was helpful and instructive.

If you have any further questions you can forward them to Mr. John Clarke and we will get back to you individually.

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We will be sending an exercise to the District SEMP Managers later this week. Again, thank you for attending this webinar, if you take the time to evaluate nonconformity and properly identify root cause using the techniques that we have shown you today, you will see improvement in your corrective action program.