Incident Investigation and Techniques 201

An Online Continuing Education Course for Engineers

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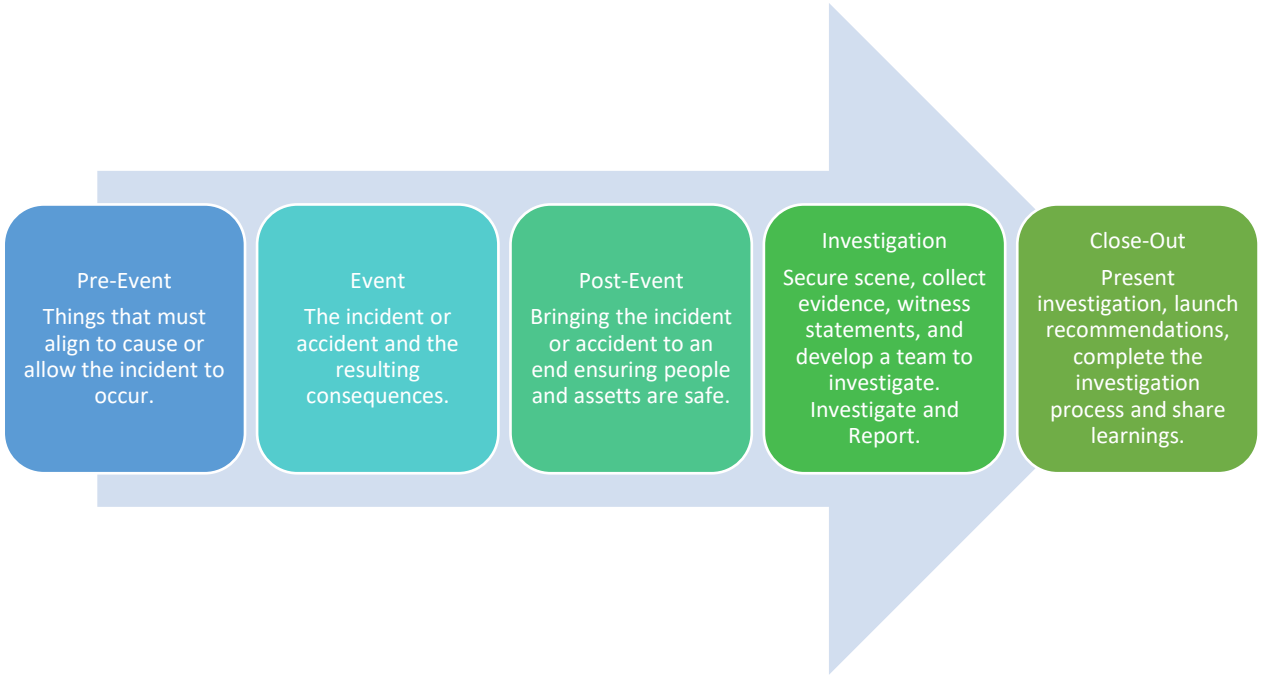
Review

Let's begin with a short review of the incident investigation process followed by the 10 Steps of an incident investigation. The best way to learn anything is by doing it. Practice makes perfect, so to speak. We will utilize a fictional incident then work to solve for "Root Causes," using three widely used and free "Root Cause" techniques.

Overall Stages of an Adverse Event

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



As you may recall, 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. Determining what "Root Causes" occur is the catalyst for future unknown events, which is what RCA techniques seek to do: prevent future events not yet realized. This leads us to the 10 steps of the investigation process.

Here they are:

1. Preserving Evidence
2. Reporting an Incident
3. Categorize – assign a risk level to an incident this dictates resource allocation
4. Evidence Collection
5. Assembling Team - based on Category level
6. Create Logic Diagram and/or Timeline
7. Interviewing
8. Draft Report
9. Develop Recommendations
10. Present the Report to Management

Before we move into the 10-steps of the incident investigation process and analyze the issue, let's begin with an example incident. Most organizations begin their day reviewing incidents from the previous twenty-four hours. Small businesses may do this on Monday, Wednesday, and Friday, or once a week. Serious incidents will always cause a pressing review so that the process can immediately begin.

An incident occurred on May 19th, 2020, in a process unit at a chemical manufacturing plant. Initial Conditions: Turnaround in progress. Demolition and replacement of a section of one of two parallel identical diesel lines running next to each other in a ground-level pipe rack due to thinning.

Description of Incident: Big Al Contracting (BAC) was scheduled to demolish and replace a 40' section of a 6" diesel transfer line that ran underneath a roadway crossing. An open trench excavation 42" deep had been previously made to expose two identical 6" propylene transfer lines where they ran under the roadway. One line had been wrapped and coated, protecting it from external corrosion; the other line, scheduled for replacement, had been coated but not wrapped, having been installed several years earlier.

The BAC Supervisor obtained a permit and performed a joint job site visit (JJSV) with Operations at the upstream valve where it was isolated. Operations showed him that the bleeder valve was clear and open – safe to go to work. The pipe on the right (East) side was where the cut was to be made. The pipe on the left (West) side was in use.

The two lines run parallel through the grade level rack, then dip under the roadway, then exit diverging to the East and West, each going to separate tanks in the same tank farm. Tank 210 the East tank was also in Tank Turnaround, but was not part of this project. Tank 212 was the West tank and was still in service during the turnaround.

The Contracting Supervisor met with his team consisting of two pipe fitter welders, a fire watch, and an equipment operator. The BAC Supervisor explained the work to the crew. They went over basic hazards of slips, trips, sharp edges, pinch points, rigging and line of fire.

The pipe fitters clamped a band saw to make their first cut on the West line. Not having walked down the lines with the BAC Supervisor or Operations, they began work cutting the line that they understood their Supervisor had pointed to.

Operations had told the BAC Supervisor to hold off on making the first cut until they returned as other permits were being issued by the same Operator. This communication was not conveyed to the pipe fitters. They began the cut on the left (West) line, not knowing that the line was not isolated.

Tags had been hung on the line where the cut was to be made. However, that morning the Contractor Supervisor and Operations removed the tag and laid it on the adjacent line to move it out of the way of where the saw was to be attached.

The pipe fitters believed this was the line to be cut tossed the tag into the excavation and continued their work. Approximately one minute after the saw was started, propylene came pouring out of the line, spraying one of the two contractors. The Fire Watch activated the emergency response button on their radio calling for plant fire services. The pipefitter and his co-worker quickly went to the nearby safety shower and rinsed off and removed their outer layer of clothing. They were attended to by a fire response team and transported to onsite medical. The line was quickly isolated, and no process materials left the excavation.

The pipe fitter that was sprayed suffered no injury or adverse effects from the release. Witness statements were collected immediately after the incident, and a copy of the permit was made along with the JHA. See attachments.

This information was provided in the morning incident report. Now it’s time for you to roll up your sleeves and get to work. Let’s learn about solving a Root Cause Analysis (RCA) problem together.

Investigation Process Step 1 - Preserving Evidence

Preserving Evidence

Let's begin with how evidence is preserved. Your company policy calls for barricading off an incident like this until Safety, Environmental, and Process Safety all give it an all-clear. Safety has obtained a copy of the work permit, job hazard analysis (JHA), and collected witness statements from the two pipe fitters.

You arrive at the scene, donning proper PPE just as the environmental crews have removed most of the propylene with a vacuum truck. The soil will be remediated in a few days, so absorbent granules were spread into the excavation. The area was covered in plastic. Boards were laid on top of the granules so that you could walk into the ditch.

You ask to have the plastic temporarily removed so you can photograph the scene. A check of the lower explosive limit (LEL) by safety was zero, thus allowing you to take a few photographs. You first notice that the saw is still clamped to the pipe. You carefully take pictures before the saw is removed by others. Wide-angle shots are taken from North, South, East, and West position around the ditch. You take close-ups before and after the saw is removed. Having completed this process, you collect copies of the witness statements and the other data mentioned earlier.

Having collected everything, you do not require any further hold on the work area. You release the scene back to emergency services so the remediation of the contaminated soil can be performed.

Preserving as much information as possible, even on a minor incident, is crucial. Having other groups involved is most desirable. Empowering them with a routine protocol to collect as much of this information as possible saves valuable data from being lost. They can then attach it to the initial reporting of the incident prior to its submission or just hand it to you when you arrive.

This is a minor incident that had the potential to be much more. However, there is no need to hold the scene any longer than this. If there had been a fire and a life-altering injury, you would hold the scene until outside agencies had an opportunity to review it, and potentially your own legal department. This is always a judgment call, so get the leadership involved if you need help to make this decision.

Your company should not only have an incident investigation policy, but also a guidance document on how evidence is to be preserved immediately after an incident. If you experience a serious incident, this is strongly recommended. This policy needs to have evidence collection and chain of custody in mind. In addition, you should have a secure area to store and lock up evidence.

Investigation Process Step 2 - Reporting an Incident

Reporting an Incident

Your facility will have a formal policy or procedure, along with a database management system to manage incidents. If you are very small with 25 or fewer employees, this may be accomplished using Access, Excel, or another data management system. Most companies already have a system and policies to manage incidents in place due to OSHA regulations. Fortunately, for you, you work for one of these companies. The incident described above was reported and is waiting on your computer in your office.

The initial incident report was completed for a spill. For this spill or loss of containment, the following basic information was provided:

- Material: Propylene
- pH: 6.5-7.5 100g/l aq. sol
- Volume: 15 gallons
- Duration: 15 minutes
- Pressure: 20 psi
- Temperature at Release: 96^F
- Vapor, Liquid or two-phase-both: Liquid Release
- Flash Point: 99 °C / 210.2 °F
- Location: Intersection of Avenue Q and 6th Street
- To Air, Water or Soil: Release to soil
- Injuries: No
- Exposures and Level of Exposure: Skin exposure only
- Anyone Sent Off-site for Further Evaluation or Medical Treatment: No

The incident report at the beginning of this example is available on the incident database along with these details. Additionally, if needed, you can pull the SDS for Propylene Glycol from the company safety database.

The SDS (safety data sheet) may have other information that you may need later. So, this is always a good idea to collect as well. Section 4, Section 6, and Section 8 may be needed to confirm information and responses. Part of the incident investigation process is to also look at how the management systems you have in place are performing. These could be opportunities to improve. If mistakes, errors, failures, or omissions were made in these management systems that made the situation worse than they could be part of the Root Cause process also.

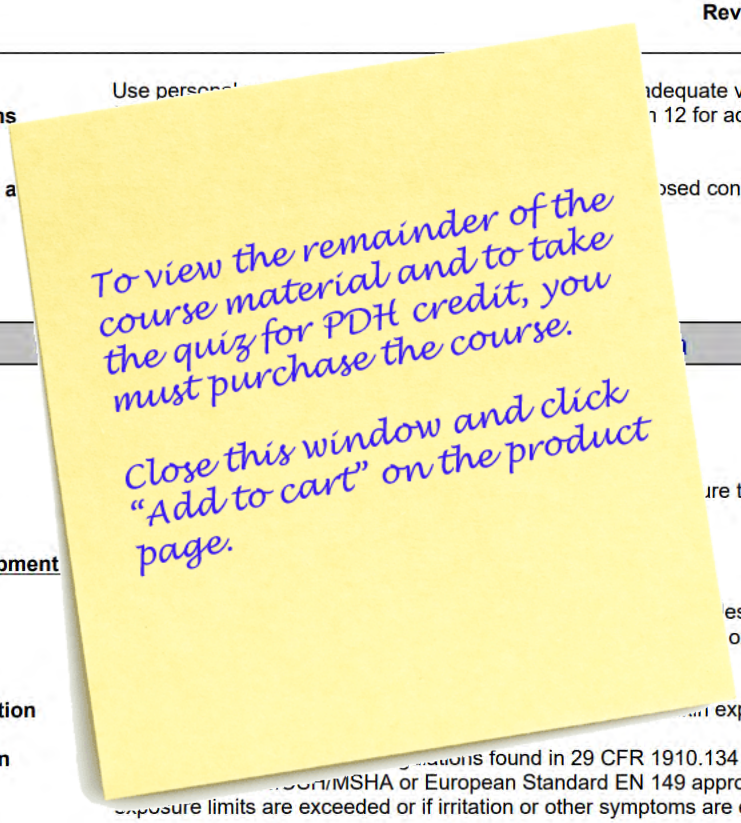
The initial incident report is often your first glimpse of what happened. Void of detail often times you can begin to plan out your incident from this form. Standardizing this process as part of your incident investigation policy will ensure uniformity and completeness in reporting.

4. First-aid measures

Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If symptoms persist, call a physician.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Get medical attention if symptoms occur.
Inhalation	Remove to fresh air. Get medical attention immediately if symptoms occur. If not breathing, give artificial respiration.
Ingestion	Do NOT induce vomiting. Get medical attention immediately if symptoms occur.
Most important symptoms and effects	No information available.
Notes to Physician	Treat symptomatically

6. Accidental release measures

Personal Precautions	Use personal … adequate ventilation.
Environmental Precautions	… 12 for additional Ecological
Methods for Containment a… Up	…osed containers for disposal.



Exposure Guidelines

Engineering Measures	…ure that eyewash stations
Personal Protective Equipment	
Eye/face Protection	…es as described by … or European Standard
Skin and body protection	…n exposure.
Respiratory Protection	…ations found in 29 CFR 1910.134 or European Standard …SHA/MSHA or European Standard EN 149 approved respirator if …xposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.