Underground Mine Environment Explosion and Their Prevention

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Abstract -- In Present study an effort has been made to carryout various cause of explosion and their preventive measures. Thus this study lead to give a review on reduction of hazard in underground coal mine explosion. In this regard the properties of explosion has an important influence on explosibility . Explosibility of explosion has been studied in laboratories, in explosion galleries and in an experimental coal mine.

Indexed Terms - Explosion, Explosive, Coaldust, Methane, Watergas, Permitted P-5 explosive.

I. INTRODUCTION

In Underground Mine, Explosion occurs naturally or artificially because there are many resources are present in U/g Mine for Explosion like Explosive, Explosive gases, Coal dust, Water gas Explosion.

An Explosive is a Solid and Chemical compound or mixture ignited by heat, produce sudden shock and change themselves into high pressure or high power of energy. Explosive gases like Firedamp, Whitedamp, Stinkdamp, hydrogen are present in Underground Mine environment and they are explode when they are in contact of sufficient heat and fire.

In Underground Coal Mines Coal Dust are present and it is also a major cause of Underground Mine Explosion. In Underground Coal Mines a rare chance of water gas explosion is also occurred. That's why In Underground Coal Mines Explosion Prevention is necessary for safe worker and safe production.

1.1 Permissible Explosives and Permissible Limit of Explosive gases in Underground Mine Environment.

● In Underground Coal mines only "Permitted P-5" type explosive are used for Solid off blasting because Permitted P-5 explosive do not produce fume or smoke.

Fig 1. Wrapped-permitted-explosive [3]

● A gas explosion is an explosion resulting from mixing a gas, typically from a gas leak with underground mine air in the presence of heat, fire or spark. [5]

Explosive limits of mine gases: [1]

i. Firedamp – 5.4% to 14.8% in general body of air.
ii. Whitedamp – 12.5% to 74% in general body of air.
iii. Stinkdamp – 4% to 75% in general body of air.
iv. Hydrogen – 4% to 45% in general body of air.

Composition of atmospheric air: [2]

i. Oxygen- 21%
ii. Nitrogen- 78%
iii. Co2- 0.04%
iv. Other gas- <1%

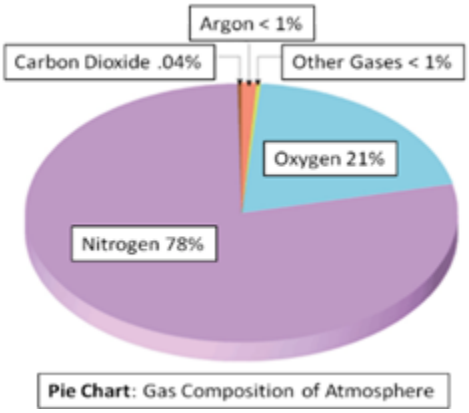

Fig 2 Gas composition of Air [4]

II. EXPLOSION AND THEIR PREVENTION

(i) Gas Explosion.

In underground coal mines if any explosion is occurring due to explosive gas like methane,

whitedamp, stinkdamp, hydrogen. This type of explosion is called Gas Explosion. Firedamp is the major cause of these type of explosion.

Causes of Gas Explosion. [1][2]

- Negligence of Miners.
- Use of damaged safety lamps and their improper handling.
- Blasting in gassy area.
- Mine fires.
- Frictional heating and frictional sparks.
- Electric sparks.

Prevention against Gas Explosion. [1][2]

- Properly and Carefully check the presence of gas in working area.
- Do not drill or blast in the working area where gas is detecting.
- In mine working area DGMS approval equipment's are used.
- In underground coal mines avoiding source of heating and ignition.

(ii) Coal dust Explosion.

In mine environment fine particles of coal is present in mine, these fine particles are exploding when they are in contact with ignition. These explosions are called Coal dust Explosion. Coal dust explode when the coal particles are 30 to 40 g/ present in general body of air. [2] The lower limit of inflammability of coal dust is 1 gm/c.c.[2]

The inflammability of coal dust is depand upon the following factors: [1][2]

- Age of the dust
- Intensity and Nature of ignition Source.
- Volatile matter percentage.
- Presence of Methane and moisture.

Causes of Coal dust Explosion. [1][2]

- Naked Flames
- Mechanical Friction
- Firedamp Explosion

Prevention against Coal dust Explosion: [1][2]

- Reducing the formation of coal dust at the working places.
- Before starting drilling or blasting procedure in working places, proper water sprays has to be done.
- Ensure that holes is properly cleaned after that charge is slotted in the holes.
- Built Stone dust barrier or water barrier in the district.

(iii) Explosive Explosion.

In Underground coal mines explosive is used for breaking of coals (Production) and breaking of rocks. Improper handling of explosive causes unwanted explosion in mines.

Causes of unwanted Explosive Explosion. [1][2]

- Improper cleaning of Coal dust in the charging hole.
- Mechanical Friction
- Firedamp Explosion
- Negligence of miners

Prevention against unwanted explosive Explosion: [1][2]

- Before starting drilling or blasting properly and carefully check the presence of inflammable gas.
- Ensure that holes is properly cleaned after that charge is slotted in the holes.
- DGMS approval Permitted P5 explosives should be used.
- During Misfire do not dissembled charged explosive except a trained or authorized person.

- During dissembled Misfire proper precaution should be taken.

(iv) Water gas Explosion.

In Underground Coal Mines a rare chance of water gas explosion is also occurred. Water gas is a gaseous fuel mixture of hydrogen and carbon monoxide (Co) and sometime time it causes of major explosion and create a major hazard in Underground Coal Mines. [5]

Synthesis gas is made by passing steam over a red-hot carbon fuel such as coke: [5]

$$H_2O + C \longrightarrow H_2 + CO \ (\Delta H = +131 \text{ kJ/mol})$$

Prevention against Water gas Explosion: [5]

- Proper Ventilation system.
- Control of Hydrogen and Carbon monoxide emission.
- Measure against accumulation of dangerous Hydrogen and Carbon monoxide mixtures in mine working from the beginning.
- Make water barrier in the mine district area.

III. CONCLUSION

The overall conclusion is that without proper handling and precautions we can't stop u/g coal mine explosion so that necessary precaution and handling always taken. Proper investigation and Prevention is the key of safe working.

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