Incident prevention tools–incident investigations and pre-job safety analyses

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Abstract
Careful and thorough incident investigations and pre-job safety analyses completed by knowledgeable and competent individuals can significantly reduce workplace incidents. Working parties must act together to make these safety tools effective. To get the staff units to work together in a co-ordinated manner, they must be shown the value of their work in preventing accidents. Examples of actual accidents investigated during the author’s 18 years as a mine inspector in Saskatchewan are discussed within the context of pre-job safety analyses. The causes of the accidents are explored with close reference to how pre-job safety analyses could have prevented their occurrence.

1. Introduction
Risk increases when the probability of an incident occurring increases or the severity of injury increases. In this paper, two general tools are outlined to prevent accidents from occurring and reduce their severity. Such tools are incident investigation analysis, and pre-job safety analysis. The working parties of management, supervision and workers must manage analyses so that incident frequency and injury severity are reduced. The combined expertise and point of view of these employee units will make the work process safer. It is essential that the working parties work together in a co-ordinated manner so that they all see the value in conducting these investigations and pre-job safety analyses.

Actual incidents that were investigated during the author’s 18 years as a Mines Inspector in Saskatchewan, Canada are presented. They demonstrate how pre-job safety analysis could have prevented these incidents from occurring.

2. Accident prevention
Incidents occur at mine sites, which may or may not have significant consequences. These incidents may not have caused injury; minor incidents can be caveats for more severe incidents, where a worker may be injured.

Frank Bird analysed the general results of more than 1,000,000 incidents, as is shown in Fig. 1 [1]. As is revealed in the model, incidents where there is no visible injury or damage occur more frequently than incidents where a serious injury has occurred. Lessons can be learned from all these incidents.

The lessons learned can provide control to the workplace so that similar incidents do not occur, which could possibly give rise to more severe consequences. These controls can be learned through incident investigations. Alternatively, the work environment can be controlled through pre-job safety analysis so that the possibility of incidents occurring is diminished.

2.1. Incident investigation
When an accident occurs, a team should be formed to investigate the reason for its occurrence, and to establish controls to prevent recurrence. The team should comprise of at least one management representative and at least one worker representative. The team should examine the site where the incident occurred, conduct interviews about the incident, and collect physical evidence. Such physical evidence could include physical objects that could possibly be used for verification, photographs, and videos. The aim of this is to reconstruct the incident, find causes, and determine controls to prevent recurrence. After reconstructing the incident, a back analysis would seek to learn the reasons the incident occurred. This would include reasons that are
physical, procedural, and associated with the work environment. This is summarized in the causes which are:

1. Direct causes: what prompted the incident.
2. Indirect causes: what events transpired to contribute to the direct cause of the incident.
3. Root causes: what practice or knowledge would have prevented the incident from occurring.

After the causes are found, controls must be observed to prevent recurrence. This would include considering what actions would prevent these causes from developing again. This would involve implementing one or more of a multitude of actions within the physical environment including how workers interact with the physical environment, procedures, and training.

2.2. Pre-job safety analysis

Ideally, unexpected incidents do not occur in the workplace. The probability of these incidents occurring can be reduced by providing workers with tools to ensure they assess their work environment: the work environments, the equipment used, the weather, their work colleagues, their training, and work procedures. Management must provide workers with these tools.

Management must provide an ordinarily safe work environment, the staff and time to provide training to the workers, the procedures to provide means to complete their tasks, and supervision to provide guidance to the work before and while it is being conducted. Workers must also work with their colleagues to ensure that they are not endangered and are working safely for themselves and others. These workplace elements which influence worker safety are depicted in Fig. 2.

A tool exists to assist workers in conducting their work safely: pre-job safety analysis. Pre-job safety analysis may be conducted individually or as a group. Unsafe conditions noted before and while work is being conducted should be eliminated before work begins [2]. The work should therefore not begin until controls are installed so that the unsafe condition or work process noted no longer pose a risk. Workers have a right to refuse work that they believe will endanger themselves or others.

Two pre-job safety analysis systems will be discussed: Neil George 5-point safety system, and field level risk assessments.

2.2.1. Neil George 5-point safety system

A pre-job safety analysis system was developed for the Ontario mining industry by Neil George in 1942. At the beginning of each shift, the worker, in this case a miner, must evaluate for health and safety risks at his worksite by using the five point safety system [3]. This system must be analyzed by the miner in the area where the work is to be conducted. As the name suggests, miners must consider five points before beginning to work.

Five-point safety systems are general and do not have specifics, and can therefore be used at different workplaces. The Neil George five-point safety system is a straightforward and structured means for miners to assess their workplace, equipment, and work procedures. Mine workplaces are dynamic and continually changing. To complete the five point safety system, it is often necessary to complete checklists and refer to maintenance log books to ensure they are current.

The five-point safety system encourages independent thinking and real time engagement, because the miners must check their workplace, equipment, and required workplace procedures and continue to do so throughout the shift. Columns for successive tasks to which the miners are assigned during their shift are often-times present. Miners often carry a card with the five points noted down for them to consider. There is space on many of the cards for miners to note down suggestions to improve safety.

Five-point safety directives are as follows:

1. Check the entrance to the place of work. The worker-miner must check his/her surroundings as he/she makes entry to the workplace. This includes travelling from the dry to the work place, and going between workplaces.
2. Are working place and equipment in good order? The miner must check the working place and equipment to ensure they are safe. Checking the working place and equipment may require examining specific checklists. If there are records detailing when a qualified professional last inspected the working place or equipment, the miner must check to ensure that the records are current.
3. Are people working safely? The miner and fellow miners must wear the required personal protective equipment (PPE). Is everyone following safe work procedure? The miner must ensure that the correct procedures are being followed by the crew or a risk assessment that is being completed if warranted.
4. Do an act of safety. The miner should note an act of safety accomplished by himself/herself. While conducting any job, an instance will present itself where a safe act is required to do the job safely or prevent a hazard from presenting itself. It is a constant reminder for miners to think about safety.
5. Can, and will, miners continue to work properly? The miner must keep safe work in mind. Before beginning the task, the miner must consider what is necessary to complete the job safely in terms of personal protective equipment, materials, equipment, and procedures or risk assessment as the job progresses. The miner must check to see if all that is required to do the job safely can be accessed. If something new becomes known during work and the means to do the
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