

**PRESENTATION  
ON**

**RISK MANAGEMENT IN MINING  
OPERATIONS WITH PARTICULAR  
REFERENCE TO DUST HAZARD**

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**INTRODUCTION**

The adverse impact on environment due to mining operations can be reduced by

- **Complying Legislation and Standards**
- **Following Guidelines and Policies.**

They need enforcement by State/Central Govt. agencies, are not site specific and are difficult to amend.

Risk management is based on concept of Self regulation and is an effective tool for development of Health, Safety and Environmental management plan.

It is site specific and acceptable to all resulting in it's effective enforcement and least adverse impact.

**GENERAL INFORMATION**

**Terminology**

- **Hazards:** a source of potential harm or a situation with a potential to cause loss( people, property, built or natural environment).
- **Risk:** the chance of something happening that will have an impact on objectives . It is measured in consequence and likelihood
- **Risk assessment:** the process whereby risk management priorities are evaluated.
- **Risk management:** the systematic application of management policies , procedures and practices to the tasks of identifying , analysing , assessing , treating and monitoring risk

**OBJECTIVES OF RISK MANAGEMENT**

**In the mining industry it aims to:**

- reduce the impact of mishaps of all kinds,
- reduce the inherent potential for major accidents
- reduce damage to the environment ,
- reduce serious production and also thus profit losses

**Examples of hazards needs Management**

1. Health & Safety
2. Environment.
3. Financial Matters etc.

**DUST HAZARD**

Dust is an unwanted by-product of all mining activities

**It is Hazardous To**

- \* Environment,
- \* Health and
- \* Safety

**Diseases**

- \* Inhalation of dust cause disease - **Pneumoconiosis**
- \* Inhalation of Silica dust causes disease - **SILICOSIS.**

**Notification (Sec.25 of Mines Act1952)**

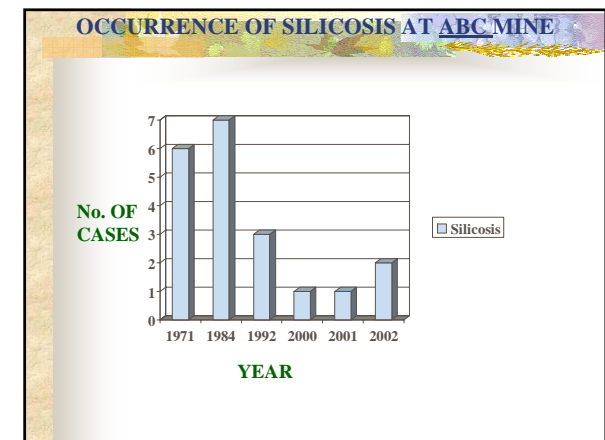
- \* Pneumoconiosis (Silicosis) from ABC u/g Mine

**Action**

- \* Directorate General of Mines Safety (DGMS) conducted
- Detailed Investigation and
- Risk Management exercise

**Purpose**

- Identification of sources of dust emission,
- Assessment of Risk and
- Developing & Implementing controls.
- Monitoring effectiveness of control measures.



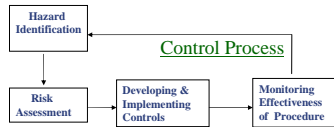
## RISK MANAGEMENT

- \* Recommended by 9<sup>th</sup> conference on safety in mines.
- \* Enforced by Directorate General of Mines Safety vide a S & T circular no.1 of 2003.
- \* Implementing by Mine Management

### Objectives:

- To reduce the emission of dust and getting it airborne.
- To prevent dispersion of dust in mine environment which could cause serious health hazard

### Process of Risk Management.



## RISK MANAGEMENT

### Formation of Team:

#### Risk management Team:

Manager  
Asst Manager  
Engineer  
Foreman  
Workmen Inspector  
Driller, Cavo/LHD operator and  
Crusher operator.

### Identification of sources of Dust Emission:

#### The basis of identification

## A -Dust Survey Data at ABC mine

### RESPIRABLE AIRBORNE DUST CONCENTRATION (2001-02)

SN	Operation	Location	Dust Concentration mg/cum
1.	Drilling	495 ML E8 FW	0.6
2.	Drilling	495 ML E4 HW	1.5
3.	Drilling	495 ML E7 HW	0.8
4.	General	495 ML Level	0.8
5.	General	555 ML W5 FW	1.0
6.	Drilling	555 ML E3 FW	1.2
7.	Drilling	555 ML E10 FW	0.7
8.	Drilling	555 ML E4 FW	1.0
9.	Drilling	555 ML E7 FW	1.0
10.	Drilling	620 ML W5 FW	0.7
11.	Mucking	620 ML E3 FW	1.5
12.	Stoping	620 ML E10 FW	0.8
13.	Drilling	620 ML Level	0.7

## B) Review of Medical Records of Periodic Medical Examinations:

- \*Chest Radiographs studied: 91 workers (drilling operations).
- \*Pneumoconiotic Opacities (silicosis): 9 workers
- \*Pneumoconiotic Opacities(suspected silicosis): 12 workers
- \*Silicosis could not be ruled out: 11 workers
- \*Normal: 35 workers

## C) Survey of Airborne Respirable Dust:

Permissible Limit of Dust Concentration(Reg.124 of MMR 1961)  
"The 8-hour time weighted average permissible limit as determined by use of approved dust sampling instrument and procedure is

- "3 mg/cum of air where free silica content in respirable dust is less than 5% and 15% of free silica in mg/cum in case free silica content is more than 5%."
- "2 fibers per milliliter of air in case of asbestos
- "5 mg/cum of air in case of manganese ore.

### At ABC Mine

- \* The percentage of crystalline quartz( free Silica): 18%
- \* Hence 8-hour time weighted average permissible limit is 15/18 = 0.8 mg/cum of air.

## Sampling Strategy:

- \* Discussion Regarding working of the mine and the mining operations
- \* Visited Underground Operations-
- \* Selected the sampling location (MMR 124)
- \* Selected Shifts A and B (maximum work persons)
- \* Selected Drilling, Loading, Mucking, Crushing and Rock breaking operations

### Identified Work Spots for Sampling :

Sl.No.	Operation	Location
1.	Crushing	580 ML
2.	Drilling with Jumbo Drill	555 ML, W 1 Stope
3.	LHD operations	555 ML, W 1 Stope
4.	Conveyor Belt Operation	555 ML, W 3 Stope
5.	LHD operations	555 ML, W 3 Stope
6.	Jack Hammer Drilling	555 ML, W 3 Stope
7.	Dressing	555 ML, W 3 Stope
8.	Mucking	555 ML, W 4 Stope
9.	Rock Breaking	555 ML, W 4 Stope
10.	Jack Hammer Drilling	555 ML, W 4 Stope

## Sampling for Personal Dust exposure

### Personal Samples :

- Sampler: **SKC, LTC personal dust sampler**
- Rate: **1.9 lit per minute.**
- Filter: **25 mm diameter pre-weighted membrane filters.**
- Duration: **U/g entry to U/g exit**
- 10% reduction of flow rates: **Discard Samples**

- \* **Analysed samples for free silica content and**
- \* **Calculated airborne dust concentration**

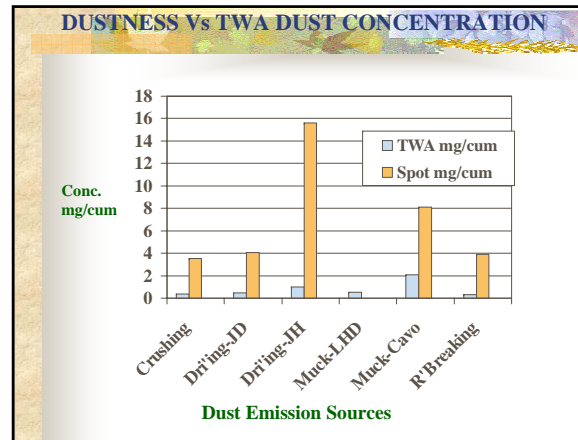
### Spot Reading for Airborne Dust:

- Sampler: **MINIRAM Personal Dust Monitor(PDM-3).**

**Results of Airborne Dust Survey :**

**Final Results:**

Sl.No.	Operation	Location	Sampling Point	Concentration mg/m <sup>3</sup>	TWA mg/m <sup>3</sup>	Reading (Miniram) mg/cum
1.	Crushing of Raw Ore	580 ML	Crusher Operator	0.47	0.38	3.52
2.	Drilling	555 ML	Jumbo Drill W1 Stope Operator	0.54	0.45	4.04
3.	Mucking	555 ML	LHD Operator	0.71	0.51	-
4.	Drilling	555 ML	Jack Hammer E 3 Stope	1.42	0.98	15.6
5.	Mucking	555 ML	E 3 Stope Driller Cavo Operator	2.49	2.10	8.12
6.	Rock Breaking	555 ML	E 4 Stope Rock Breaker E 4 Stope Operator	0.35	0.29	3.92



**Final results of dust survey Indicates:**

1. The Jack Hammer Drillers and Cavo Loader Operators were exposed to a very high dust concentration than permissible limit i.e. **0.8 mg/cum of air.**
2. The dust concentration during operation of Jumbo Drill and LHD is also more than the 50% of the permissible limit hence sampling frequency shall be reduced to **3 month interval.**
3. The spot measurement by MINIRAM indicates that there is huge dust generation during operation of LHD, Jumbo Drill, Crusher and also Rock Breaker which may not affect miners because TWA dust concentration is quite below the permissible limit but definitely pollute the environment.

**Risk Assessment and Ranking:**

Sources: Ranked on the basis of consequence and Likelihood.

**RISK = CONSEQUENCE\* LIKELIHOOD**  
**= CONSEQUENCE\* PROBABILITY\* EXPOSURE.**

Consequence	Probability	Exposure
Effect	Score	
Several affected	5	Well be expected
Few affected	1	Quite possible
Significant chances of disease	0.3	Unusual but possible
Small Chances of disease	0.1	Remotely possible
		Unlikely

Effect	Score	Probability	Exposure
Several affected	5	Well be expected	10.0
Few affected	1	Quite possible	7.0
Significant chances of disease	0.3	Unusual but possible	3.0
Small Chances of disease	0.1	Remotely possible	2.0
		Unlikely	1.0

**Risk Assessment and Ranking**

**Principal Sources of Dust Emission and Ranking**

No.	Major Source	Cons	Prob.	Expo.	Risk	Rank
1	Drilling	5	7	5	175	I
2	Mucking	5	7	5	175	II
3	Crushing of raw Ore	1	2	10	20	III
4	Rock Breaking	1	2	5	10	IV
5	Conveyor Belt Operation	0.1	2	10	02	V

**Developing and Implementing Controls**

**Aim**  
 To reduce severity of hazards  
 With due regards to the cost and it's applicability.

**Statutory Provisions:**

**Reg. 124 of MMR 1961 prescribes**  
 \* Permissible limits for various types of airborne respirable dust,  
 \* Dust sampling strategies and  
 \* Control measures required to be adapted in mines.

**Reg.131 of MMR1961 prescribes Standards of Ventilation**  
**Reg.41 of MMR 1961 prescribes Duties of person employed in a mine**

**Section 72A of Mines Act 1952 prescribes**  
 \* Punishment for a period of six months and/or  
 \* Fine up to Rs 2000/- for contravention of provisions

**Section 22A gives powers to prohibit employment in such cases.**

## Developing and Implementing Controls

**Control Measures:** They includes,

1. Wet suppression with Calsolene oil, non ionic detergent and colset approved by DGMS
2. Dust settling ionizer: Pulver Bond and Dust Bond approved by DGMS
3. Dust removal equipments
4. Enclosures
5. Work practices including use of sharp bits, good ventilation, sufficient time elapsed after blasting etc
6. Physical/ Vegetation covering.
7. Dust respirator
8. Dust plans.

## Action Plan for the Control of Dust Hazard

## Monitoring Effectiveness of Control Measures

The action plan for control of dust hazard was monitored regularly and reviewed by Risk Management team once in every three month. The result of airborne dust survey conducted on satisfactory implementation of control measure during last quarter is as below.

■ **Final Results:**

Sl.No.	Operation	Location	Sampling Point	Concentration mg/m <sup>3</sup>	TWA mg/m <sup>3</sup>	Reading (Miniram) mg/cum
1.	Crushing of Raw Ore	580 ML	Crusher Operator	0.42	0.35	2.78
2.	Drilling	555 ML W1 Stope	Jumbo Drill Operator	0.54	0.45	3.65
3.	Mucking	555 ML E 3 Stope	LHD Operator	0.48	0.42	-
4.	Drilling	555 ML E 3 Stope	Jack Hammer Driller	0.34	0.28	7.7
5.	Mucking	555 ML E 4 Stope	Cavo Operator	1.20	0.78	3.34
6.	Rock	555 ML	Rock Breaker			

## CONCLUSIONS

- 1) The reduction in dust concentration below permissible limit is mainly achieved in ABC underground Mine through systematic implementation of control procedure as indicated in Action Plan Worksheet developed as result of Risk Management Exercise.
- 2) Risk management studies shall be carried out for every mining operation and also monitored at specific intervals.

THANK YOU