Fuse Head Incidents – Poor initial investigation and use of Root Cause Analysis

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INTRODUCTION.

Even in an open safety culture it occurs that though near misses are reported, a thorough incident investigation is not conducted. Reasons for this maybe no or slight injuries and very limited damage in combination with confidence in processes and operations in place since decades. Near misses will thus be perceived as single events and investigation stops in identifying the immediate causes rather than analyzing underlying causes that lead up to the event. Corrective action is then limited to reduce consequences in case of recurrence rather than mitigating or eliminating hazards.

The present example demonstrates the consequences of a poor initial incident investigation and the benefits of a consequent application of Root Cause Analysis techniques.

INCIDENT HISTORY AND CONSEQUENCES.

Fuse heads (FH) are known to be sensitive to friction, impact and static discharge.

Between Jun 2nd 2005, Feb 9th 2006 and Feb 17th 2006 three incidents (ignition of fuse heads) occurred during manufacturing of FH in different workplaces. Every incident happened without obvious causes.

The first incident (assembly line) took place without an injury. During the following incidents (dipping line, visual checking) the line operator suffered burns on her face, neck and right hand requiring hospitalization for 1 to 3 weeks. Those incidents had operational impact on the company as after the third one the production had to be interrupted for 3 weeks.

INCIDENT INVESTIGATION PROCESS.

General considerations.

Incidents and near misses often happen suddenly, but never for no reason. Normally there are signs or indications prior to an event, but those may be overlooked or ignored. The role of the investigation process is to identify these signs and to ask why they were not acted upon. In simple words: ‚What is the story leading up to an incident?'
This does require a thorough analysis not only of the immediate cause(s), but of the (technical) root or underlying causes (usually several unsafe conditions or situations). Only with a systemic approach (such as developing an incident tree) and a proper corrective action plan equal or similar conditions can be avoided in the future (prevention of recurrence).

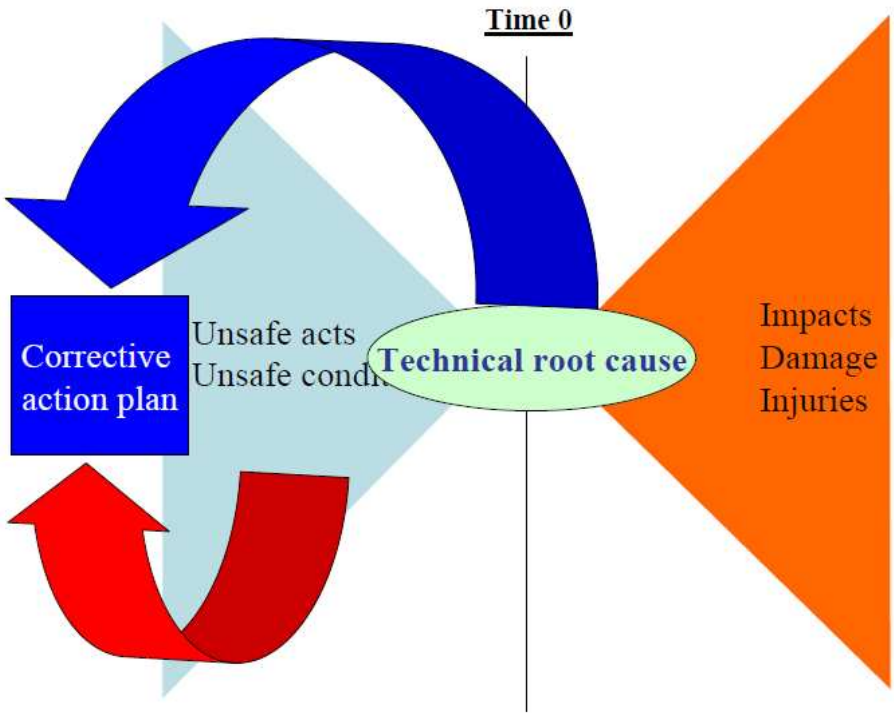

Figure 1

Initial investigations.

The analysis of the investigation process shows that the investigation after the first incident stopped at the level of immediate causes and did not go down the path to identify the underlying (root) causes.
Figure 2 shows that from the incident statement , fuse heads burnt with material damage‘ the investigation was superficial in only questioning why there was a material damage and not asking for the reason why the fuse heads burnt. With the cause ‚too high inventory‘ identified as a consequence only the packing size of boxes to carry fuse heads throughout the assembly line was changed (corrective action). This action reduces the material damage (consequences) in case of a future event, but does not eliminate the hazard for another ignition.

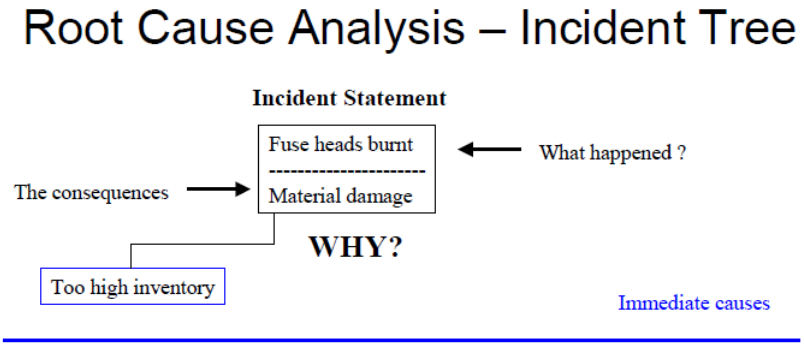

Figure 2

Also after the second incident the investigation and actions focused on how to reduce consequences rather than redesigning the process according to BOS principles and GEP.
Figure 3 shows that from the incident statement , fuse heads burnt with operator injury‘ the investigation identified ‚poor protection‘ as the immediate cause and did not ask why the protection was poor. Again the path why the fuse heads burnt was not followed.
The corrective action in this case was a protection shield an additional PPE.

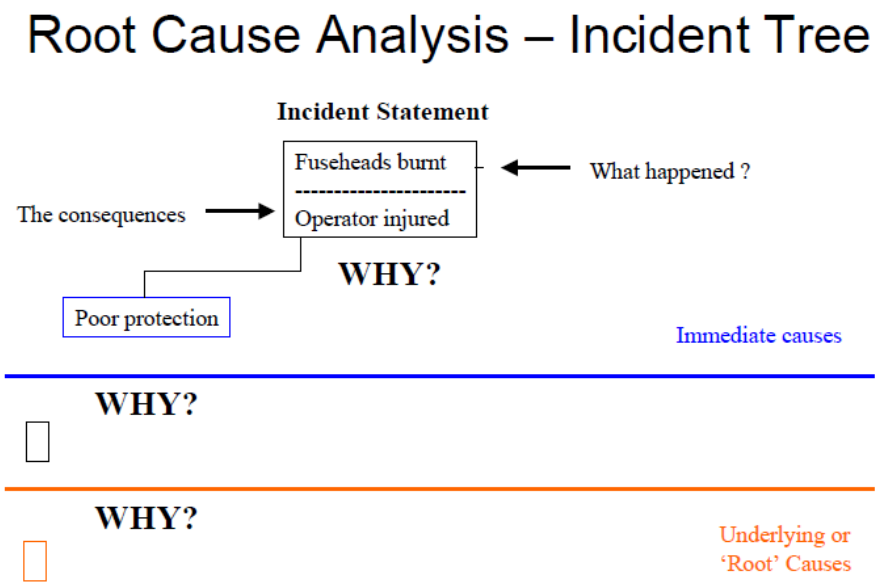

Figure 3

Root Cause Analysis after 3rd incident.

Only after a deep root cause analysis the probable underlying cause of all incidents was found after two months of investigation:
The raw materials being used at the time included a batch of calcium silicide, which on detailed testing proved to be significantly coarser than normal. Microscopic examination indicated that the FH made using this coarser material had “bumps” on their surface. It is felt that these “bumps” could have increased the sensitivity of the fuse head composition towards friction and electrostatic discharge by interfering with the robustness of the lacquer coating.
Figure 4 shows that only now it was scrutinized why the fuse heads burnt and operators were injured and the ‘why’ questioning chain had been followed to the end (to identify the root/underlying causes).

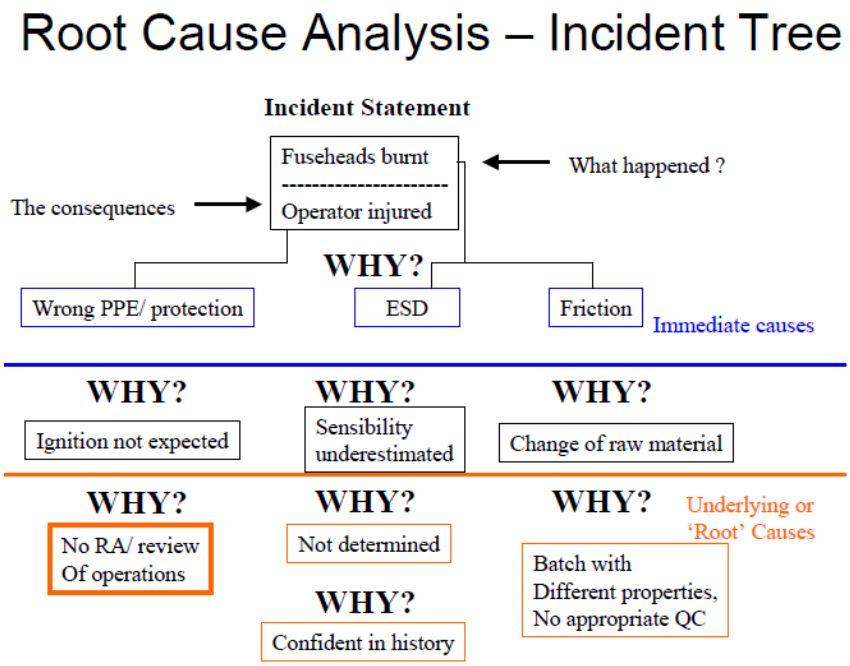

Figure 4

CORRECTIVE ACTION PLAN AFTER ROOT CAUSE ANALYSIS.

After the thorough root cause analysis to identify the underlying causes that contributed to this series of incidents, the investigation team developed a corrective action plan to prevent recurrence and to protect operators. Actions of this plan include

- Review documented risk assessments of the entire process of FH production. Every previous and following operation or handling needs to be analyzed in detail.
- Review QC system that deviations/changes in raw material quality are identified.
- Review the system of change management as a change of raw material (or its supplier) is a change/modification to an existing process.
- Install protecting screens where necessary.
- Apply 1:1 tests to ensure that a change of the design of workplaces and installation of protecting equipment delivers the desired effect.
- Instruct operators to wear face shields for the most hazardous operations.
- In all workplaces of FH production and assembly line operators have to wear conductive wrist straps.
- Advise operators to wear gloves on both hands that do not leave wrists exposed.
- Allowed quantity of explosives (inventory) to be reduced.
- Change in packing process of FH.
- Training of workers with videos. The videos are showing the behavior of the flame after ignition of different numbers of FH against protecting equipment.

CONCLUSIONS AND ‘TAKE HOME MESSAGE’

1. Ensure and reinforce the importance of a robust reporting system that catches unsafe actions and near misses and does not start as recently as a lost time or severe incident has happened.

2. Near misses also require a thorough incident investigation to identify root causes and management system failures.

3. A poor or superficial investigation may virtually force the next incident to happen.

4. Ensure that staff conducting an investigation is competent and acting independently.

5. Never have business requirements as a driver for the time line of an investigation.