Incident Investigation Principles & Techniques 101

An Online Continuing Education Course for Engineers

Course Number: F-3007

Credit: 3 Hours / 3 PDH / 3 CPD

Incident Investigation Principles & Techniques 101

Jeffrey S. Caudill, P.E.

Introduction

An "incident" is any unplanned or undesired event that negatively impacts or could have impacted your facility's operations. The primary incident areas most commonly monitored are personal safety, environmental, process safety, product quality, reliability, and security of assets. Assets include people, property, equipment, environment, and the surrounding community.

Incident Investigation programs are often perceived as a necessary evil. However, when your facility's management systems fail, an incident investigation is the only avenue to facilitate the necessary change to prevent a repeat event.

There are many companies that offer *root cause* incident investigation tools, applicable once a cause is determined. This course will not promote or recommend any particular *root cause* management system. The purpose of this course is to teach you the principles and techniques required to successfully investigate any unplanned or undesired event, regardless of the tool utilized to determine *root causes*. Further, this course will enhance your skills as an investigator by providing a road and direction for all the work that must be completed accurately to finalize a thorough investigation.

A *root cause* is defined as an underlying cause or a deep-rooted cause that may not be obvious from a general review. Addressing and mitigating the *root cause* will either reduce the chances of the event occurring again or drastically lengthen the time between events. Comparable to a weed, if you cut off the top, it will grow back, but if you kill the root, the rest will wither and die. Addressing a *root cause* will remove many other general causes, sometimes referred to as "band-aid fixes."

Correctly performing ten basic steps will improve your facility's incident investigation program. If you are interested in improving your own skills in this area, this course will propel you to an expert level, even if you have never conducted an incident investigation before. What's more, this knowledge will help you understand what to do when an incident occurs. How can this all be accomplished in a single course? Just like sports, those who master the basic mechanics and can perform them flawlessly without thought and excel.

This course is meant as an enhancement to an existing investigation Management System. This course does not teach advanced *root cause* determination analysis tools but fills in the voids many investigation programs leave up to the student to learn through experience. You may be able to use this course to resolve *minor incidents.* This Ten-Step program will perfect your investigation skills and can catapult you ahead of your peers.

Are you ready to learn the ten basic incident investigation steps in detail? This ten-step process applies to any investigation process, whether regulated by OSHA or not. What does this mean? Whether you conduct simple investigations or complex, under regulatory necessity or because it improves your companies' competitive advantage, this course is for you. Let's walk through the process together to become experts in the basics of managing an incident investigation.

Why Do We Investigate?

There is a basis of application for the Occupations Safety and Health Administration (OSHA) rules. This course will provide some explanation of the OSHA regulation and its application. However, for construction, manufacturing, chemical, refining, and other industries that meet their applicability rules, the following rules may apply. This set of rules is for the Chemical and Refining Manufacturing Industry for the expressed purpose of managing highly hazardous chemicals (HHCs).

On July 17th, 1990, OSHA issued a proposed rule for the management of hazards associated with processes using highly hazardous chemicals. This rule, called the Process Safety Management standard, was finalized on February 24th, 1992.

Below is the actual regulation, as stated in the OSHA rule for incident investigation. As with most governmental regulations, they provide only a framework or basis. Therefore, the burden of interpreting an application falls upon your organization. Any policy created by your company that expands, explains, and interprets the regulation becomes your compliance rules as well. What does this mean? If you write it in a policy and say you are going to do it, that is what OSHA will hold you to. Compliance with your written incident investigation policy is of utmost importance. It does not matter that other companies have a different facility or even another facility in your own organization. It is what your organization determines OSHA rule 1910.119(m) to mean to them.

OSHA Regulations State: 29 CFR 1910.119(m)

1910.119(m) Incident investigation.

1910.119(m)(1) The employer shall investigate each incident that resulted in, or could reasonably have resulted, in a catastrophic release of a highly hazardous chemical in the workplace.

1910.119(m)(2) An incident investigation shall be initiated as promptly as possible, but no later than 48 hours following the incident.

1910.119(m)(3) An incident investigation team shall be established and consist of at least one person knowledgeable in the process involved, including a contract employee if the incident involved work of the contractor, and other persons with appropriate knowledge and experience to

thoroughly investigate and analyze the incident.

1910.119(m)(4) A report shall be prepared at the conclusion of the investigation, which includes at a minimum:

1910.119(m)(4)(i) Date of incident;

1910.119(m)(4)(ii) Date investigation began;

1910.119(m)(4)(iii) A description of the incident;

1910.119(m)(4)(iv) The factors that contributed to the incident; and,

1910.119(m)(4)(v) Any recommendations resulting from the investigation.

1910.119(m)(5) The employer shall establish a system to promptly address and resolve the incident report findings and recommendations. Resolutions and corrective actions shall be documented.

1910.119(m)(6) The report shall be reviewed with all affected personnel whose job tasks are relevant to the incident findings, including contract employees where applicable.

1910.119(m)(7) Incident investigation reports shall be retained for five years.

For many companies, incident investigations are based on similar Federal and State Regulations. Even though it may be required by law, it does not remove the opportunity. If you want to be a "Best in Class" company, you must embrace these laws to be competitive and successful. Companies that maintain a robust incident investigation program can not only improve culture but reduce high consequence/extreme severity incidents. Additionally, they can potentially unlock hidden tribal knowledge, experience, and value-added knowledge to transition from reactive to preventative. Therefore, we investigate to comply with the law and for the opportunity to improve.

This ten-step process is applicable to small companies and organizations not covered by the OSHA rule 1910.119(m). The purpose of restating this several times is to ensure the understanding that an investigation is conducted in the same manner and with the same basic steps no matter what regulations exist. The basics are what will make or break any process. If the basics are not executed flawlessly, then the overall results will not be accurate.

Incident Investigation History

Incident Investigation was born out of necessity. For many years prior to February 24th, 1992, some companies realized that blaming the worker was not a sustainable approach to problem-solving. Further blame does not produce real change. For example, hanging a sign on a fabric

loom or near a rotating piece of machinery in a paper mill that says, “Do not put your hand in here,” only works if the process does not require you to put your hand in there.

The problem is that things don’t always go as planned. People are human, and equipment malfunctions and breaks. Companies learned that replacing or disciplining the worker only improved the human resource department’s skills at hiring and firing. Nothing was really changed, and the cycle continued to turn.

Some companies without policy began to learn from their mistakes and improve, driving innovations in safety and process safety. They made the connection that they made more money when they were running, as opposed to being down for an injury or fatality. What’s more, they avoided more courtrooms and angry families.

Still, some companies did not learn from their failures and had to be dragged down the improvement path kicking and screaming. Most of us have seen or heard of how factory workers were treated during the industrial revolution, both here and around the globe. We discovered the value of oil in the late 1800s and early 1900s as more than a heating fuel. The combustion engine propelled manufacturing both in industrial machinery and fuels, chemicals, and petrochemicals to what we know today.

The technology revolution hit in the late 1970s and really took off in the 1980s. Even with this new technology, incidents were still occurring. In short, no matter the business and no matter the process, if humans were involved, incidents occurred. To combat this inevitable symptom of progress, an incident investigation program is one of several tools that can be implemented to begin breaking the cycle.

Sakichi Toyoda (1867–1930) is credited with the first root cause methodology, still employed today know as the “Five Whys.” His theory rests on the idea that asking “why?” five times can often get to the root of any problem. For Example:

1. The pump stopped running. Why?
2. The motor quit running. Why?
3. There was a loss of power. Why?
4. The breaker tripped to the pump. Why?
5. The hot feed electrical wire (red) vibrated loose and began arcing. Why?
6. No QA/QC on the pump after maintenance. Solution: create one.

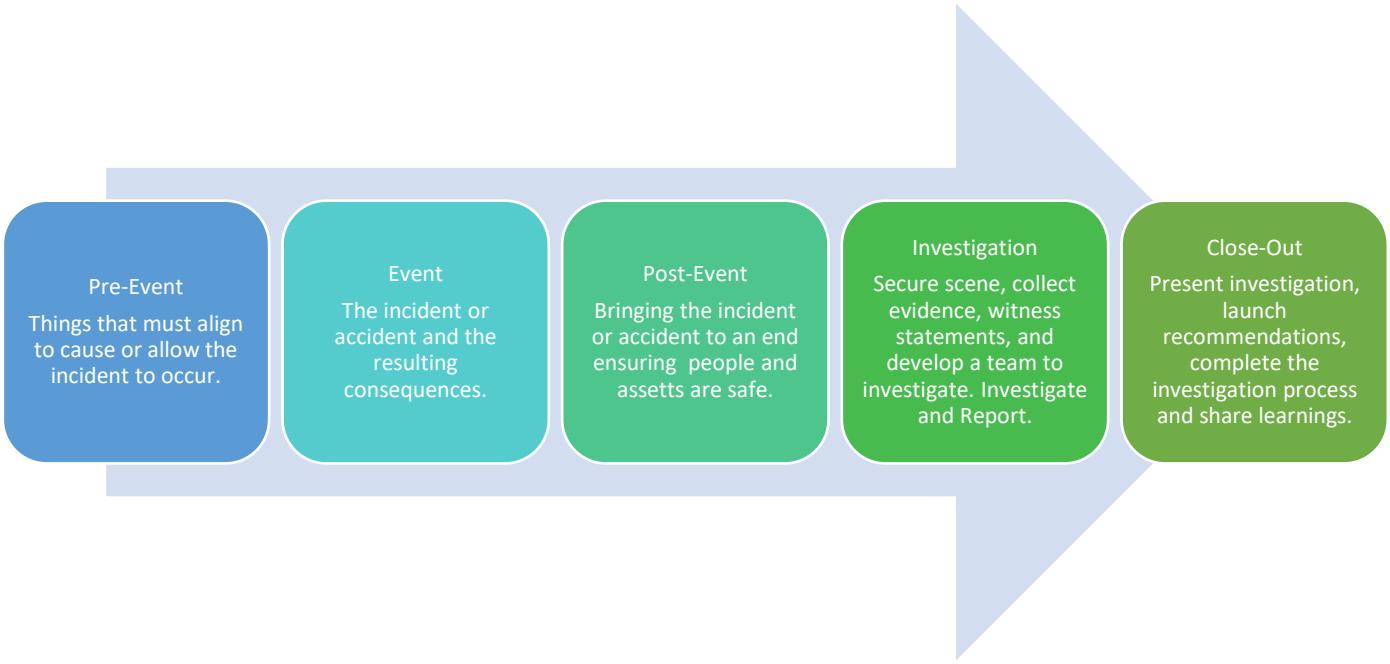
Sakichi, as you may have guessed, was the founder of Toyota Limited, known for many manufacturing processes. He was also known as the Japanese Thomas Edison of his day.

Fast forward to today. There are many companies that offer root cause investigation methodologies. OSHA 1910.119(m), along with the other 13 elements in that rule, spurned many technology and innovations since its adoption in 1992. The internet has an entire history of root

causes. However, a brief history is enough for the purposes of this learning module, as this module does not go into teaching root cause methods.

Overall Stages of an Adverse Event

There are five phases of an event that result from an incident or accident. These are detailed in the ten steps process this course covers. All incidents go through these major phases. The graphic below defines these phases.



With all these processes, we begin with a big-picture view of what the process entails. Then we keep defining each layer as we narrow the process down into the core lesson. Now that you have the big picture of why we investigate, a brief history, and the overall framework. We can move into the details of the process.

The investigation process begins in the Post-Event phase block shown in the graphic above and carries us to the end. If we had a crystal ball, we could jump to the Pre-Event phase and prevent incidents. That is what the investigation process is all about.

What if I said this was an option? It is, but we have to start with the initial facts and build from there. A robust incident investigation begins by compiling a database of what we need to change. Over time, other programs that concentrate on behavior, good engineering and maintenance practices, and overall culture and knowledge allow a crystal-ball-look into our purpose for the Incident Investigation program.

Compiling trends of lower-level, near-miss causes and low-potential-risk incidents permits previous events to be a predictor of future events. This will allow adjustments prior to a major incident and accident. To get there, have a good understanding of the basics of an investigation makes them accurate and value-added for learning and correction purposes. Let's move into the details.

Investigation Process Step 1 - Preserving Evidence

Preserving Evidence

Let's begin with how evidence is preserved. This is not to be confused with Step 4, an understanding of all the evidence that may be required to conduct a thorough investigation. We will break these into two groups and define the scope of each one. *Minor Incidents* and *Major Incidents*. The distinction between what should be considered a *Minor* or *Major* incident is a *Speculative Assumption of Credible Potential Harm*. This distinction is not a hard and fast line as *Credible Potential Harm* is considered when deciding on a *Major* or *Minor* incident compared to just *Actual Harm*. Let's define these terms before we progress further along with *Actual Harm*.

1. *Actual Harm:* Actual harm or an undesired outcome is obvious. For example, a broken arm, a broken valve, a hole in a pipe resulting in a quantified release amount, or a forklift strikes a fire hydrant and breaks it.

2. *Credible Potential Harm:* This is defined as credible scenarios that if things were slightly different, something more serious could have occurred. For example:
   - The broken arm could have been a fatality. The difference could have been the fallen object that struck the worker's arm if one foot to the right could have struck them in the back of the neck or head.
   - The hole in the pipe could have been a serious fire and explosion. The released material was hydrogen that did not find an ignition source and was found quickly due to operator rounds. This, combined with the op diately mitigating the leak prevented a more serious ev
   - The forkli destrian. The equipment operator re a heavy load that fell off the forks o

These are just a few cr arm was obvious, but a closer examination dem re severe. The key is to know when to apply a c incident to a major or higher risk incident.

3. *Speculative Assu* ulative assumption is when you assume ccurred, resulting in *Credible Potentia* rooted. For example, I trip over a curb be a fall and minor abrasions to my h also credibly occur. However, if you st d people have died from simple falls. would be millions of people step onto year after year. Based on the frequency, the f is outlandish to consider. When making speculative assumpt ible potential harm, always seek a second opinion if you are unsure.