Hazard Identification and Risk Analysis in Coal Mining – A Case Study

by
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Presentation Outline

- Introduction
- HIRA Process
- Methodologies for Risk Analysis
- Case Study
- Conclusion

Introduction

Adequate mine safety and emergency preparedness requires consideration of all of the possible hazards that could be encountered.

Some hazards more likely to cause problems than others at a given mine

Some would result in greater damage than others

These differences are identified by conducting a risk analysis

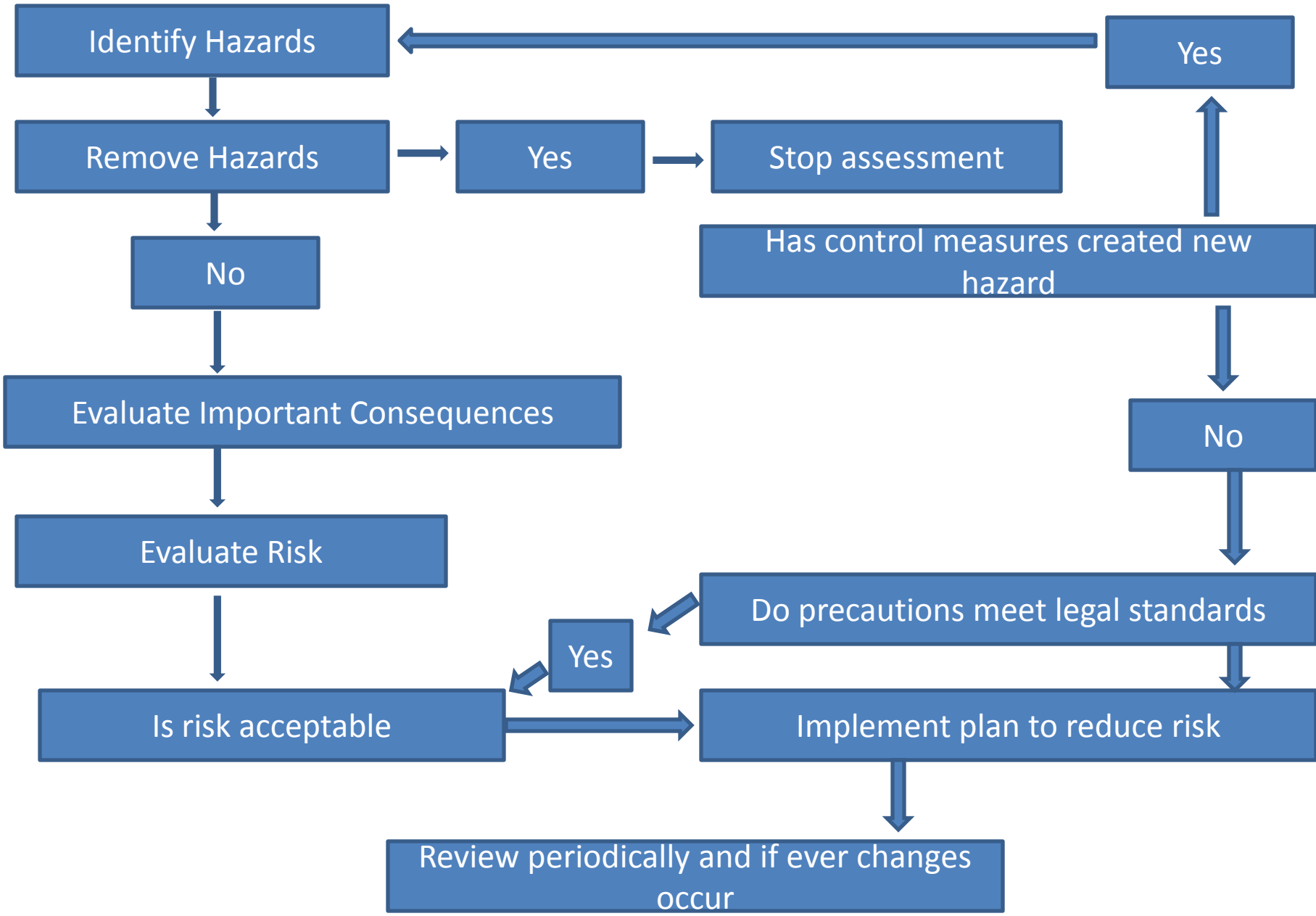
The outcome used to target resources at the types of events most likely to occur and/or most destructive

Multiple hazard analysis techniques recommended because each has its own purpose, strengths, and weaknesses

HIRA : A systematic way to identify and analyze hazards to determine their scope, impact and the vulnerability of the built environment to such hazards

Purpose
To ensure that there is a formal process for hazard identification, risk assessment and control to effectively manage hazards that may occur within the workplaces

Risk Assessment Model

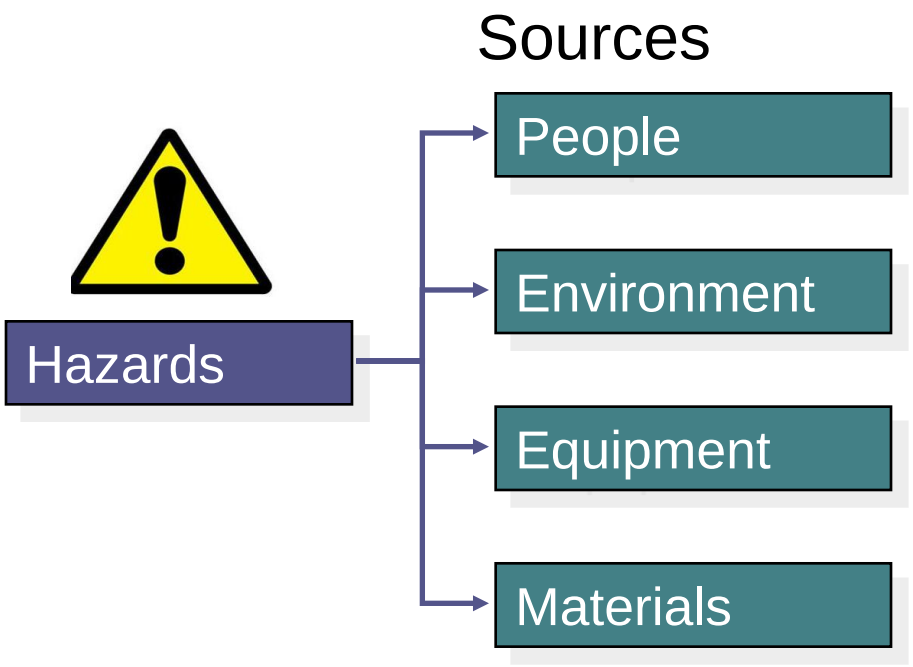


Process to Manage Hazards

1. **Identify the Hazards-** What can cause injury or illness

If one does not properly identify the problem then it becomes difficult to assess the risk or postulate solutions

Hazards are grouped into 4 common sources



Presence of Hazards

Visible Hazards

➔ Those readily seen, heard, smelt, tasted or otherwise sensed by the inspection

➔ Moving Machine parts, open edges, Vehicles

Hidden Hazards

➔ Those not readily sensed without prompting a more detailed search

➔ Dust, Radiation, Ergonomic stressors

Developing Hazards

➔ Those which get worse over time, may not be detected without measurement

➔ Integrity of plant (corrosion), design failure, Mine Bench (Loose Digging face)

Likelihood

- The number of times tasks/cycles/situations occur
- The number of people performing the tasks or exposed, and
- What has happened in the past here or elsewhere in similar situations.

Table: Likelihood criteria guideline

Rank	General definition	Likelihood
L1	Almost Certain	Event or exposure daily
L2	Likely	Event or exposure monthly
L3	Occasional	Event or exposure annually
L4	Unlikely	Event or exposure once in 10 years
L5	Rare	Event or exposure once in 100 years

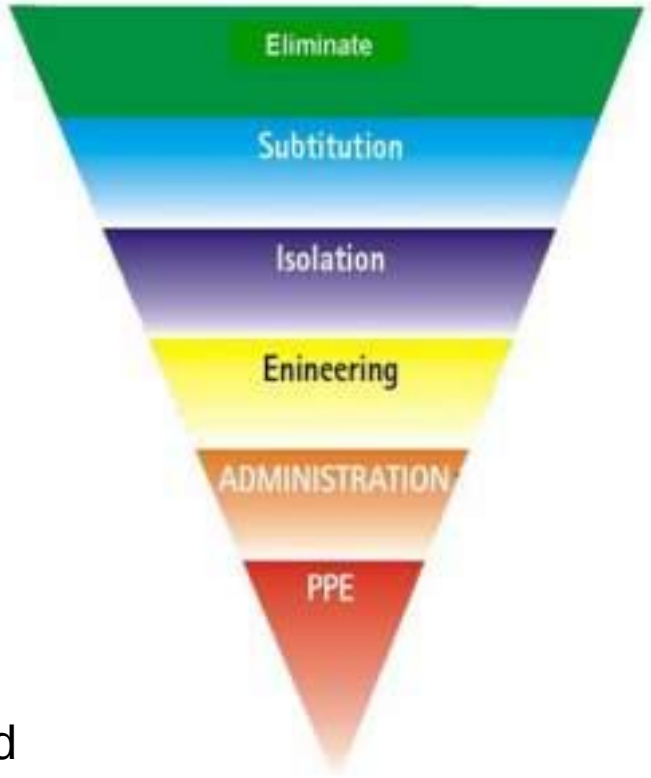
Risk Ranking

Risk Rank Likelihood x Consequence	L1 Almost certain	L2 Likely	L3 Occasional	L4 Unlikely	L5 Rare
1 Catastrophic	1	2	4	7	11
C2 Major	3	5	8	12	16
C3 Moderate	6	9	13	17	20
C4 Minor	10	14	18	21	23
C5 Insignificant	15	19	22	24	25

Hierarchy of Controls

- **ELIMINATE** - redesign the task to eliminate the Hazard?
- **SUBSTITUTE** - replace materials, equipment or processes with less hazardous ones?
- **ENGINEERING / ISOLATION** - Is it possible to provide mechanical aids, barriers, guarding etc to isolate the hazard?
- **ADMINISTRATION/TRAINING** – Use training and procedures to inform people how to avoid the hazard?
- **PPE** – Use Personal protective equipment to avoid impact with hazard.

Most Effective



Least Effective

Case Study

A opencast coal mine in Chhatisgarh

Mining operation started in 2006

Current production 1200 tonnes per day

Machinery:

- Drill m/c, 160mm dia
- Dumpers (35 OB, 20 Coal)
- Loaders
- Haul road: 300m length, 20m wide, slope 1 in 6
- Transportation road: 2.5 km long, 30m wide
- Dump height: 30m, Slope: 37^0

Dust, Chemicals & Hazardous Substances

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
Dusts that can effect operations	L2	C3	9
Dusts that can effect health such as silica	L4	C3	17
Fines or build-up of combustible particles	L4	C3	17
Chemical such as petrol, diesel, oils, degreasers, solvents.	L4	C3	17
Gases such as H_2S, CO, CO_2 NO_X	L3	C5	22

Electrical Energies

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
Electricity(High voltage installation)	L4	C3	17
Electrical energy from apparatus such as cables, transformers, switch gear, connections	L3	C4	18
Electrical Equipment inspection, testing and tagging to standards	L4	C4	21

Explosives

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
Explosives – general (Fly rock occurrences, noise and vibrations)	L2	C1	2
Handling Explosives	L4	C1	7
Explosives Storage -including detonators	L5	C1	11

Gravitational Energies

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
Mine road design and construction	L3	C1	4
Fall and dislodgement of earth and rock	L4	C1	7
Instability of the excavation and adjoining structure	L4	C1	7
Floor	L3	C3	13
High wall / pit wall / stockpiles / berms	L3	L3	13
Objects / structures falling on people	L4	C3	17
Fall of things such as components, tools, structures	L5	C3	20

Mechanical Energies

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
Road traffic in and out issues	L2	C3	9
Inappropriate exposure to moving machinery	L4	C2	12
Mechanical failure (including critical systems)	L3	C3	13
Loss of control of a vehicle or other machinery at the mine	L4	C3	17
Interaction between mobile plant and pedestrians	L4	C3	17
Unintentional fire or explosion	L4	C3	17
Contact of mobile plant with overhead structures	L5	C3	20

Pressure (Fluids/Gases)

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
Inrush into/flood intrusion of mine (directly or indirectly)	L2	C2	5
Unusual rain event	L3	C3	13
Flow failure of pumping system e.g. Outlet blockage	L3	C4	21
Road drainage	L4	C5	24

Work Environment

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
Noise	L4	C2	12
Wildlife such as snakes, spiders, insects	L3	C3	13
Manual handling hazards	L4	C3	17
Biological, such as exposure to work related diseases	L4	C3	17
Slip/trip hazards	L4	C4	21
Vibration	L4	C4	21
Building maintenance / cleaning	L3	C5	22
Effects of Ventilation	L5	C4	23
Condition of Buildings / Structures	L4	C5	24
Sufficient Hygiene Facilities	L4	C5	24

Others

HAZARD TYPE	Likelihood Level	Maximum Consequence	Risk Rating
Use of PPE	L2	C1	2
Spontaneous Heating	L2	C4	12
Inundation	L3	C2	8

Conclusion

Mining activity because of the very nature of the operation, complexity of the systems, procedures and methods always involves some amount of hazards.

Adequate mine safety and emergency preparedness requires considering all of the possible hazards that could be encountered.

Some hazards, however, are more likely to cause problems than others at a given mine and some would result in greater damage than would others.

These differences are identified by conducting hazard identification and risk analysis.

Risk assessments will provide information on the probability of harm arising and severity of harm by understanding the hazard, combine assessments of probability and severity to produce a risk assessment matrix.

Thus the mine management can prioritize risks into high, medium and low risk levels, which can be used in better management of risks.

The outcome of the analysis can be used to target resources at the types of events that are most likely to occur and/or are most destructive.

Thank You

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