

# Safety and Incident Investigation

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**Abstract**—Incident investigation is required all over the world in all chemical process industries or academic laboratories or specialized research centers to avoid reoccurrence of these incidents/accidents and save humanity. Incident is an unusual, unplanned, and undesirable event which effect people, property and environment and incident must be investigated. This article is based in education pedagogy and encapsule student learning and reporting from single article provided them as an assignment. This methodology is expected to work worldwide in learning process safety. Undergraduate students were under observation/consideration. This research is important for student teacher learning and education pedagogy. Undergraduate students' skills are enhanced for reading, understanding and writing assignments, thus making them future safety leaders. This scheme will equally be important for all undergraduate and postgraduate students from various disciplines.

**Keywords**—Education Pedagogy; Student teacher learning; safety and incidents; postgraduate students

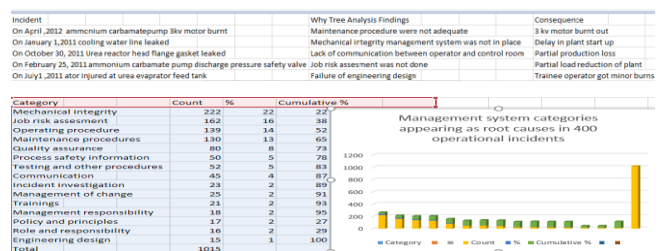
## Introduction

Incident investigation improve industry performance however, it must not highlight affected worker as this can reduce employ morale. The learning from operational incidents plays a key role in improving the performance and safety of the chemical process plant. Identification of direct root and system related root cause for accident investigation along with problem help us to minimize the hazards.

## Incident Investigation

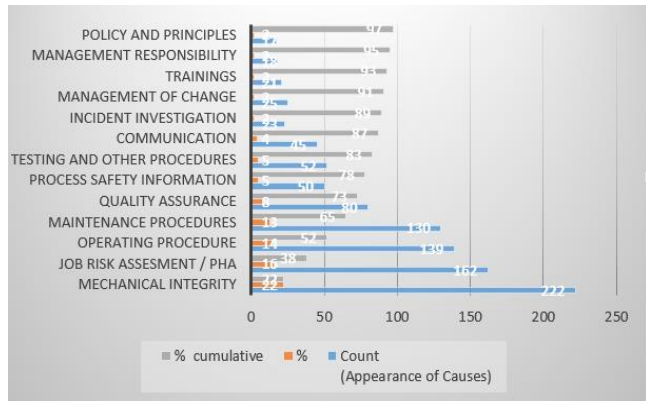
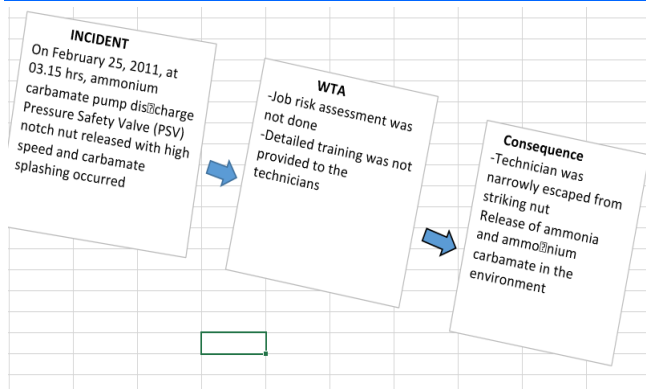
US chemical safety and hazard investigation board CSB investigates industrial accidents, identifies deficiency in safety management system or root cause of accidents, report key findings of investigation and makes recommendation to plants regulatory authorities and labor groups as this may be better for whole country or all world can benefit from findings of the occurred incident/accident. CSB pointed that 83/95 root and cause of accidents related to management system .PSM, ARPA also showed generalized lack of safety management system. This research showed that all industries needed to pinpoint and identify the failure in safety management system and keep record of incidents yearly .This will be helpful in future improvements .We can use different methods or tools like Sequence Diagrams ,Time line ,Brain-Storming, Casual factor Investigation to

investigates the root cause of accidents. WTA use cause and affect tree known as a Why tree. It is important to build the Why tree first so that interaction of cause can be seen. Pakistan is an agriculture country .Different fertilizer plants are installed to fulfill need .Five plants are selected to investigate the incidents .Two of them already implemented safety management .The incidents in remaining three plants were analyzed using WTA. Analysis of 400 incidents [1] occurred in different fertilizer plant in Pakistan was done. All industries and plants need to investigate every incident and keep record of it. Safety manager should make recommendation for it. Safety management system failures and appearance of root causes (Figure 1).



**Figure 1. Safety management systems failure and incident investigation reporting, modified from [1].**

The aim is to identify failure in the safety management system for Prevent incident. Learning from the incident in the workplace has become increasingly important in health, safety, and the environment. Identification of direct roots and related root systems for accident investigations along with problems in analysis or and from analysts discussed in the Blair literature, the CSB chemical incident investigation uses 21 CSB investigations to identify the failure of the management system in this incident. Safety Management Process the Canadian Chemical Producers Association Committee collects incident data from CCPA member companies every year and analyse it through related processes the size of the incident to analyse the failure of the PSM element. The 5-Whys approach for the root causes of analysis is often used for investigations into event failure and safety incidents at work. WTA identifies the root causes of this incident. WTA identifies the root causes of this incident. Repetitive accidents can be prevented thoroughly investigate the fundamental causes of each incident and on time. Specific root cause of individual incident and linked to overall system failures (Figure 2).



**Figure 2. Specific root cause of an incident can be linked with the overall analysis of incidents**

The incident happened to occur in between January 2011 and April 2012 in different sections, such as, Ammonia, urea and utility units of fertilizer sector been analyzed using WTA (Why Tree Analysis). The article emphasis on finding the failures in safety management. It is obvious that improvements in system will lessened the severity of such incidents. 5-Why are hence explained for the betterment. Why is asked to find every proceeding trigger until the root cause is identified. Why Tree is formed using WTA cause and Effect Tree and built earlier to find out the interactions of causes. Major causes effects the incident despite of the ratio, but people end up fixing the problems that are not the root cause. Specific incident linked to overall cause consequence categories (Figure 3).



**Figure 3. Specific incident linked to overall analysis of cause consequence categories**

When we have to identify the root causes of system & Management Failures and to determine the solution of these causes, different tools/methodologies such as Time lines, Sequence Diagrams, Brain-Storming, Casual Factor Identification, Checklists, Predefined Tree and Logic tree have to be employed. Different companies and agencies, i.e., CSB, CCPA, are there that identify different root causes like system management deficiencies, accidental incidents etc. and recommendations of these by reporting to regulatory authorities, industrial organizations, and labor groups etc. by successfully implementing above mentioned tools. It has been seen that 90% of industrial incidents are mainly due to Management Problems. Improvements in Management systems decreases approximately 75% of such incidents. Many companies on annually basis analyze the failure of elements of Project Safety Management. The best way to overcome the failures of plant incidents is to keep in view the record of previously occurred reasons of incidents and try to overcome on these so that such incidents never reoccurred.

The 5-Why tree analysis method helpful in identifying the cause-effect failure path by determining how the sequential causes of a failure arouse. Interaction of causes can be seen by building the Why Tree, known as cause-and-effect Tree Diagram. In this tree method, there are different branches, and each branch has its own effect. Instead of Determining the Safety Management root causes, we can also implement such method in determining the failures and incidents happening in plant equipment and workplace safety respectively. WTA Analysis not

limited to the counted incidents that might happen but spreading to countless incidents that might be the reasons of the incident occurred. WTA basically the brainstorming in which people note down the reasons and their effects and consequences and find the solution of that to enhance the efficiency of the plant capacity. Like that, Fish-bone diagram is also the one. Management system categories appearing as root cause are presented in Figure 4. Overall incidents in fertilizer section of Pakistan (Figure 5).

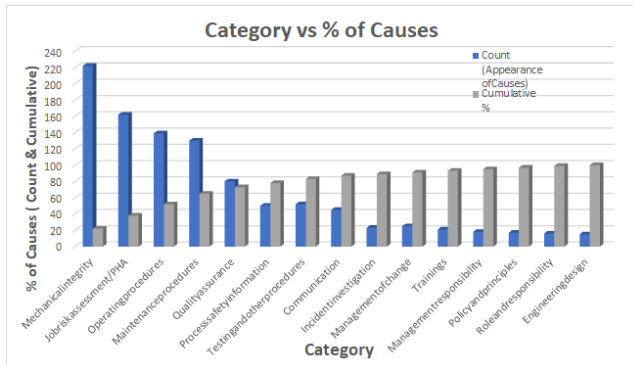


Figure 4. Management system categories appearing as root /contributing cause, number with percentage

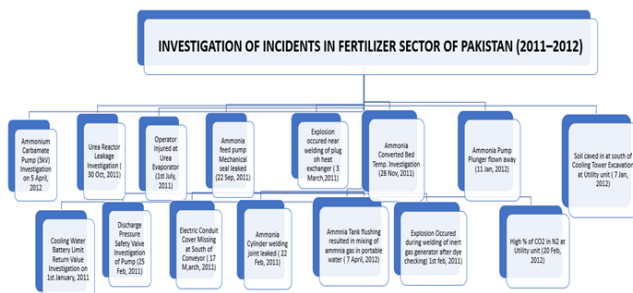


Figure 5. Overall incidents in fertilizer sector of Pakistan

Overall Finding from WTA (Why Tree Analysis)

Overall findings from reported incidents are shown in Figure 6 (sub figures 1-10).

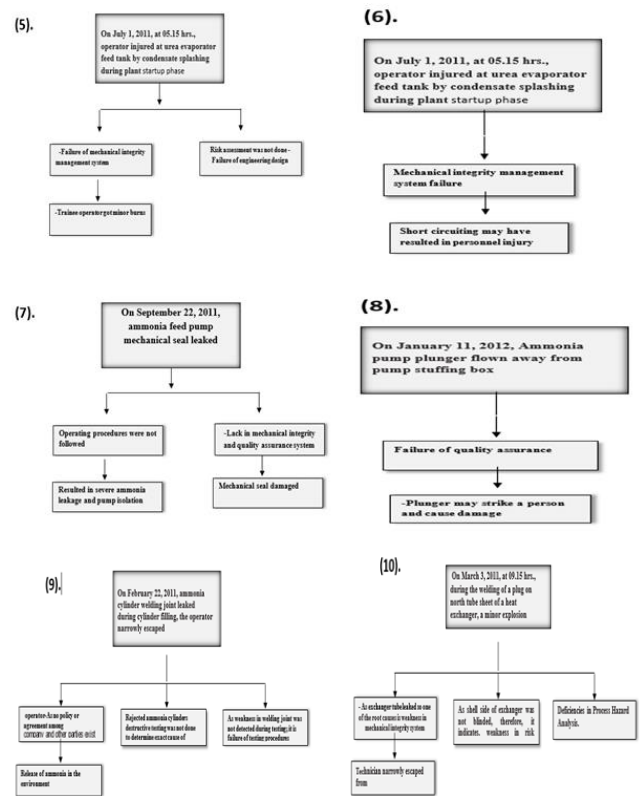
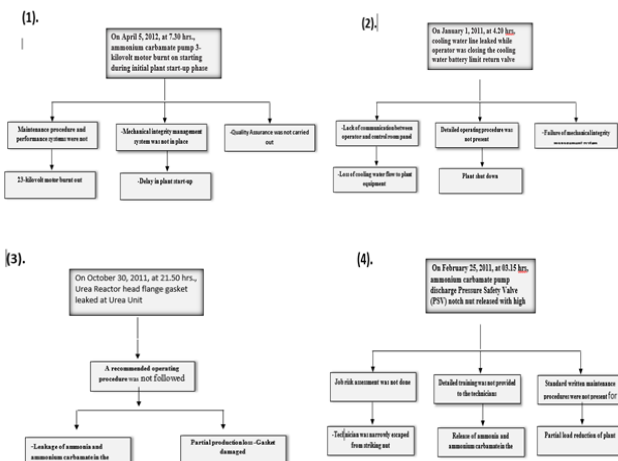
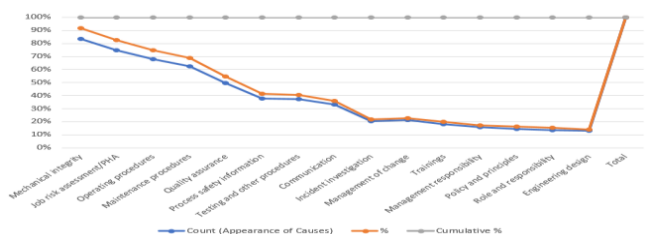
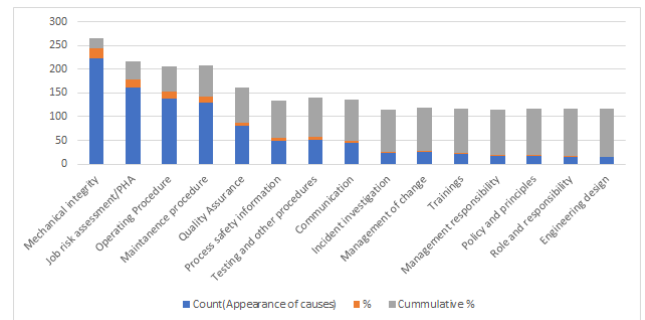
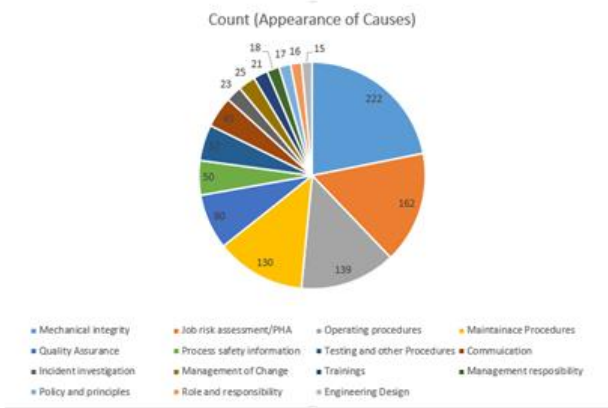


Figure 6. Overall findings from ten incidents (with detailed analysis presented graphically)

Overall Analysis

Overall analysis can be represented graphically. This constitutes count of causes, their individual percentage (%) and cumulative percentage (%). Count of causes (Figure 7).





**Figure 7. Count of causes (appearance number), percentage of individual cause and cumulative percentage (top, middle and bottom figures)**

**Things to do about incidents and incidents reporting**

- Communicate incident
- Provide incident reporting and communication system
- Monitor reporting and communication system
- Record keeping
- Investigate all major or occasionally smaller or less severe incidents

**Conclusion and Recommendations**

During the investigation in fertilizer sector in Pakistan five units are in working to apply safety precautions in fertilizer company, by keeping in mind the failure of 2011 to 2012 urea, ammonia fertilizer. As we know Pakistan is an agricultural country so we should to follow the safety rules.

Incident means an event or occurrence and Investigation means incident/accident investigation.

**Incident investigation** means any incident that occurs naturally and then to find out the cause that is being investigated.

These steps are a guide to perform an effective incident investigation.

➤ **Information collected**

information collected means gathering facts about the problem you are facing and the way other organizations and communities have solved it. The more information you have about this issue and the way it has been approached.

**Look for and confirm fact:**

In usually, the incidence does not occur on its own, but there is a purpose for it. We seek for a possible cause throughout the incident investigation so that we can figure out what happened.

- **Determine the most important contributing factors:**

No blame game, highlight system operability issues and solving lower staff technical job issues will enhance employee morale, this will also increase industry daily production.

**Find a root Causes:**

It is very important to identify root cause and fix it with a timebound activity.

**Determine the source of the problem:**

Determine the root cause and its fixation will fix the problem.

**Implement corrective actions**

- **Take corrective actions:** Corrective actions are a set of particular quality management measures intended to resolve work-related concerns and improve corporate performance.

Five step incident investigation and reasons to investigate workplace incidents are important.

**References**

[1] M.I. Rashid, N. Ramzan, Q. Almas, Incident investigation in Pakistan's fertilizer industry—Common safety management system failures and issues, Process Safety Progress 33(4) (2014) 399-404.