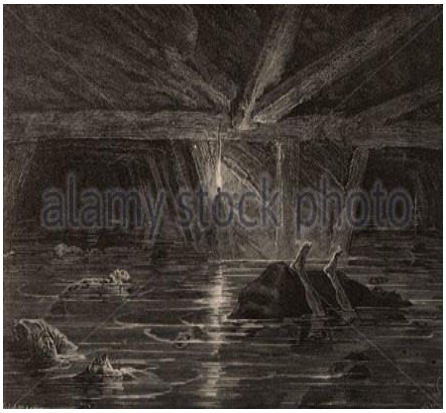
:::::::::::::::::::::::::::::: MEE with CSEP (Comprehensive student enhancement pattern) ::::::::::::::::::::::::::





MINE ENVIRONMENTAL ENGINEERING



HEARTFELT THANKS TO:

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J.B.INSTITUTE OF ENGINEERING & TECHNOLOGY
(AUTONOMOUS)
B.TECH- Mining
III Year II SEMESTER L T-P-D C
4 0-0-0 4
MINE ENVIRONMENTAL ENGINEERING

Unit-1

Spontaneous Combustion: Various theories, factors, various indices for determination of susceptive of coal to spontaneous heating, control measures.Mine Fires: Survey of various causes of mine fires with statistical data of Indian mines, various methods adapted to combat fires and their advantages and disadvantages. Advances in fire fighting techniques and equipments, rescue operations in fire zones.

Unit-2

Reopening of sealed-off areas: Factors to be considered, methods, precautions. Mine Explosions: Causes of firedamp explosion with statistical data of Indian mines, preventive measures against firedamp explosion. Production, assessment and control of mine dust and associated hazards. Causes of coal dust explosion with statistical data of Indian mines, preventive measures against coal dust explosion.

Unit-3

Mine Inundation: Causes of inundation with statistical data of Indian mines. Precaution to be taken while approaching old workings, preventive measures of inundation.
Noise and Vibrations: Causes and measurement of noise levels. Precautions, prevention and reduction of noise levels. Environmental aspects of blast induced vibration and noise.

Unit-4

Mine illumination: Its effects on safety and efficiency, illumination standard, common types of flame safety lamps, their use and limitations, electric-hand and cap lamp, their maintenance and examination, lamp room design and organization. Illumination arrangement of opencast and underground working.

Unit-5

Rescue and recovery work, equipment, short distance apparatus. Self contained oxygen-breathing apparatus. Rescue stations, principles of risk management.

Text /Books:

1. Mine Fires, Explosions, Rescue, Recovery and Inundation – M.A. Ramulu.
2. Fires in Coal Mines – Kaku

DEPARTMENT OF MINING ENGINEERING-Mining 3rd year JBIET								
Day/Time	**9:10-10:00**	**10:00-10:50**	**10:50-11:40**	**11:40-12:30**	**12:30-1:00**	**1:00-1:50**	**1:50-2:40**	**2:40-3:30**
Mon	**MEE**				**LUNCH**			
Tue							**MEE**	
Wed				**MEE**				
Thu		MEE-Lab(B II)!Exam@10min						
Fri		MEE Lab(B I)!Exam@10min						
Sat		**MEE** • Comprehensive Scrutinizes(3) • Prototype Replicas(2) • Journal Interpretations(5) • PPT Talks(5)			**LUNCH**			

Day/ Time	**9:10-10:00**	**10:00-10:50**	**10:50-11:40**	**11:40-12:30**	**12:30-1:00**	**1:00-1:50**	**1:50-2:40**	**2:40-3:30**
Mon	**MEE**	**UMMT**	**MS-II**	**MM-II**	**LUNCH**	**MD**		
Tue	**UMMT**	**E-I**	**MM-II**	**SEM**		**UMMT**	**MEE**	**Lib**
Wed	**E-I**	**MS-II**	**MS-II**	**MEE**		**MM-II**	**MD**	
Thu	**MM-II**	**MS-II Lab (B I)/MEE-Lab(B II)**				**E-I**	**MS-II**	**MM-II**
Fri	**UMMT**	**MS-II Lab(B II)/MEE Lab(B I)**				**Life skills lab (B-I & B-II)**		
Sat	**MS-II**	**MEE**	**MEE**	**E-I**		**UMMT**	**E-I**	**Sports**

IMPORTANT/GUESSED SHORT QUESTIONS

UNIT-1:

1) Explain briefly the mechanism spontaneous combustion.*
2) What is mine fire? How it causes.*
3) What are the indications of mine fires?
4) What are the various statistics of mine fires in India?

UNIT-2:

1) What are the precautions to be taken for reopening sealed off areas, which was sealed due to fire damp explosions?*
2) What are the various statistics of fire damp explosion in India?
3) What are the preventive measure of fire damp and coal dust explosion?*
4) What are the various statistics of coal dust explosion in India?

UNIT-3:

1) What are the causes for ground vibrations due to blast in open cast mines and explain briefly the step to be taken to minimize them.*
2) What is inundation and explain how it causes?*
3) What is ground vibration and how it affects mining life?*
4) What are the various statistics of inundation in India?
5) What is noise? How it is measures.*

UNIT-4:

1) What is illumination? And explain illumination standards on opencast and underground mines as per DGMS circular.*
2) Explain SFL. What are its types?*
3) Explain lamp room design and organization.*
4) Briefly explain electric cap lamp.*

UNIT-5:

1) Explain briefly mouth to mouth resuscitation.
2) What is rescue station?*
3) What are the principles of risk management?*
4) Explain briefly principle of self rescuer?
5)

IMPORTANT/GUESSED ESSAY QUESTIONS

UNIT-1:

1) Explain the factors influencing the spontaneous combustion, with suitable examples.*
2) Explain with suitable diagrams the constructional features and operations of
   - Soda acid extinguisher
   - Water co_2 extinguisher*
3) What are the rescue operations in fire zones? Explain any one advanced fire fighting technique.
4) What is difference between spontaneous heating and mine fire? List out ten control measure of spontaneous heating.*

UNIT-2:

1) What is Cowards diagram? Explain it in detail, with a neat diagram*
2) Explain the measures to be adopted to prevent formation of dust in underground coal mines.
3) What is effect of applying stone dust? What is index of explosibility of a coal dust? Explain the desirable qualities of stone dust.
4) What are the methods to reopen sealed of areas and write down any five influencing factors of it.*
5) Explain firedamp explosion along its causes and preventive measures*
6) Explain coal dust explosion along its causes and preventive measures*

UNIT-3:

1) What are the causes for noise in opencast mines and explain the steps to be taken to minimize them? *
2) explain in detail the causes and preventive measures to be adopted against inundation due to underground water*

UNIT-4:

1) Explain in detail, with suitable diagram, the constructional features and working of a flame safety lamp commonly used in underground coal mines.*
2) Explain the maintenance to be done for miners cap lamp and its battery and precautions to be adopted for the safety and adequate life of a cap lamp*
3) Explain standards of illumination in both opencast and underground?*

UNIT-5:

1) Explain self contained breathing apparatus along with its precautions to be taken while using it?*
2) Explain the statutory duties of a leader of rescue team while carrying out rescue work.*
3) Discuss briefly on fresh air base when rescue operations are carried out
4) What is self rescuer? Explain its constructional features.*
5) What is gas mask how it will be used?
6) What are the principles of risk management?

UNIT-1

Spontenous Heating :

Spontenous Combustion of coal or other Carbonaceous matter may be defined as the process of self heating Eventually in its ignation with out any Exteened application of the heat/ flame.

Cause :

→ When the coal is Exposed to air it absorbs the oxygen at the Exposed surface. Some of fractions of Exposed coast substance absorbs oxygen at faster rate then others and oxidation occurs in the formation of gases, mainly CO, CO_2 and the water vapour along with the Evalution of the heat during the chemical reaction.

At raised temperature the process of oxidation is slightly accelerated and some other fractions of the coal become susceptible to oxidation.

→ A stage reached when the build up of heat and the rate of temperature reaches the ignation point of coal which then catches fire.

→ As known that once the coal reaches the ignation point, the air supply to the it will only increase the Combustion.

The Ignition temperatures

Bituminous coal – 200°C

Anthracite coal – 398°C

→ The coal may be smouldering in the begning but it may soon break up into flames if sufficient oxygen of fresh air feeds the hot coal.

→ This prouss of self heating of coal resulting ultimately in its Combustion is known as "Spontenous Combustion"

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Factors influnced Spontenous Heating :-

→ Chemical Composition of coal

→ Banded Consitituents of coal

→ Foriability

→ presence of iron pyrites

→ Nature of adjoining Strata

→ Depth of seam

→ Thickness of seam

→ Geological disturbances.

Chemical Composition of coal :-

→ High moisture and volatile coals are more Susceptible to spontenous heating

Moisture – coal solid Consist of water

volatile – substance which easily Evaporated at Normal temperature.

→ All Bought coals with following levels are liable to Spontenous heat

→ 25% or More volatile matter

→ 7-15% of the moisture

→ The Moisture does not exist directly in oxidation of the coal but as it dries up the coal disintegrates so the disintegrated coal having high chances to prone Spontenous heat, due to Contact of the more surface air.

→ High volatile ranked coal and Carbon Content coals are less liable to Spontenous heat

→ Lignite and Bituminous are High susceptible to heat

→ with 2% of oxygen or less the coal is not liable to Spontenous heating.

Banded Constituents of Coal :-

- Bought Bands
  - vitrain
  - clairain
- Dull Bands
  - Durain
  - Fusain.

→ Brigh are more liable to spontenous heating

→ In dull, durain is hard and difficult to fracture and resistant to self heating

→ Fussain consits of verty largely of resistant materials But it porous.

Friability :-

Coal which can Easily Broken and Crushed in to Smaller size are more liable to the Spronetenous heating than hard Coal.

Presence of iron pyrites :

→ Coal usually containing of iron pyrites, due to presence the coal swell and digenerate more likely chances to absorbs surface air which Causes or generate spontenous heating.

Nature of adjoining strata:

Thermal Conductivity of coal measures shale is only 1/3rd that of sandstone.

→ If the coal heap covered with sandstone then is less chances of spontenous heating will be then, In covered with shale, then is likely chances of spontenous heating.

Depth of seam:

The strata temperature and Crushing Effect of Superincumbent rocks of coal seam increases the with the depth of seam. As known that Auto-Compression of the rock will be increases as depth increases.

Thickness of Coal Seam:

If the coal seam thickness is not suitable to Extract or Some cases where need to leave the coal as rib and between adjacent rocks Such coal provides suitable material for the Spontenous heating. Coal of Stooks Easily crushed and enough to attacked by the oxidation process.

* Slack and inferior coal left in underground Due to poor marketability, chances of catching fire.

Geological disturbances :

→ Near fault planes, generally the rock are fractured and crushed, thosee used to support the fault planes to generate sliding. Those crushed rock can easily lecible to Spontenous heating.

Various Indices :

Three stages — Intial stage
Intermediate stage
Last stage of heating

Intial stage of Heating :

* faint Hate
* Moosture deposition
* faint adour Known gob stink
* Cricket and other insects Chirp

Intermediate Stage :

previous symptoms intensified and there is a further pronounced petrol like odour and indicating the begning of distillation of coal.

Last stage of heating approching ignition :

→ petrol like smell will changes to tarry odour Some times known as "fire stink", due to the distillation of the coal. Feathure produce smoke and travel against the air current in the intake airway

The above said smells are obscure the actual smells which arises out of the self heating

Smell are : 1) Decay of wood in warm damp places
2) Tarred brattice cloth
3) lubricating oil. etc..

→ The systematic records of dry and wet bulb hygrometer are maintained for return airway of mines.

→ For preparatory analysis, air samples also give Enough indications of the likely spontaneous heating.

MINE FIRES

Mine fires occurs whenever and wherever Combustible materials are present in mine workings. They endanger not only the valuable lives of men in a mine but also cause considerable economic losses to the organization affected by them.

The losses incurred are both direct and indirect. The direct losses include the loss of coal reserves and valuable mining equipment and the cost of fire fighting and recovery of sealed off areas. The indirect losses includes production losses.

→ Most of mine fires starts very small and can be extinguished, if it detected in the time, with the bucket of water or a bag of stone dust.

Classification of Mine fires :

- → class A → Combustible material ✓ (Ex: timber, coal, rubber)
- → class B → Inflammable Liquids ✓ (Ex: oil, diesel, petrol)
- → class C → gaseous fuels ✓ (Ex: Butane, LPG)
- → class D → Metal fires ✓ (Ex: Iron)
- → class E → Electrical Equipment ✓ (Ex: motors, cables, circuit Equip)

Methods to Combat fires :

→ fighting by direct attack

→ fighting by indirect attack

- Isolation of fire
- Sealing the fires area or Entire mine

→ Flooding the area or Entire mine

→ Flushing the fire area with sand or suitable material with water

→ Introducing inert gas in to fire area

→ Special methods of fire-fighting.

* There is no pertained rules to deal with the fires, according to the situation and the type of fire the actions should triggered up

* The position, intensity and extent of fire depth and layout workings, degree of gaskiness of mine and immediatly availability of the fire fighting facilities govern the selection of method to Combat fires.

Spontenous Heating
mine fires
Accident Reports.

→ Spontenous heating & Fires in the Majori Colliercy 31-1-2010

→ 77 years old working second degree gassy mine, with the telemonitoring system from the 1997. (Detection of the CO, CH_4)

→ Telemonitoring system detected Co above the set limit (8 ppm) and started sounding beeps from first shift of 30th Jan. However it overlooked and not reported; but by the end of night shift, Co went up to the limit and spontenous heat found in fallen coal lying on the floor of the main return of mine, and it Engulfed to other gallaries too.

→ 8.am, 31st Jan, 2010 work was suspended

→ Directors rushed to the Site and inspected

→ At 6pm, Exhust fan found belching smoke in bulk. The telemonitor showed Co - 2000 ppm

→ 6.15 pm fan was stopped

→ Cut off the ventilation (oxygen.

→ At 8.45pm a blast of hot and poisonous gases and smoke hit 11 workers, they crushed out

→ They tried to Construct stoppings, It did not happened.

→ Following dangers in Construction of stoppings Mangement Sealed all outlets of mine on the Monday, 1st Feb 2010.

→ There are Caured loss of the 500 t/day and almost 1200 miners orendered

→ The mine Remained Sealed about 3 months

→ CMD suspended 7 workers

→ (GM(Safty), SO, VO, UM, 2 OM and AF

→ There are the above Caures listed out in Mine mangemt legislations & General Safty.

Fires in Kunustoria Colliery

(24-10-2009)

→ 650 tpd

→ 1150 men from 3 panel

→ Depillaring with stowing

→ 8.4 m thick, II gassy mine

→ 17-10-2009, High Concentration of CO was detected. It was found that there was a heating in fallen coal in bottom section of the old workings.

→ water pipelines laid to attempt was made the cool the hot mass by water., But not successful, and fire become active on 24-10-2009

→ They decided to Erect stoppings, But it took time and fire very much aggravated on 29th. which Caused the methane Explosion

→ fires almost propagated to pit No 2 and flames raised up to the headgear.

→ Some multiple actions were taken on 30th oct Suggested by the CIMFR Scientist

- Application of water mixed with foaming chemical to douse the flames
- water mixed with Sodium Silicate and DAP at high pressure on smoke
- Injection of the high pressure high stability foam through pipe. No-1. 2400 liters of liquid nitrogen and 2000 Liters of the foaming chemical were used in operation.

→ finally flames were arrested by 31st oct the but emission of the smoke was continued. fan drift was sealed, followed by the sealing of No. 2 pit. This was Completed by morning of Nov 1st. Thus the whole mine was Sealed at outlets.

→ 8 boreholes drilled, Injection of nitrogen and nitrogen foam through boreholes Continued from the 30th oct to 14th DEC. 2009. →

1,73,858 liters of nitrogen flushed down.

→ Nitrogen brought from Kolkata in Cryogenic tank

→ To monitore the gases, 3 Bore holes, Sampling Pipes. By the 31st July 2010,

Nitrogen → 82%. ↑
Co/ CoQ → 43%.. ↓ to decreased
0.29- 0.0001%. ↓ good
Temperature → 31.6°C.

→ Then after they tried several times to reopen the mine by the help of CIMFR.

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Fires in Muralidih 20/21 pit colliery. (6th oct 2009)

→ Manpower - 1350
→ BCCL - II gaury mine
→ 500/ day - two shafts serving

→ 6th oct 2009, at 8 Am mining sardar found smoky haze and informed via telephone and returned to surface.

→ Action with in 30 mints, general manger reached the mine and issued instructions to withdraw all 160 persons with self Rescuers.

→ Intimation given to all Higher officials DDMS, DMS, MRS Dhansar.

→ 9:00 AM power Cut off

→ 9:30 AM Mechanical ventilator stopped

→ 9:44 am ventilator re-started

→ Attendence has took properly at pit top.

→ Completion of withdrawal was Recorded in form 'C' Register. and lamp room record.

Causes of Mine fires :

→ Workings not developed properly on panel system
→ Developed workings not kept isolated.
→ Non-removal of fallen coal/shaley material from old workings and not dusting stone dusting
→ poor ventilation ;
→ poor quality in construction of the fire stoppings
→ lack of tele-monitoring systems in deg II & III rd
→ Subsidence cracks/potholes not properly sealed and blanketed causing leakage of air in to the old workings.

Suggested Measures :

→ If any drive commencing to isolate old workg ; have to remove fallen coal before totally
→ Systematic Cleaning and stone dusting of un-isolated workings and paticulary in the Return airway.
→ Should not used falled coal for packing

→ All unused workings / old workings / return airways should be under charge of senior mining official (2nd class and first class holders) they have to inspect personally as per regulation 1957 CMR - 117(6) 116A, (2)(3)(a)(b) and (c)

→ Meticulous workand inspection of unused workings should be carried by one overman.

→ for inspection Adequate Enviormental testing Equipment should be holded.

→ Sufficient material to fight with fires should keep in stock.

→ Blanketed and subsidence areas should frequently inspected

→ Testing Co in return airway of the Every depillaring district and determining Co produced / O2 absorbed ratio.

→ frequent check for gas samples / Analysis

→ Multigas detectors / methanometers should on roll.

→ Improve awareness over fires in workers

→ Great caution while taking a re-open sealed off areas / mine.

Methods to Combat fires :

→ fighting by direct attack

→ fighting by indirect attack

- Isolation of fire
- Sealing the fires area or Entire mine

→ Flooding the area or Entire mine

→ Flushing the fire area with sand or suitable material with water

→ Introducing inert gas in to fire area

→ Special methods of fire-fighting.

* There is no pertained rules to deal with the fires, according to the situation and the type of fire the actions should triggered up

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facilities to DO --- (Combat fires) :

* fighting directly

The standard fire fighting facilities are Considered when planning fire protection in mines are:

→ (a) water mains or lines

→ (b) Sprinkler system

→ (c) truck mounted water tanks

→ (d) fire Extinguishers *

→ (e) stone dust, sand, or dry chemicals

→ (f) Miscellaneous fire-fighting materials

Water Mains :

→ Without any doubt is an Excellent fire-Extinguishing agent for fires at any stage. It can be used as Solid Stream or Spray Depending on the nature and location of the fire. by the cooling the burning material. The thing here to facilitate needed Quantity of the water.

→ The water mains Capable of the 400 liters / minute with minimum flow pressure of the 1.5 bar

→ water should neatly covered with steel or reinforced concreet tank reservior.

→ The tank capacity should be 100 m^3 and preferably should not used for another purpose.

→ The water mains should provided at all mines not naturally wet throughout, at the top and the bottom of the main shafts, secondary haulage roadways, and in staple shafts.

→ The dia of the mines atleast 50mm in diameter and fitted with Hydrants near the pitbottom and at interval not exceeding 100m in the main roadway and 50m in gate roads, 25m in the conveyor haulage roadways, 20-25m in intake side of main Jounction, engine rooms substations.

→ The perpose of the Hydrants should be installed in such a way that they are protected aganist damage and are easily accessible & visible.

Sprinkler System:

Automatic sprinkler systems, as fixed the fire extinguishers systems are advantageous because of economy, Relaibility, good supression capability and minimum maintaince.

Suitable For :-

→ Belt Conveyor roadways
→ timbered main and staple shafts.
→ Host engine room.

In timbered Shafts:

The sprinklers should installed to sprinkle Every Squre meter area of the shaft section.

→ The amount of water required is atleast 500 liters/minute/Squre meter of Cross-Section

→ For main shafts needed 400 liters/minute...

→ Every sprinkler System should Examined weekly and founctional test should don

* Sprinkler Systems have the disadvantage that their Installation, Care, maintaine are somewhat Complicated.

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Truck-mounted water tanks:

where Ever not possible with water mains. mobile-truck mounted tanks should provid

→ The water Car should

Extinguishers

Portable fire Extinguishers :-

Most mine fires are small when they first start and they can often be Easily Controlled by the use of suitable hand held portable fire Extinguishers which are first aid fire fighting appliances. When the fires assume larger proportions, they may still be fough successfully by large truck mounted fire Extinguishers or Chemical fire-fighting trucks if the weight of the Extinguisher more than, it need to be mount on wheels.

Principles of extinguishers:

- → Cooling Effect of water
- → Fire-Extinguishing Effect of Carbon dioxide
- → Blanketing or Shutting-off Effect of foam
- → Smothering effect of solid substance
- → Combining more than one Effect

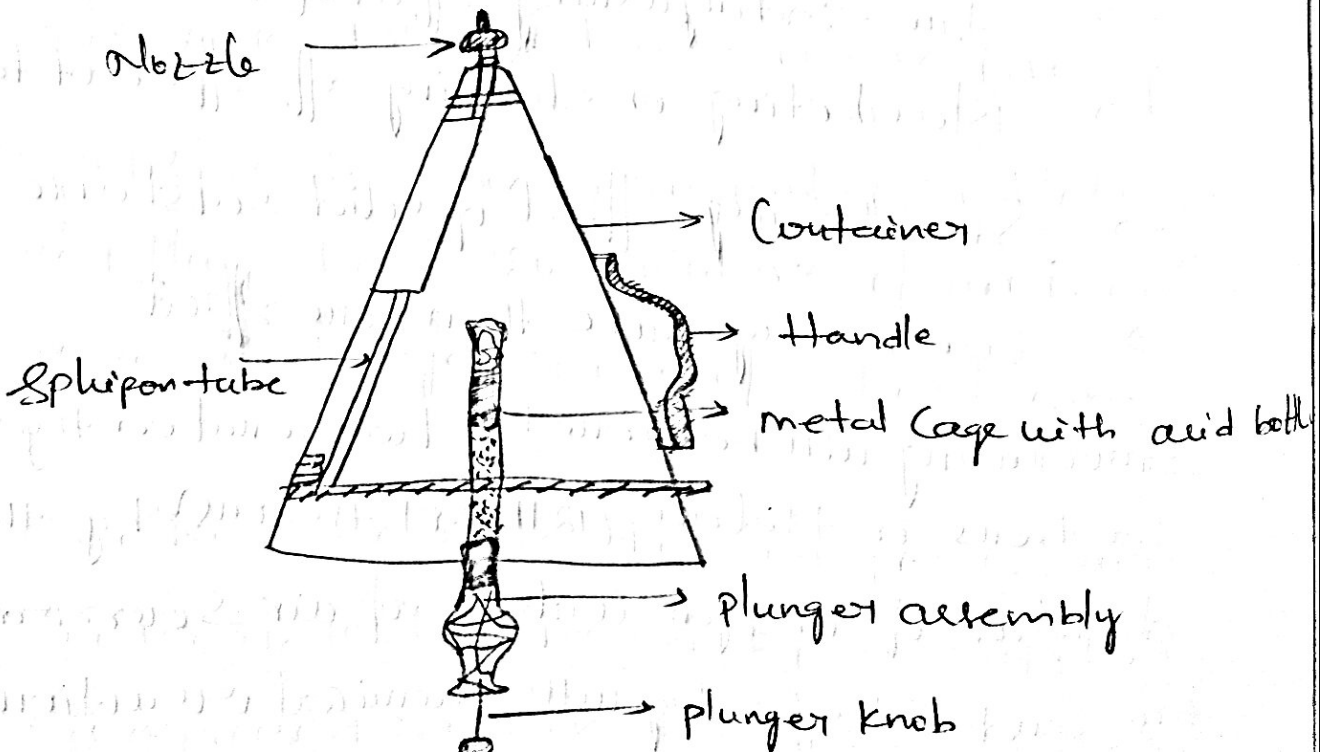
* Smothering will be done by halogenated Hydro-Carbons or Halons (1211 1301 Halons) by the dilution of oxygen Content of air Surrounding fire and interferring with chemical reactions

Types of Extinguishers :

* Soda acid Extinguisher
* Foam Extinguisher
  - Chemical foam
  - Mechanical or air foam
* Carbon dioxide snow Extinguisher
* Dry chemical Extinguisher
* Multipurpose dry chemical Extinguisher

Soda-acid Extinguisher :

-> It consist of a conical or cylinderical sheet of a fet liquid steel container and charged with basic medium bicorbonate solution.



→ A siphon or discharge tube, a Nozzle, a hermetically sealed acid phial or Bottle, a perforated acid Bottle with ~~a protection~~ disc metal cage and finally a plunger knob Assembly.

→ The Nozzle is closed with a Disc, which ruptures the Pressure and Cause for build up of the high pressure 2 bar(g)

→ The Rupture Disc furthermore, builds up a pressure inside the Extinguisher when the latter is operated which is sufficient to force the Extinguishing liquid out of the Nozzle in powerful Jet after breaking the disc.

→ The Extinguisher is operated by breaking the acid phial with the plunger knob, permitting the acid and soda solutions to mix and directing the Nozzle at the same time towards the fire.

→ The chemical reaction produces Carbon dioxide at pressure 6-5 bar(g)

→ The Capacity 10 liters

→ Discharge time is 90 seconds

→ Suitable for to Quench Solid Combustible materials

→ Not suitable for Electrical fires or fires involving Burning oils or flammable liquids

Mechanical or air foam Extinguisher :-

→ It is somewhat similar to Chemical foam Extinguisher

→ Minimax air-foam Extinguisher Consists of Cylinder Container filled with an aqueous solution of a foam-forming Compound

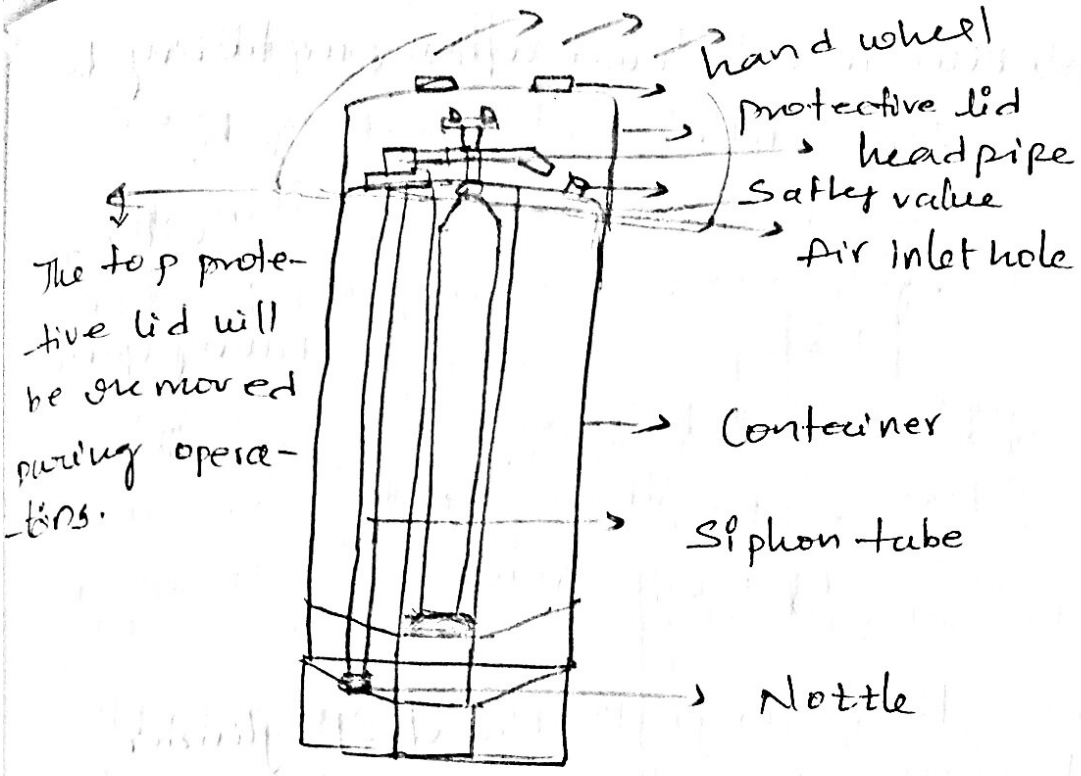
→ It is operated by the turning an Compressed air by means of handcohe el. at 150 bar to 6 bar(g) by Reducing valve before it

→ Exerts pressure on the top of the solution forcing it up siphon tube and the mixing Chamber.

→ A part of flow air through a hole in the Siphon tube at its top mixes with the solution in the mixing Chamber and Converted into very fine-bubbled air foam finally Exerted

→ A 10 liters air foam Extinguisher produces with one filling about 120-140 liters of air foam and has a discharge range of about 5m.

→ Another type Instead of Compressed air also used, But it need special appliances
→ Compressed Carbon dioxide.



Dry Chemical Extinguisher :-

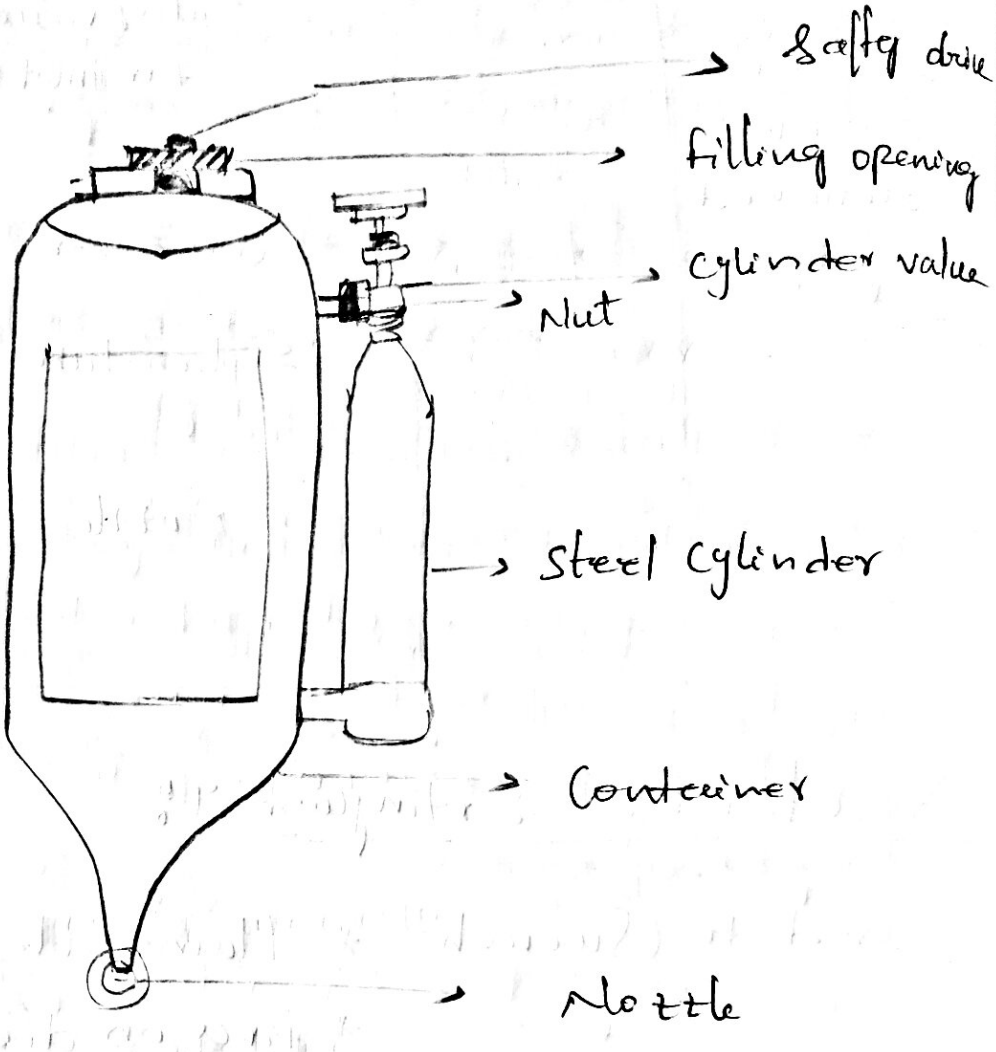
→ used to Quench
* flammable liquid fires
* fires on diesel vehicals
* fires in Electrical subjet to
* Circuit breakers
* And also for Combustible materials.

→ Sodium Bicarbonate

→ It Consist of a Container outside the fixed Nottle at the bottom, a liquid Carbondioxide Steel cylinder outside the value down the Bottom of the Container.

→ When the cylinder valve is opened Carbon-dioxide gas released which, when sufficient pressure is developed in Container, Expels the dry chemical

out the Nozzle in a cloud after rupturing the Nozzle protection disc.



→ Its very clear from above illustration – the Steel Cylinder with Carbon dioxide will be at outside of the main Container.

→ In some conditions: very low temperature Nitrogen will be preferred.

Multipurpose Dry Chemical Extinguisher:

→ The Chemical Composition is

1) Ammonium sulphate }
2) Mono ammonium }

phosphate and additives } for strong impact

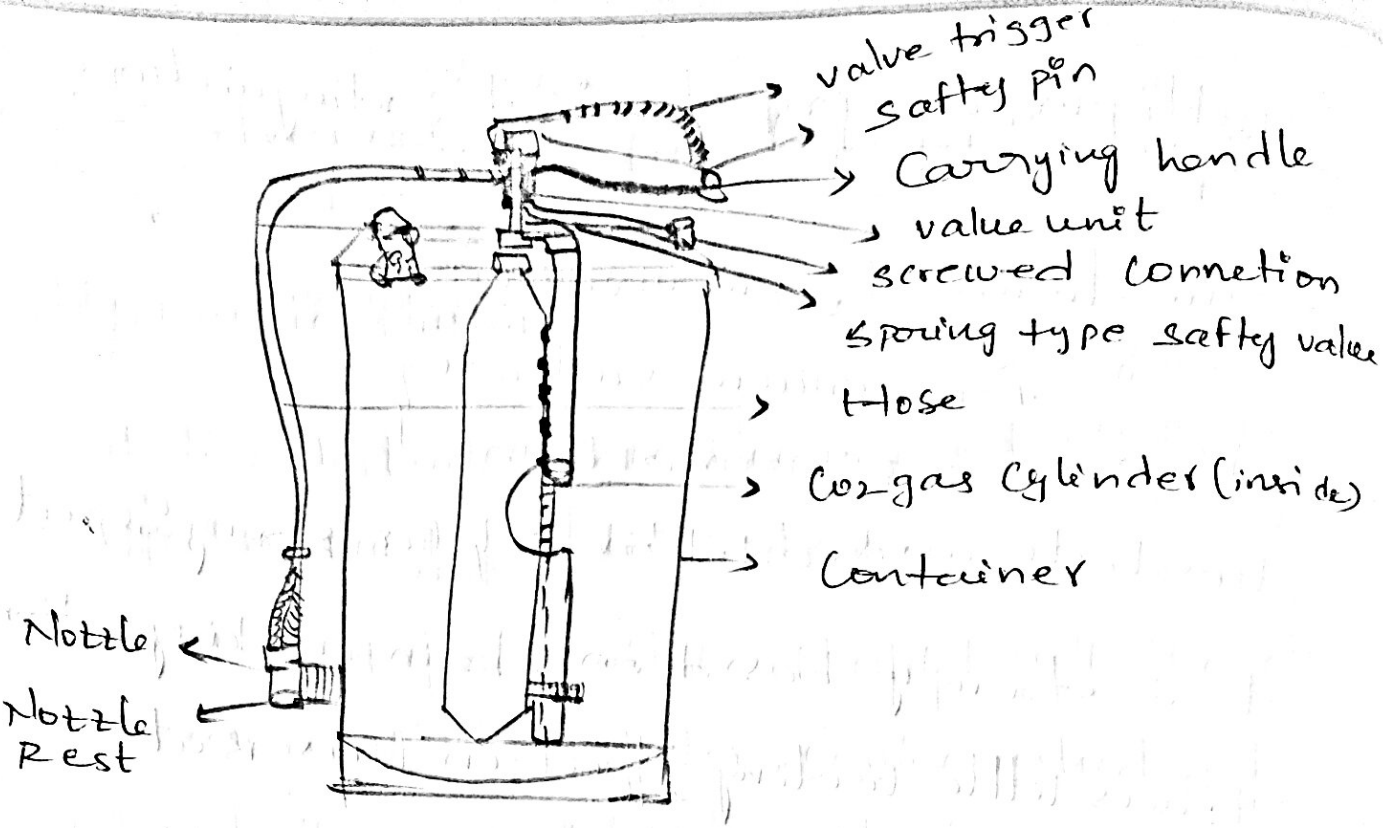
→ It is strongly based on chain-breaking action

→ It has little cooling effect on fires But its Extinguisping action is Considered as due to the inhabiting effect of the liberated ammonia and the formation of the adhering glassy crust of metaphosphoric acid over fires, in the ordinary Combustible materials.

→ The Extinguisher may be stored pressure or the Cartridge type.

→ The Extinguishers are effective in Quenching

1) Glow fires
2) flaming fires
3) flammable liquid
4) Electrical fires



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Stone Dust Barriers:

Inert dust: → limestone
→ Dolomite or anhydrite dust
→ or Sand Simply

→ → Sufficient supply of stone dust in sacks and suitable Equipments for Conveying and using it should be provided at suitable places along main Haulages, Entrance of the Each district, entrance of pump rooms and Rectifier stations in the mine.

→ The interval of provision will be on the basis of the Experience and the history

→ Extra dust and care should be paid in where ever Relative Humidity is more.

Miscellaneous fire-fighting Materials and Tools:

→ On Every haulage roadway in Each mine, fire depot or fire station should be Established at suitable places which should be Conspi-cuously marked.

→ Such stations, suitable extinguishers should be arranged.

*** Fighting by indirect attack:

→ Isolation of fire

→ Sealing of the fire area
- → temporary stoppings
- → wooden stoppings
- → Glass wool stopping
- → sand bag stopping
- → Concrete & Fly ash

→ Sealing off the Entire mine

→ Flooding the fire area

→ Hydraulic flushing

→ Introducing inert gas into fire area
- → Inert gases for inertization
- → Carbondioxide
- → Combustion gases.

→ Special methods

Advances in fire fighting techniques :

Hydraulic flushing :

→ It is adopted where flooding and sealing may not Effective due to Strata broken.

→ The sealed of area will be flushed with the clay-water and Sand water, semi crushed rock-water through the pipes left in the stoppings.

→ In metal mines, mill tailings as sludge used.

→ During flushing care should pay inorder to avoid any water gas Explosion.

→ for Controlling fire in Hydraulic stowing mines, the fire seat preferably be Encircled with a gride of the Sand barrier.

→ for flushing purpose, the drilled holes from the Surface may Cause problems further.

fire fighting with High Expansion foam:

→ High Expansion foam has been Successfully used for Combating Especially roadway fires which cannot be Successfully fought with hand fire Extinguishers or water due to smoke and heat

→ The Quenching effect of the foam is due to the water it carries with it to the fire. the vapour formed by the Evaporation of water in the walls of the foam bubbles has a blanketing effect upon the fire besides its Cooling action by virtue of latent heat of vaporization

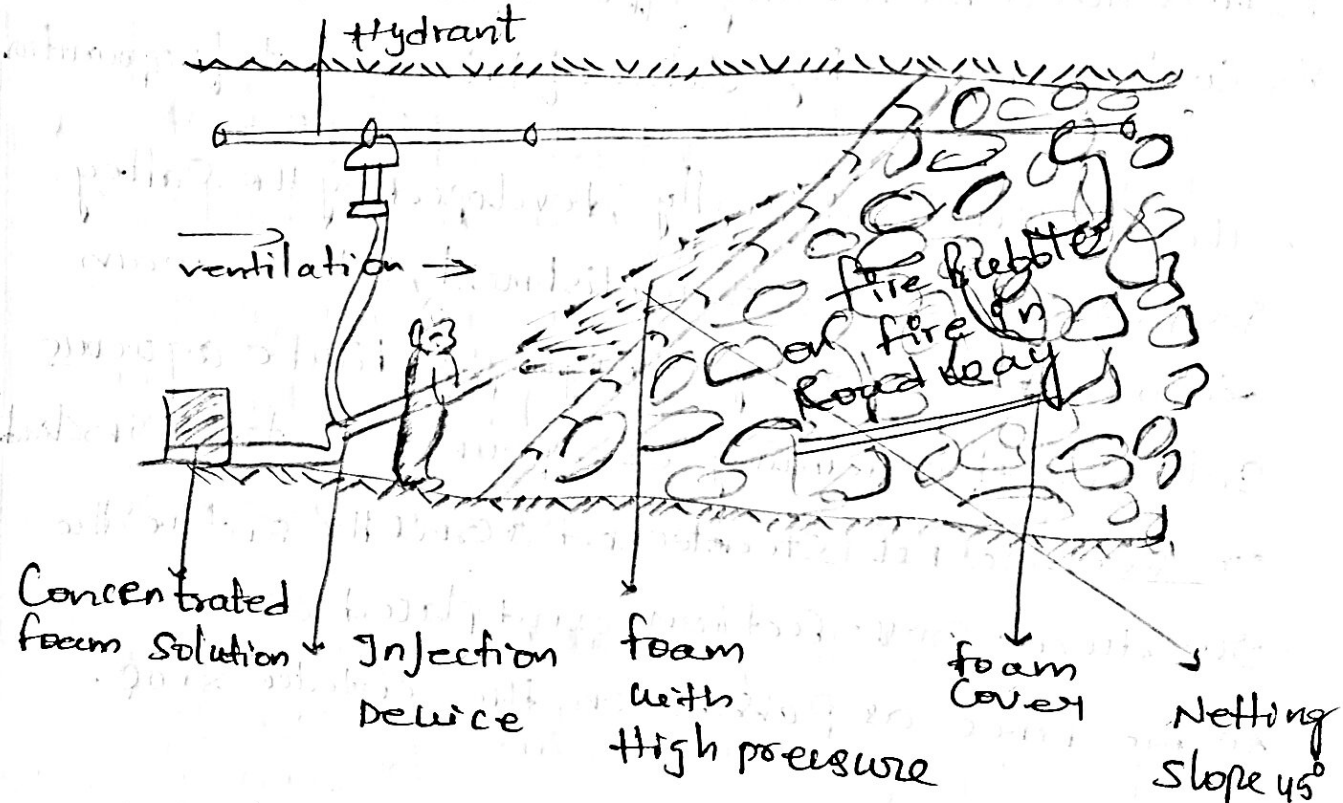
→ This method originally developed by the Safety in mines Research establishment, U.K. the foam is formed Uniformly spraying a dilute aqueous Solution of a forming Compound on to an inclined or verticle net stretched across the Entire the roadway Cross-section and placed as near to the fires as possible on the intake side.

→ The volume occupied by the generated foam is 500 to 1000 times the volume of the sprayed Solution.

→ The foam can
- Climb over obstructions
- turn sharp corners
- Expand into sectional Enlargements

→ foam plug length depends on the ventilating pressure, Nature of the roadway, stability

→ The foam should be Cover atleast 0-3kg H_2O per cubic meter, where ever fire arises.



Demerits:

→ Not suitable in Roadways > 1 in 5 or rising > 1 in 10

→ Not Effective on deep-seated fires, deep-End plate

Key points:

→ The ventilation must atleast 0.3 m/s nor Exceeds 2 m/s pressure.

→ Hydrant pressure should be about 7 bar

→ Ammonium lauryl sulphate is best foaming Compound which produces a stable foam having water Content of 0.2 – 0.3 kg / Cubic meter of foam

→ The solution must Contain atleast 2 %. foaming Compound.

→ The Rate of feeding the solution must lie between 0.002 and 0.001 of the volumetric rate of air supply.

** Fire-fighting with antipyrogene mixtures and solutions:

→ Sodium Silicate – clay water
→ Sodium Silicate and Calcium chloride

The above two type Chemicals are very successful ways to Quench the fires.

Suitable:

* Deep seated fires
* Open fires in Roadways.

Fire-fighting with dry fly ash injection:

→ Injection through Borehole consist of:

* fly ash - Bentonite portland Cement
* Inert gas - Nitrogen

The both Combination gave Excellent results in most cases.

Ventilation Controle:

→ Reversed of mine ventilation
→ Short - Circuiting
→ Isolation of fire
→ Regulation of air Quantities

Important factos of Reversed ventilation

→ Stage of fire
→ location of the fire
→ presence of workers in mine
→ Type of fan
→ Type of Doors.

Comprehend(1st Unit)

Topic name:

Date:

What you understand from the topic:

Rate yourself (10):

Rapid test

Comprehensive Scrutinizes

- Scrutinize Area:
- Define Problem?
- Root Cause:
- Control Measures:
- Your Perception:
- Any Enhancements:

PPT Talks

- Topic:
- Subtopic:
- Extracted Core Stuff:
- Pen the Illustrations:
- Mathematical terms:
- What you understand?
- Rate your friend(10):

Journal Interpretations

- Journal name:
- Title:
- Authors names:
- Publishing year:
- Synoptic abstract

- Pen the Illustrations:

- Gross theme:

- What you understand?

Journal Interpretations

3/2/17

Re-opening of Sealed off Areas

The re-opening or recovery of a district or an area which has been sealed on account of the spontenous combustion or fire from other causes poses an ardous and hatardous problem to the mine management.

Factors to be Considered:

1) Extent and intensity of fire at the time of sealing
2) Nature of burning material and adjacent strata
3) Air tightness of stoppings and the sealed area
4) Composition of the atmosphere in sealed area
5) Inert gas injection.

Extent and Intensity of fire at the time of sealing

→ If the fire Intensity and Extent is high, It requires more oxygen to burn the material

→ A large amount of the burning material will boring about a quicker reduction of the oxygen than smaller amount.

Nature of Burning material and adjacent strata

→ Nature of the burning material inside a sealed-off area whether it is timber, coal or both and the rate of burning may influence the possibility of re-kindling of fire on admission of the fire.

→ Coals having higher volatile Combustible ratio are more rekindled than less Ratio Coals

→ The Nature of the adjacent strata, especially when they are Combustible, influences the time of re-opening as they retain heat for the long time even oxygen Content has fallen below the limit when Combustion Ceases.

Airtightness of Stoppings and sealed area:

→ Airtightness of stoppings and enclosed area is very Essential for Control of the oxygen

→ After oxygen reduction percentage only the area should Effectively sealed off.

→ Some time Air may leak from stopping due to difference in the ventilation pressure and the temperature variations. Such Conditions Extra Care should take.

Composition of the atmosphere in Sealed area:

→ Knowledge of the Composition of the atmosphere obtaining in a sealed area is vital Important in deciding the reasonably safe time of the re-opening the area.

→ The percentage of the atmosphere Composition will give precise Idea of the Scenario Either safe or chances to Explosion.

→ The active Combustion will triggered out Even the oxygen percentage is 12 and Slow Combustion with the Evolution of CO_2 and CO_2 may continue Even Concentration of 5 percent.

→ Apart from the methane, Remaining Combustible gases have less Impact on the flammability.

→ Carefully Experiments should Carry for checking the levels of the methane. and the Coal dust.

→ Mayorally the fire damp Explosion Causes due to higher percentage of the methane.

Inert gas injection :

→ The place should be properly injected with the inert gas before entering in to the sealed off areas.

Methods :

* Re-opening by re-ventilation
* Re-opening by air-locking in stages (stage method)
* Combination of the above two methods.

The method selection depends on following

→ Type
→ Extent of fire
→ Site of area
→ Time allowed for cooling off
→ volume of fire damp Enclosed
→ Conditions of doors and ventilation
→ Inclination of roadways
→ Accessibility of roadways
→ presence of the water
→ Temperature
→ Inert gases Availability.

Re-opening by re-ventilation :-

a) Re-ventilation with out Inspection by Rescue brigade → with Inspection by RB
b) Re-ventilation with Inspection by the Rescue Brigade. → with out Inspection RB

RB : Rescue Brigade

In simple : large Quantity of air will be supplied to the sealed area in order to supprels or drop If any fires exist, later Extinguishing fires the area will be inspected and Re-opened. The area will be pumped with air at Origin stage with out any Inspection by the Rescue Brigade.

→ The method of direct Circulation of air through the fire area without inspection by rescue brigades is Employed when fire in an isolated area in a non-gasy mine & Known to be small in in Extent and should obtain positive Evidence the fires has been Extinguished

→ If large air decided to Circulate, It should not be more than the 140 m^3/ Minute.

→ Air should be largely and Effectively Circulated Before in any case, If the Rescue people entering

→ If any District has been sealed off, gassy mine If it re-opening, Rescue members have to inspect the place Adequetly and Samples should analyte and perfect inspection should be done.

→ Basic steps involved during Re-opening

→ The Rescue Briga de people Enter in to the Sealed off area with the Safety arrangements like self contained apparatus

→ The Intake and out (Return) should be Suitably Equipped with Airlocks

→ The Brigade team should Carry Hygrometer and Anemometer for checking levels.

→ The team Breach the intake and Entered

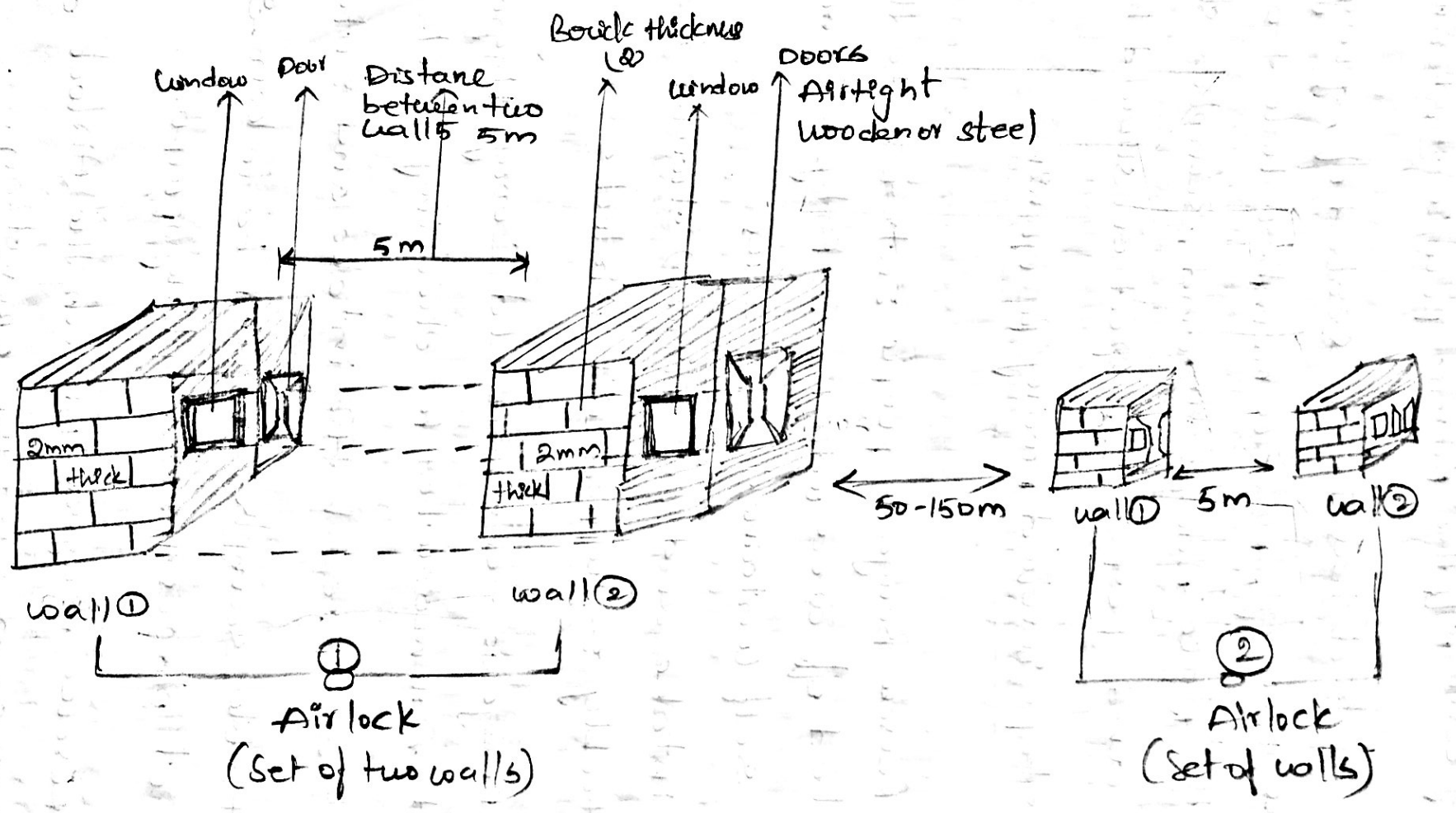
→ Suitable samples should be taken in Different places for Sampling purpose.

→ The Rescue Brigade Breach the Airlock at Return and End the operation.

→ If any suspectence in Area, It will be Filled with inert gases.

→ later with High End Clearance Confirmation the Area will be Re-opened.

Re-opening by air-locking in stages (stage method)



Applicable in

→ Roadway highly incline, fire seat is inaccessible

* procedure :

1) An air lock consists of two Brickwalls one-two brick thick 5m apart, Equipped with airtight wooden-steel Doors having glass windows for watching the advancing rescue brigade inside.

2) Between the DOORS all equipment and needed materials are used to arrange. These are to prevent air in to sealed off area to mitigate fires

3) Now the Rescue Brigade Explore the general conditions and collect air samples, take Hygrometer readings and measure for material required for the inbye Stopping of next air lock and return to fresh airbase

4) Now Construct a new air lock with in distance of 50-150m with Exist Airlock, after Construction of the New one, old one will be breached off.

5) And space between air locks is ventilated by auxillary ventilation, adequately fitted with necessary Requirements..

6) Like that the operation follows in stage method

7) It is necessary that during operation oxygen-content of fire gases be kept as low as possible at all times by limiting air leakage in to area.

8) To keep back gases and heat during erection of airlock a temporary stopping is Erected beyond proposed site of airlock

* Other Method

Re-opening of Hydraulically-flushed Sealed district

If any fire Exists during reopening of the sealed off area, the fire area is flushed with the sand or clay, the district can be re-opened Either by cleaning the mine workings of the flushed material or driving new ones. It is suitable for the smaller fires.

***

Precautions :-

* Assembling rescue and recovery crew
* Withdrawl of all men from the mine main fan to see that fan other than those required in Connection with reopening operations
* Stationing a man at the main mine fan to see that the fan Continues to ren
* Cutting off Electric power from the part of the mine in which a fire is sealed off as well as in the return airways utilized for Carrying the fire fire gases.

* Making necessary adjustments in ventilation so that the return from the fire area can be diverted on to the main return.
* Heavily stone dusting all roadways leading to and from the fire area.
* Establishing telephonic Communication between the fresh air base and the surface.
* preparatory measures for the nitrogen flushing during re-opening should it is Contemplated.

Explosion :

It is a Sudden Combustion process of great intensity accompained by the release of large Quantities of heat energy and which the original gas or solid substance like coal dust is Converted instantaneously ie to the gaseous products. An Explosion is invariably accom-pained by violence on a large scale.

Types of Explosions

* fire dam
* Coal dust } Explosions.
* water gas

fire damp Explosion:

Methane present in coal mines is a by-product of the coalification process during which coal was formed from the vegetable matter.

Methane presents in the coal seam both in the adsorbed state adhering to the internal micropore surface of the coal matrix and compressed in the fracture system of the seam.

When the seam is mined, the equilibrium that Existed in the coal seam and the surrounding strata under confining pressure is disturbed and raised.

No explosion will takeplace unless sufficient air Quantity is Circulated through the mine to dilute its Concentration in the general ventilation to the less than the safe prescribed limit.

The amount of methane stored within the coal increases with the depth of cover over the seam.

Methane burns in air when ignated with the Blue flame but when is mixed with the air, it can Explode on ignation. The Combustion and the Explosion takes place according to the Equation.

$$CH_4 + 2(O_2 + N_2) = CO_2 + 2H_2O + 3N_2$$

One volume of methane requires two volumes of oxygen for its complete combustion.

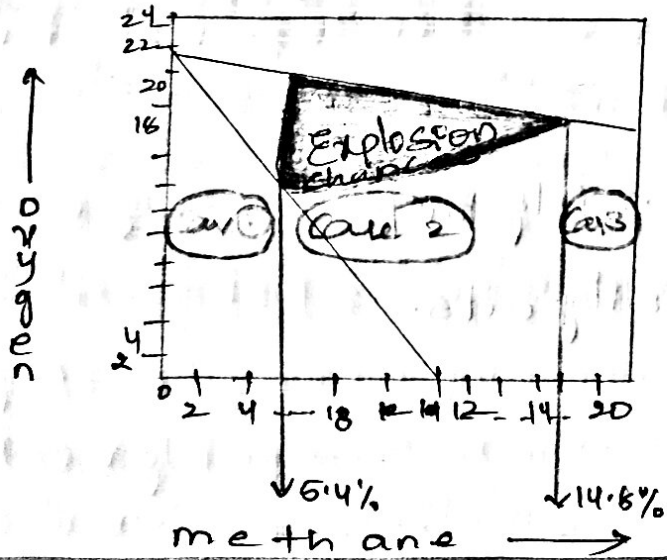
presence of fire damp in air between 5.4 & 14.8 %. forms an Explosive mixture. If any source of ignation is fetch with the mentioned fire damp Explosion will takes place. The maximum Explosive violence is produced when the Explosive mixture Contains about 9% of the fire damp.

The methane Explosions are characterised by the two distinct phases, ① Direct Blast

② Indirect Blast or Backlash

- In the Direct Blast a pressure wave travels ahead of the Explosion flame.
- In the Indirect Blast Caused by the vaccum raising out of the cooling of gases and Condensation of water vapour behind the exploding flame and is of less intensity than the direct Blast

A pure fire damp Explosion does not Extend over a wide area unless there has been emission or accumulation or large Quantities of methane.



Coward Diagram

In coward diagram mentioned three cases

Case ① → Not capable to form explosive mixture

Case ② → Explosive mixture will form and takes place explosion → fire damp explosion

Case ③ → Here it needs right amount of the oxygen or air to form Explosive mixture

Causes of fire damp Explosion :-

* Negligence of miners
* use of damaged safety lamps
* Blasting
* Mine fires
* friction
* Electric sparks
* Some special causes other than listed.

Negligence of Miners :-

- Smoking
- Making fire
- opening of flame safety lamp
- Some negligence silly acts.

use of damaged safety lamps:

The safety lamp should be safe and clean, good condition. All parts should be suitably fitted and properly handled.

Blasting:

Blasting itselfs represents a dangerous source of the ignation. The Explosives should be new and tested. No short circuits should be happen.

Mine fires:

Mine fires can easily bring about ignition of the flammable fire-damp air mixtures in contact with them.

Friction :

- friction between metal and metal
- friction between metal and Rock
- Friction between Rock and Rock.

} All cases capable to cause fire-damp Explosion.

Electrical sparks :

- Switchgear
- damaged cables
- Signalling apparatus
- faulty electrical equipments

All times spark may have a very short life and its Electrical energy may not sufficient to cause ignation. The minimum Energy of the spark Reponds on the :

→ Methane Concentration
→ Humidity
→ Oxygen content
→ temperature
→ pressure
→ turbulence.

Special Causes :

- Due to static or frictional electricity
- Due to Belts and pulleys
- Methane Blowers

} Cause Methane Explosion.

Preventions :

* Avoiding dangerous accumulation of firedamp much below the lower limit of Explosibility.
* Avoiding sources of ignition which may cause the firedamp accumulation to Explode.

Few preventions :

→ Needed proper ventilation to prevent dangerous build up of firedamp
→ Regular inspection where firedamp may accumulate
→ If firedamp Exists, place should not ventilated adequately, If the firedamp per Exceeds 1.25% and a mine is considered to be inadequately ventilated If the firedamp % in general body of return air Exceeds

→ In gassy mines, where Electricity used, If the firedamp in Exceeds 0.8, Necessary steps should taken:

→ Air samples have to be taken daily to bring down the less than the 0.8%

→ If the gassy mine, the percentage of the CH_4 exceeds 1.25% at any time Electric supply to the that district should be cut off and steps to be taken.

→ If any Geological Disturbance Exist such as

- Dykes
- Folds
- Faults

following things should not done Befor 8om of it

- No working
- No gallery in } Second & Third gassy mines → 30m

→ High care should maintain on ignation sources

- Motors
- Switch gears
- transformers
- Rest things

} All should be flameproof Enclosures.

→ If the gas Emission is too High, some extra care Should take like, providing Compressed air instead of the Electrical power, methane drainage

Coal Dust Explosion

In simple : After fire damp explosion, it may raise the deposited dust from the mine floor, sides or roof in to mine area air very quickly before its flame has ceased and then propagate as a coal-dust explosion.

→ On many experiments its proved that the number of the explosions that coal dust, when suspended in the air as a cloud, is capable of bursting in to an explosion and propagate it, even absence of firedamp

→ The dust cloud space around amount of 80-40g/m³

→ It is really less space, But the density is important

→ once the coal dust explosion starts, its propagation needs very small quantity of the dust.

→ Even one gram per cc of the space dust can enough Equal to the thickness of the layer of ordinary thick paper over the periphery of 2-4+2-7 m Road

→ Generally the process begins with the, the dust must be raised in to air in the form of the cloud, and then ignated by a source of heat of sufficient intensity ex- after fire damp explosion.

→ At 700–800°C the fine dry coal dust cloud can be ignited and can cause the flame to the travel throughout the dust-air mixture at said temperature.

→ The inflammability of the coal dust is dependent up on the following factors.

* percentage of volatile matter
* fineness of the particles
* percentage of inert or incombustible matter
* presence of moisture
* presence of firedamp
* Nature and intensity of ignition source
* Age of the dust
* condition of dust distribution.

Causes :

* Naked flames
* Friction
* Electric sparks
* firedamp Explosion.

Friction

Naked flames :-

Hot surfaces

A naked flame as a result of Mechanical friction such as overheated bearings, may ignate the sourrundings Explosive dusty atmosphere.

Naked flames :-

A Naked flame is Easiest means of igniting a dust cloud as the source of heat is of the Considerable site and larger part of the Dust cloud Can be heated.

Electrical sparks :-

Sparks from short-Circuiting and arching at the Electrical Equipment or overhead trolley wire may ignite an Explosive Dust air mixture. static Electric Sparks also ignite the Explosive Dust air mixture

Preventions :-

* Reducing the formation of the Dust at the workings Haulage roads and Elsewhere
* Preventing its spread
* Rendering Coal Dust harmless by wetting it with water or mixing with inert stone Dust
* provision of stone Dust barries or water barries formation of coal Dust Can be reduced.

at face :

⇒ In longwall face, holes drilled at an angle of about 45° with High pressure of water injection so it can render the coal Easier. for ploughing and shearing, also it Fullfil main moto to supress the coal Dust.

→ Spraying water on Coal cutting machines picks.

→ Sharp picks produce more dust than the using of the Blunt picks, use of gummer on cutter header it Easily collects the Dust.

→ By selecting good Explosive and proper shoot firing. Can Easily reduce the Dust.

→ It's very clear if the lump site increases, Dust generate less

→ so it is Better Explosive like Armstrong air breaker, Cardox, Hydrox ect. which produce more lumpy coal can also be tried.

During transport of Coal :

(i) Coal tubs and mine cars should be spillage proof

(ii) Haulage track should be well laid to prevent derailments.

→ Belt Conveyor should suitably aligned and so installed as to avoid spillage. The fall of the coal from Conveyors and mine cars should be Mitigated.

→ Much dust may gather at base of the Rollers and Return Drums, should Removed frequently.

→ At loading points - transfer points should suitably sprayed with water

→ If any dust generating transfer points, suitably Extracted by the dust collectors.

→ For wetting the coal dust sprays of water on the roof, sides and floor are used.

→ Some chemicals are like $CaCl_2$, Calso-lene oil are used to suppress coal dust.

* Coalest X5
* Coalset

} Few more Chemicals

Main Steps are

* Wetting of the coal dust with water
* Spraying or sprinkling stone dust
* Provision of stone dust Barriers.

1/8/17

Mine dust and its Hazards

Mine dust : Dust can be defined as finely divided solid matter and can be considered from two aspects 1) Its Explosive properties
2) Its Harmfull physiological effects

Dust becomes a nuisance when it is in the form of the clouds, reducing visibility, creating an uncomfortable Environment, which possess the Eye irritation, Ears, Nose and throat and skin. And also increases the Equipment and maintaine costs due to Excessive wear and premature failure of components. It also causes higher mining costs by increasing the accident frequency and undue delay on days that it is too dusty to work.

Production / Sources / Causes of Dust :

* Airborne dust
* Drilling
* Cutting
* Blasting
* loading
* Continous mining
* Dumping cars
* Drawing chutes.

Dust Assessment by following instruments:-

→ Assessing dust by light scatter ✓
→ Assessing dust by Beta-absorption
→ MRE gravimetric dust Sampler
→ TBF 50 gravimetric dust sampler.

Assessing dust by light scatter :-

Two instruments are based on the measurement of the scattered light have been dereloped by the Germany and Britain.

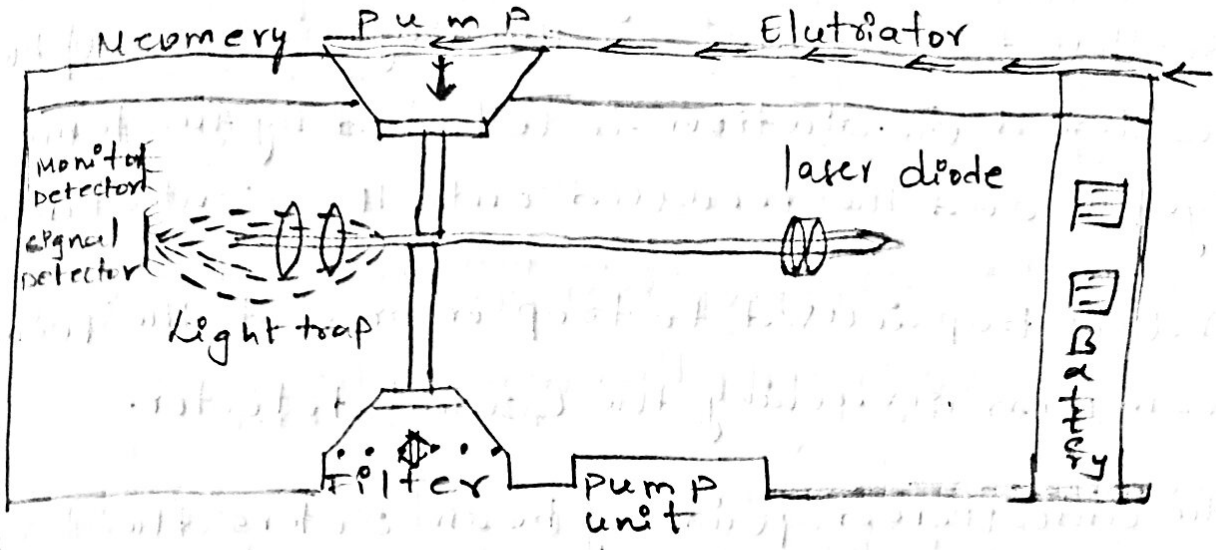
Germany Based - Tyndallometer TM Digital
Britain Based - Simslin ✓

Simslin :-

The instrument was dereloped at the Safety in mins Research Establishment in the UK and is manufactured by the Rotheroe and mitchell.

Some details of the self contained MK II instrument are it consist of the following.

* pumps,
* Light trap
* Monitor detector
* Signal detector



A small pump draws the dust-laden air at the rate of 0.625 liters/min through the parallel plate Elutriators to Remove the Non-Respirable Dust, through a light beam and then filter so that the dust can be used for further analysis. The use of the filter also Enables instrument Calibration.

The air Containing the respirable dust is drawn through the photometer via two tubes. The space between the tubes form the light-scattering Region. Here the dust laden air is Constrained to flow in a well-defined Column by a sheath of re-circulated clean air.

A small laser diode Emits infra-red radiation which is collected and focused into a primary beam by the Condenser lens. This beam is directed along the axis of the photometer towards the Column of the dust laden air in the Scattering Region.

A small fraction of the incident radiation is scattered by the dust in this region. Some of the scattered radiation is collected by the lense system and the focussed onto the Central detector.

A light trap is used to trap or prevent the primary beam form reaching the Central detector.

The unscattered primary beam enters the trap via light pipe to a second Identical detector which is used to generate a reference signal. So that it generates instantaneous signal on Digital display. It also Calculates automatically and displays the Running average Concentration Every 15 minutes.

Control Measures :

Drilling : Drilling is done wet when possible. If it has to be done dry, Exhaust ventilation and dust collectors are used to Capture the dust.

Blasting : Prior to Blasting the area is sprayed with water, water stemming can be used, and spray mist Can be used during Blasting. Ventilation removes the dust from the area. Muck piles are sprayed after Blasting.

12/12/17

Mine Diseases :-

Associated Hazard with Dust

* Nystagmus
* Ankylostomiasis
* pneumconiosis
* Silicosis
* Asbestosis
* Siderosis

} Associated Mine Diseases

Dust Hazards :-

Before appreciating typical diseases arising from inhalation of the dust in mine, one should understand the dust hazards. The hazards of the coal dust as a potential cause of the Explosion has been described in Earlier Explosion topics.

Airborne dust of coal and other rocks in mines have harmful physiological effects. It is now well established that the incidence of the pneumoconiosis, Silicosis, etc... depends up on.

→ The period of Exposure to dusty surroundings
→ Nature and Concentration of the dust.

The dustiness of the dust particles i,e the Quantity of dust contained in it is stated in two ways :-

→ As the number of dust particles per cm^3 of air, this method is known as the dust Coent method

→ As the number of Mg of dust per m^3 of air, this is known as the weight or gravimetric method.

The Idea of the dustiness of a Sourrounding can be formed from the following figures obtained after a Number of observations :

Dwelling	–	About 1·5 mg/m^3
Stone crushing sites	–	About 22–45 mg/m^3
Cement work and ore treatment plants	–	About 130–200 mg/m^3
At chutes during coal loading by Conveyors	–	About 5–15 mg/m^3

Short Note on Diseases :

Nystagmus :- The term Nystagmus is applied to disease in which the muscles and nerves of the Eyes are affected and there is abnomal Eye ball movement. It Caused due working many years in unsufficient light

Ankylostomiasis :

Also call as miners anaemia is practically the same disease as "hook worm disease" and is caused by the thread-like blood sucking worm which enters the body through skin. Due to standing long time in dirty water it may affected.

Pneumoconiosis :

The term used to all conditions the lungs resulting from the inhalation of dust over long periods, but in recent years, distinct terms are being used to denotee the diseases caused by dust eg- Silicosis....

- → Silicosis = Quartz dust
- → Siderosis = Iron oxide dust
- → Berylliosis = Beryllium dust
- → Asbestosis = Silicate Magnesium

Asbestosis :

It Results from the Inhalation of Hydrated Magnesium Silicate. An Important feature of this disease is the presence of asbestos bodies in the lung and sputum.

Statistics of firedamp Coal Dust Explosions in Indian mines from 1954–2006

Major Accidents in the Indian Coal Mines

The major accidents in the Indian Coal Mines (post Independence period) (1952-2005)

S.N.	Dates of Accident	Name of Mines	Fatalities	Cause
3	14/03/1954	Damra	10	Explosion of fire damp.
5	05/02/1955	Amlabad	52	Explosion of fire damp.
7	19/02/1958	Chinakuri	175	Explosion of fire damp.
10	28/05/1965	Dhori	268	Coal dust explosion
12	18/03/1973	Jitpur	48	Explosion of fire damp.
17	04/10/1976	Sudamdih	43	Explosion of fire damp.
18	22/01/1979	Baragolai	16	Ignition of fire damp

(Source: http://www.coal.nic.in)

	Mine	Degree of gassiness	Number of fatalities	Reason	Date
1	Nadir Khan (Ghost Colliery)	-	20	Firedamp explosion	16.06.1908
2	Dishergarh	-	11	Firedamp explosion	07.02.1910
3	Namdang	-	14	Firedamp explosion	26.11.1910
4	Kendawadih	-	14	Firedamp explosion	09.11.1911
5	Chowrasi	-	27	Firedamp explosion	22.10.1913
6	Dishergarh	-	14	Firedamp explosion	20.07.1916
7	Dishergarh	-	10	Firedamp explosion	18.11.1918
8	Amlabad	-	11	Firedamp explosion	28.02.1921
9	Ghost Colliery	-	13	Firedamp explosion	09.03.1922
10	Farbelia	-	74	Firedamp explosion	04.01.1923
11	Bagdgi	-	19	Firedamp and coal dust explosion	29.06.1935
12	Kurhurbaree	-	62	Coal dust explosion	24.07.1935
13	Poidih	-	209	Firedamp explosion	18.12.1936
14	Begunia	-	13	Firedamp and coal dust explosion	19.03.1946
15	Damra	-	10	Firedamp explosion	14.03.1954
16	Amlabad	-	52	Firedamp explosion	05.02.1955
17	Chinakuri	-	176	Firedamp explosion	19.02.1958
18	Dhori	-	268	Coal-dust explosion	28.05.1965
19	Jeetpur	III	48	Explosion of gas/dust	18.03.1973
20	Sudamdih Shaft	III	43	Explosion of gas/dust	04.10.1976
21	Baragola	III	16	Explosion of gas	22.01.1979
22	New Moghla	II	10	Firedamp explosion	03.03.1997
23	Bhatdih	III	54	Firedamp and coal dust explotion	06.09.2006

Comprehend(2nd Unit)

Topic name:

Date:

What you understand from the topic:

Rate yourself (10):

Rapid test

Comprehensive Scrutinizes

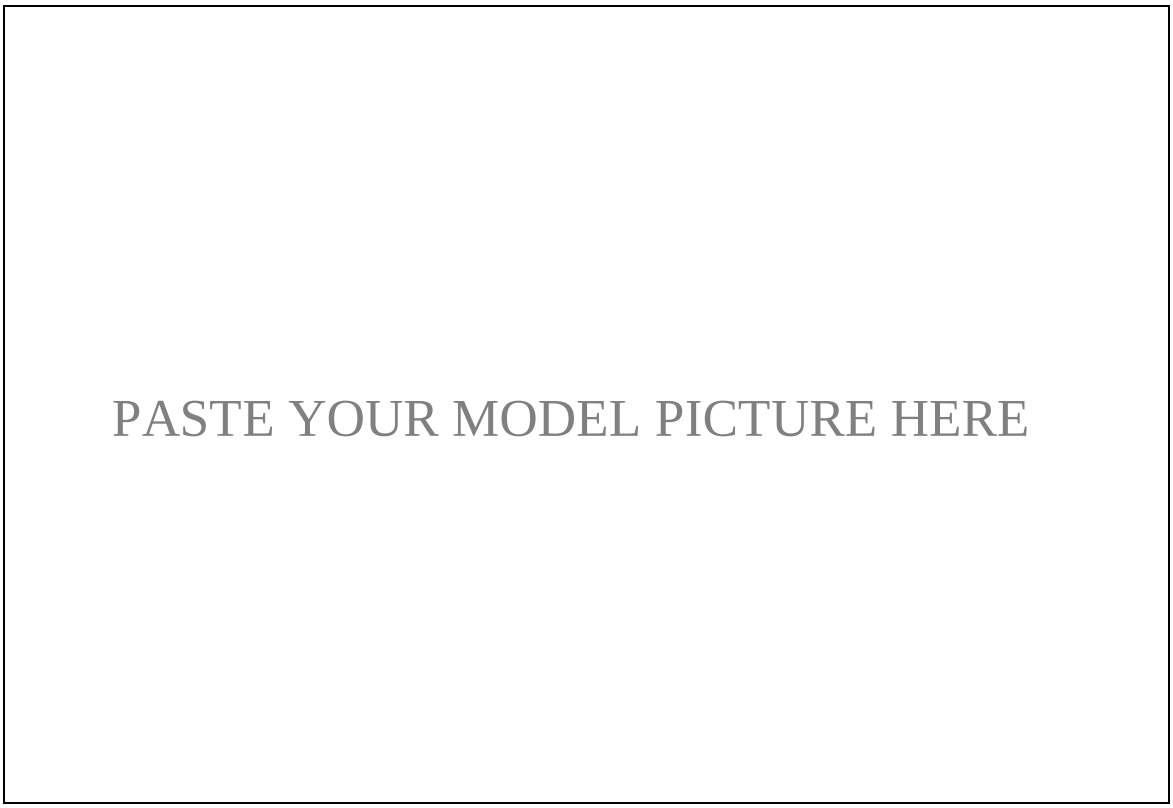
- Scrutinize Area:
- Define Problem?
- Root Cause:
- Control Measures:
- Your Perception:
- Any Enhancements:

PPT Talks

- Topic:
- Subtopic:
- Extracted Core Stuff:
- Pen the Illustrations:
- Mathematical terms:
- What you understand?
- Rate your friend(10):

Prototype Replicas

- Topic:
- Days spent:
- Team names:
- Expenditure:
- Stuff Acquired:



Journal Interpretations

- Journal name:
- Title:
- Authors names:
- Publishing year:
- Synoptic abstract

- Pen the Illustrations:

- Gross theme:

- What you understand?

Journal Interpretations

8/10/17

Inundation

Abandoned mines and quarries get filled with the water and pose a problem for working of mines below and near such water logged areas. The worst disaster caused by the inundation of mine was at the Chasnala colliery in Bihar 1975 when 372 persons were drowned underground during drivage of the underground gallaries which were approching the waterlogged old workings of an abandoned mine.

Causes :

* Inaccuracy of old plans
* The lack of old plans
* Errors of Judgement of Neglect of precautions
* Unsuspected presence of
  - old shafts
  - Boreholes
  - Drift connections
  - Geological disturbance
* Encroaching - Intentionally or unintentionally in to the working of the adjacent mines by the crossing the common boundary when the state of working of adjacent mines not known.

* Sudden collapse of water bearing strata due to faulty method of working or insufficient roof support.

* Sudden bursting of a dam to hold water.

* Inundation by the surface water.:

  - May from surface due to heavey rainfalls the water may get flooded through the mine shafts, inclines, adits and get submerged

  - Some times large Quantities of the water also Breakes in to the mine with in a short time preventing Escape of the workmen.

* Inundation from the overlaying strata:

  - when Impervious strata are pierced by the mine workings

  - when fissures or fractures plans develop by in the Impervious strata due to subsidence Communicating with water-bearing strata abov

  - when faults, fissures or fracture planes in Communication with the water-bearing bed are intersected by the mine workings.

  - where boreholes drilled for prospecting have not been sealed off.

  - when a mine working near to surface accidents takes place into ponds, stream bod

Accident Reports
on

Inundation

→ Amrer opencast Inundation (23/9/2010)

→ Capacity - 8.5 million tonne

→ Embankment 41cm long was built against the river. The Embankment designed by the CDOC central design organisation)

Mishap

→ On 23/9/10 because of multiple causes, bench slide occured, It damaged the Embankment About 150m of the Embankment breached and millions of liters of water gushed into mine.

→ The Accumulation of water at base of the dragline dump weakened it, The dump started sliding, some shovel withdrawn, But one Russian 15/90 dragline due to it old and its slow marching time it slide about 70m Horizontally and 25m vertically down damaged

→ The driver was rescued, but he died on way to the hospatral.

→ Almost 4.5% of WCL output came to a stop.

Lapses in Implementation of Diversion

* failures during Diversion
* failures during Embankment construction

→ The Embankment Construction Quality is not up to the mark

→ wet face pitching was not done properly on Embankment, which river water was Piping (Entered) into the Embankment and weakening it.

→ plug point in the river was left unblasted which causes obstruction in flow of river water and Causes accumulation to Embank-ment (plug point- A portion of area Constructed to divert water to build Embankment)

→ Tension Cracks were not filled properly on Embankments.

Lapses mining

* failures in mining

→ Mining dragline & Shovel-dumper Combination was advanced as 15m of the Embankement infact almost its touched the Embankment

→ Bench width was not adequate, Back Breaks reduced the Effective bench width.

Enquiry : Committe headed by Dr. Khurana Dir-tech, CMPDI :

→ walkie-talkie should pordided to all operators (Doregline-Shovel dumper) so they can transfer the information in flexible manner

→ Effective Bench width should maintained Excluded with back break.

→ Mapping of weak tones, faults should regudy updated by Grologist department

Loss * → 3 million tonnes — 400 Crores loss

Statistics

Major Indian coal mines inundation Accidents from 1952-2005

***

Mine name : Dhori Khas underground mine
Sr. Manger – Mining sardar killed
28/8/2012, Dhori Area, CCL

Mine description :

→ Dipping – 1in10
→ Persons/Shift – 80
→ Development – 1in6
(along with geological
disturbance)

Accident :

on 28/8/12 after firing shots, there was some seepage of water in face. A Hole was drilled in the face with the intention of draining the water accumulated on other side. water started pouring and stopped, Every one though and foreseemed water had drained out.

At 12-30pm on orders of the Manger P.K singh the drever widen the hole, some portion of the coal removed out, a huge Quantity of water and muck gushed out with a great force then Rushing the blasted coal. Manger and Sardar died.

Could the accident be averted ?

→ The accident would not be happened if the muck and water from the gallery had been cleared before attempting to make connection.

Chasanala : Big accident in Indian (1976) Mining History

Early 1970's Iron & steel Co. took over the mine sunt a shaft on dip side of the property and working by underground method.

when approaching the abondoned water-logged seeline workings, advance boreholes were drilled as required by the coal mining regulations.

On the basis of plans of abandoned mine that were made available to him, the mine manager very confident the on going workings are very far from water-logged areas. But one unfortunate day the after blasting it touched water logged area.

High crush of the water gushed and Shaft Submerged, 375 miners drowned in underground

** Mahabir colliery Eastern coalfields :
(1989 NOV 13)

→ The development drivages in the Narayanakuri seam and overlayed with the Nega seam 25 m above had been worked deades ago and head been abondoned. It was filled with the water. The above water in the Nega seam was gushed in to the Narayanakuri seam after blasting at one of the development faces. out of 230 miners 71 got trapped in mine, due to shaft submerge.

→ 65 people were rescued with the help of rocket-shaped metal capsule lowered in a specially drilled borehole immediatly after the accident.

→ 6 people died pathetically

→ The Capsule designed by prof. M.A. Ramulu

precautions over inundation :

→ Coiticle Review of vulnerable mines & precautions
→ Infrastructure for the advance drilling
→ Embankments
→ filling up
→ Standing orders for withdrawal.
→ Warning of heavey rains & discharge from dams
→ Constant availability of winding systems
→ Means of Communications
→ Survey & Infrastructure
→ water-tight chamber

* Coiticle Review of vulnerable mines

Each mine should be Critically Examined for its proneness to inundation and assessment regarding danger of inundation. and the precautions to be taken befor monsoon.

All plans should Carefully Examined by the Higher authorities.

Advanced drilling infrastructure :

→ for drilling suitable boreholes : Examination of the water - suitable infrastructure is needed.

Embankments :

Embankments should provide against the river bores to guard against inundation should according to the Engineering properties

Filling up : where ever the water areas likely connected with the underground workings should be suitably filled up completely.

Standing orders for withdrawl :

Detailed precautions against inundation. may be laid down where working exist beneath or in any vicinity of rivers and major water bodie

warning of heavey rains & discharge from dams

like the Cyclon warning, warning for the heavey rains should also develope for impending the team to get alert and beware

Constant availbility of winding system :

Ingress and Egress should be made Constantly available Even in adverse weather conditions, failure of the steam, Electricity or any reasons.

Means of Communications :

Effective Communications may be established with in the mine and between mine for the safe withdrawl of persons.

Survey infrastructure :

Suitable instructions given in 6th Conference of the Safety in mines.

Water tight Chamber :

R & D is going on to emplement water tight chamber in the underground But getting refuge.

S.NO	Date of the Accident	Name of Mines	Fatalities	Cause
1.	05/08/1953	Majri	11	
2.	10/12/1954	Damra Netwan Chikli	63	* Inundation
3.	26/09/1956	Burra Dhemo	28	
4.	20/02/1956	Central Bhowara	23	
5.	05/01/1960	Damua	16	
6.	18/11/1975	Silewara	10	
7.	27/12/1975	Chasnala	375	* Explosion
8.	16/09/1976	Central Saenda	10	
9.	14/09/1983	Hurriladih	19	
10.	13/11/1989	Mahabir	6	
11.	26/09/1995	Gaslitand	64	
12.	2/02/2001	Bagdigi	29	
13.	16/06/2003	Godavari Khani-7LEP	17	
14.	15/06/2005	Central Saunda	14	

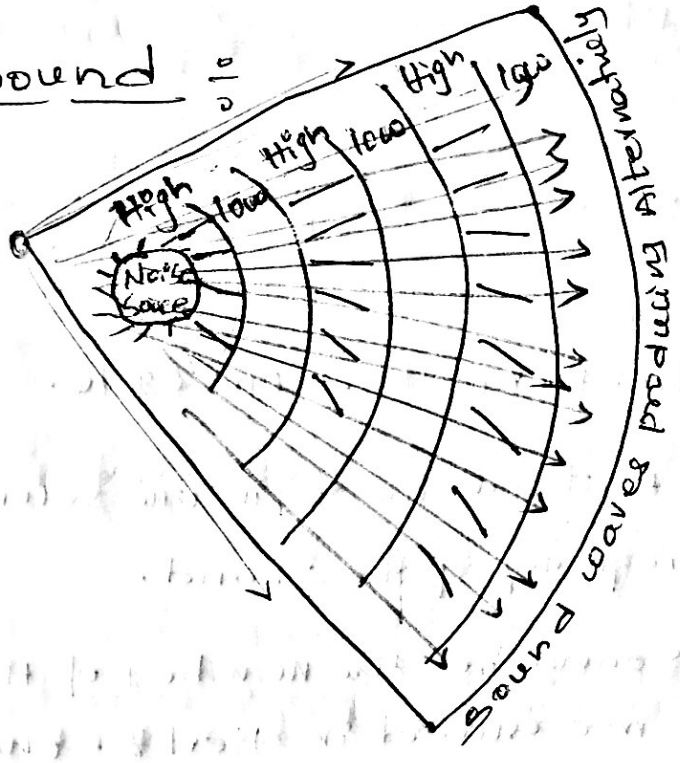
12/19

Noise and Vibration

Noise is a loud sound that some one does not want. It may - permanently damage hearing
- Interferes with Comunication there by increasing chances of the having an accidents
- Create disturbance, Annys

Some May give pleasure. Eg - At football ground
At Newyear party

Sound :-

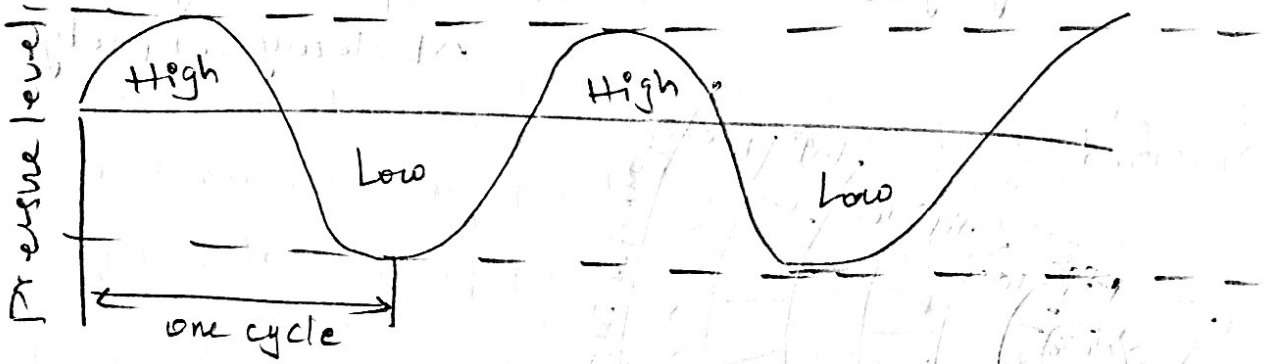


Sound is a vibrational Energy is made when the something moves back and forth rapidly and creates waves.

Sound waves can travel through any substance rock Metal, water, air Sound waves can't be seen, but they can be felt.

when we hear something what we really doing is feeling a sound wave which is travelling through air. change in pressure is really what sound level measuring instruments measure. Ear can detect changes in pressure as small as 3×10^{-8} .1 lb/in^2 with Each doubling of the distance, The sound level is reduced by one half. Already shown above.

A sound wave is often represented symbolically by the drawing as shown below:



High and low waves together called one cycle.

- The number of cycles that are made in one second is refferred as the frequency of the sound.
- The frequency of the sound i.e the number of the cycles per second is measured in Hertz. One Hertz is one cycle per second.
- The frequencies most important for the understandi Normal speech lies between 800 - 500 Hz.
- The Human Ear can detect sound from the range - 20000 Hz.

Permissible limits of Noise are:

* warning level – 85 dB (A) for 8 Hours daily Exposure.
* Danger level – 90 dB (A) 8 Hours daily Exposure

Compulsary wearing Ear protection limit

* 115 dB (A) for 8 Hours daily Exposure.
* 130 dB (A) for impulse noise of short duration
* No work limit of 140 dB (A)

Causes:

- → Human
- → Machinery
- → Drilling
- → Blasting
- → Explosions
- → Subsidence

} Mining Noise Causes

- → Industrialization
- → poor urban planing
- → Social Events
- → transportation
- → Construction activities
- → Household chores

} General Noise Causes

Noise preventions :-

(a) Lubricate noisy parts - A squeaking sound on a machine is a signal that it needs lubrication

(b) Make certain a machine is mounted properly - Because of the continous vibration, many machine shake loose from their mountings. If possible mount Noisy machinery on rubber or thick plastic Materials.

(c) Make certain that the machine is balanced - un-balanced moving parts cause uneven wear and generate a lot of Noise.

(d) Replace worn out parts. They are major sources

(e) Put Muffles on Noisy Exhaust system - If they are worn replace them.

Preventing Noise via changing its Direction (or) some methods :-

(1) Changing direction of a muffler or changing working position of the operator so that he is not directly in front of the source of Noise.

(2) Isolate the Noise by Building an Enclosure around Noise making machine.

(3) use baffles: Baffles or screens hung around the machine will help reduce the movement of sound waves.

(4) use sound absorbing (Acoustic) materials — lining inside the Enclosure by sound absorbing materials can control the Noise.

Some few : (short)

→ Relocation of Noise Source

→ providing Enclosure or Barries to Noisy machines

→ Damping by layers of soft or Elastic material

→ fiting Silencers and Noise absorbers

→ Isolating man from source by means of the acoustic Enclosures

→ use of remote control Equipment.

Noise Measurament :

The sound measuring devices must adjust to mid frequency readings - the frequencies to which the Ear is most sensitive. The weighted readings are expressed in dB(A)s. A Reading in dBA takes into account the sound level frequency as well as the sound level.

Commonly used device is called a dosimeter.

→ Doctors conduct audimetric tests to Establish the degree of hearing loss at Each frequency.

→ In a mine five measuraments of Each type of the noise producing operation are taken to which the miner is Exposed.

→ Each measurament is Observed for 30 seconds and the Average of the five shall be Considered Representative of the operations.

→ The sound level meter should be held with in one meter and the Readings shall be taken atleast once Every six months.

→ The Really Critical noise level in 90 dBA. If the Noise level Exceeds 90 dBA, the Exposure must be Reduced. The Exposure must be halved for the Every 3 dBA increase for Example.

For 90 dBA — 8 Hours Exposure

For 93 dBA — 4 Hours Exposure

For 96 dBA — 2 Hours Exposure

1/2/17

Vibration

Explosive Energy will be wasted in three types

* Rock shattering and displacement
* Ground vibration
* Air vibration

Ground vibration

In mining when an explosive charge detonates, intense dynamic waves are set around the Blast hole, due to sudden acceleration of the Rock mass. The energy liberated by the Explosive is transmitted to the Rock mass as strain Energy. The transmission of the Energy takes place in the forms of the waves.

The waves are Different kinds

- Compression or P waves
- Shear or Secondary or S waves
- Rayleigh or R waves

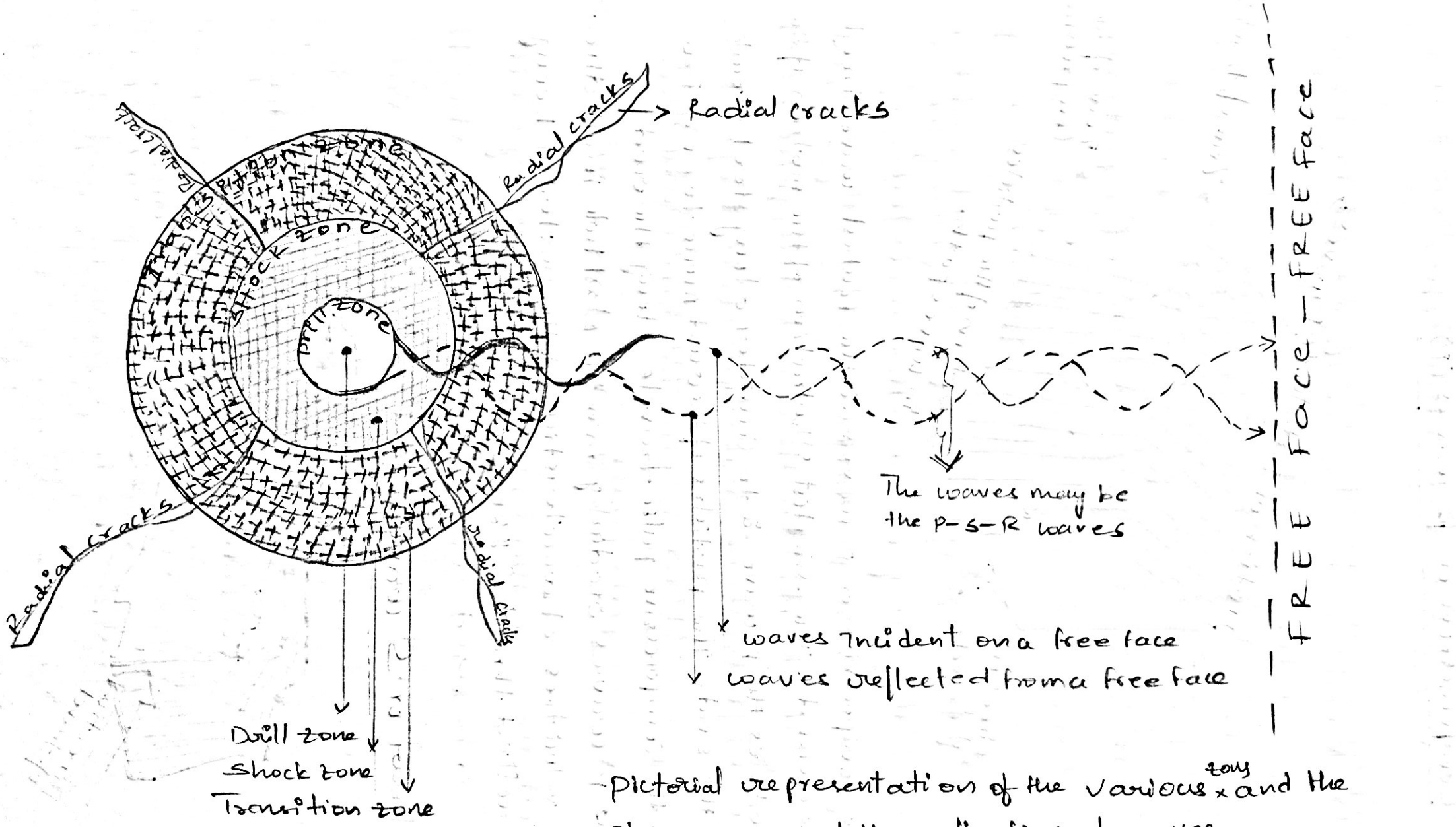
The Energy carried by the above waves Crushes the Rock, which is the Immediate vicinity of the hole, to a fine powder, The Region called Shock zone. The Radius of the Shock zone is nearly two times the Radius of the hole.

→ Beyond the shock zone, some energy waves gets attenuated to some degree which causes the radial cracking of the Rock mass, which cause more fragmentation due to gasses. The zone is called transition zone.

→ The Radius of zone is twenty to fifty times the Radius of the hole.

→ The waves propogates few cracks But not High much, If the there attenuated waves are not reflected from the free face, then they are cause libration in the Rock.

→ However If a free face is available, the waves reflected from a free face cause further breakage in the Rock mass under the influence of the dynamic



Pictorial representation of the various zones and the phenomenon of the reflection of waves.

Mucking : Muck piles should be wetted down frequently

Dumping : The dump Entry should be maintained under Exhaust ventilation. Water sprays should be used. In the case of ore and waste passes, proper planning, Extraction fan installation and tipping-point door design are important to Control the dust created at rock passes and tips.

Hauling : Cars and Haulages ways should be wet down adequately. Rock with a moisture Content of only 1% by mass produces significantly less dust during transportation than rock transported under dry conditions. A moisture content of 5% is usually aimed for minimum dust production during transportation.

Crushing : At the Crusher mouth, spray Nozzles should be used. Also the Crusher mouth should be Enclosed and maintained under Exhaust ventilation At floor level, an airtight seal should be made and Exhaust ventilation should be used under the Crusher to Contine airborne Dust.

The Exhaust take-off should be positioned far away from the Crusher discharge and the dust-ladden air cleaned by the filter or discharged into a return airway.

Coal cutting :-

There are several factors influencing the amount of the dust produced, its size distribution pattern and its dispersion properties in airstream.

→ High rank coal consist High percentage of the vitrinite produces more dust in Comparison to low rank coal.

→ Some cases pre-drainage of methane and the undermining of seams and standing pillars the coal dries up resulting in High dust Concentrations during mining.

→ The amount of material being cut also influence the amount of dust produced cutting in sandstone or shale can produce up to 30 times as much fine dust as the same operation with coal.

Comprehend(3rd Unit)

Topic name:

Date:

What you understand from the topic:

Rate yourself (10):

Rapid test

Comprehensive Scrutinizes

- Scrutinize Area:
- Define Problem?
- Root Cause:
- Control Measures:
- Your Perception:
- Any Enhancements:

PPT Talks

- Topic:
- Subtopic:
- Extracted Core Stuff:
- Pen the Illustrations:
- Mathematical terms:
- What you understand?
- Rate your friend(10):

Journal Interpretations

- Journal name:
- Title:
- Authors names:
- Publishing year:
- Synoptic abstract

- Pen the Illustrations:

- Gross theme:

- What you understand?

Journal Interpretations

PASTE JOURNALS HERE

Unit-

Rescue & Recovery

Rescue operations :

The Rescue team has to establish a fresh air base from where the team proceeds in to the affected part of the mine. Such fresh air base is as close to the affected part as possible and, as the name suggests, has to be at a place fresh air will be available and should be unpolluted with any fires or gases.

Fresh air base :

→ Two men of whom one is rescue trained

→ Team Consisting of 5-6 persons including a leader. All persons should fully equipped with the self contained breathing apparatus and ready for the service. Such team is in addition to one that goes inbye.

→ Equipment such as reviving apparatus, Smoke helmet, gas mask.

→ first aid equipments such as
  - → Stretchers
  - → Tools
  - → Bleaching powder for disinfectant when removing dead bodies

→ flame safety lamp, munia birds

→ Hygrometer

→ Drinking water

→ Mine plane and rescue tracing on large scale.

→ fire Extinguishers.

Team Coordination:

→ The team should be strong and gathered

→ The leader should lead properly.

→ If anybody Experience trouble due to physical Cause, they should retain to fresh air base.

→ Mostly, wearer has to Communicate with others only by Nods, hand Signals and Coded sounds of horns since speaking would Endanger the wearer's life toxic atmosphere

→ Every one should Carry plans of the districts

→ The total Rescue should Complete with in the time of the self Contained breathing apparatus.

→ No member of the Rescue team should be asked to do a second spell of work, unless medically Examined and Certified fit.

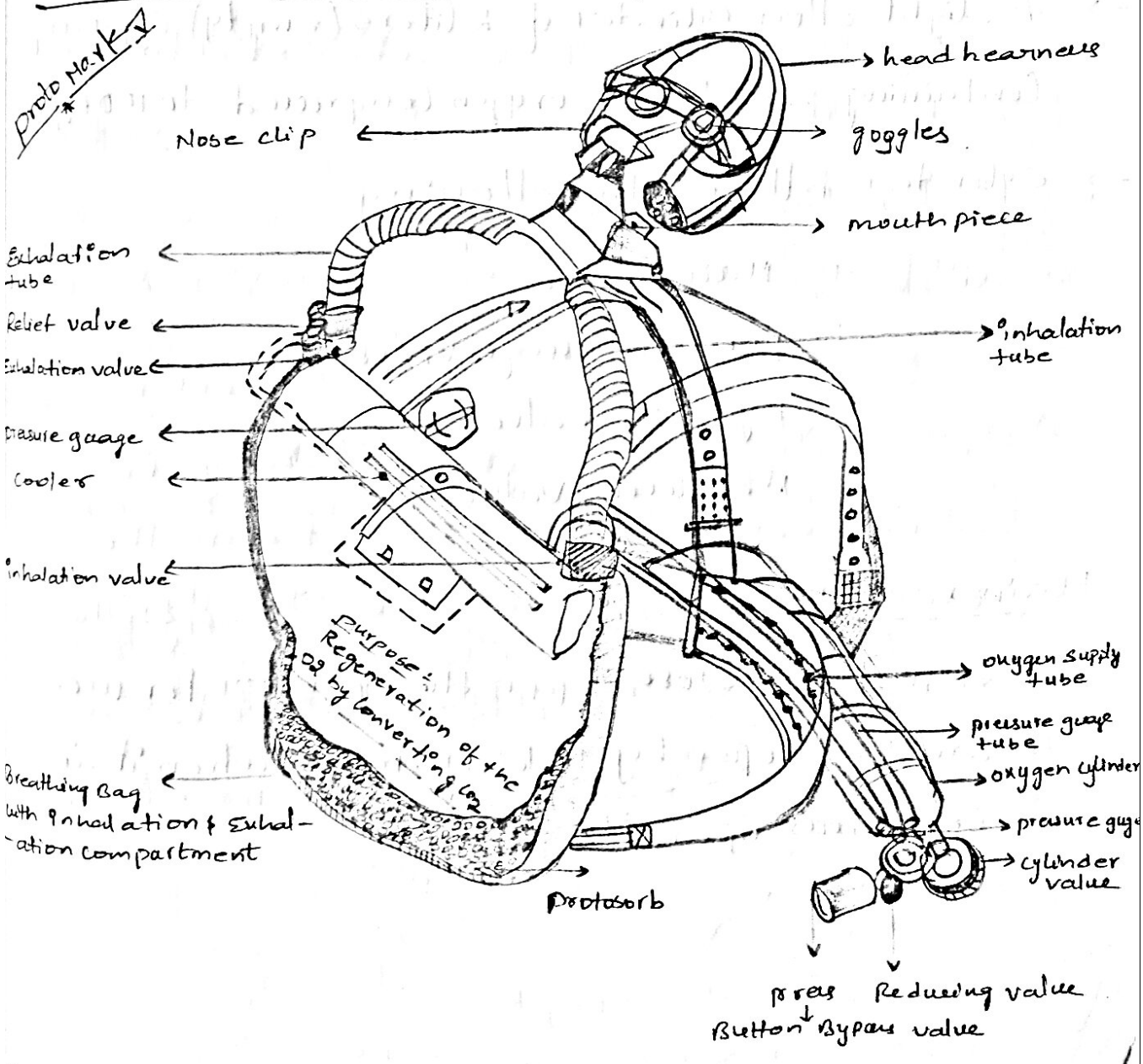
→ If the road is smoky and visibility poor, then it should be marked with chalk powder

→ A thin polythene coiled rope should be always be with team member for life line.

→ The team leader should properly coordinate the team members instead of engage in work.

→ The team should not proceed inbye unless the roof is safe or made secure by the team.

Self Contained Breathing apparatus :



Application and Constructional features:

Protomark-V

type	:	Two types	
		1 hr Capacity ⇓	2 hr Capacity ⇓
Coolant	:	Cacl2	Soda phosphate
weight	:	14.5kg	17-2kg
O_2 flow rate	:	2-5 lit/min	2-0 lit/min

→ A light alloy cylinder of 2 liters (empty) capacity, Containing 800 liters of oxygen Compressed to 150 kg/cm²

→ Cylinder fitted with following

+ Main valve
+ pressure gauge valve
+ By-pass valve
+ Reducing valve

Main valve:

It is used to close / open the cylinder for use
It can keep open by locking device, when it is in Continous operation.

Reducing valve:

It Reduces the pressure of oxygen supplied to the wearer (Person) and Ensure 2 lit of oxygen/minute

By-Pass valve:

Here it is push Button instead of hand wheel in the proto IV type. Manually operated by the wearer if the reducing valve fails or whenever needs more oxygen.

Pressure guge valve:

It admits high pressure oxygen to the pressure guege.

→ The Breathing bag made of vulcanised rubber and divided in to two Compartments. Bag Contains 2kg of Co_2 absorbent known as "protosorb". It is mixture of Calicium Hydroxide and Caustic soda and It keeps the percentage of Co_2 in the breathing Circuit 2%

→ The Cooling Chamber of Copper Containing Sodium Phosphate which is in Crystal format at the Ordinary temperature but liquifies at 35°c absorbing much heat in the process. The weight of sodium phosphate 170g.

→

Procedure :

→ Breathing is through the mouth and the nasal passages are closed by a special Nose clip.

After donning the apparatus the wearer has to take a few breaths of the pure oxygen and flush out the Nitrogen from the respiratory system

→ The Exhaled air by the wearer will pass over the Protosorb which Removes the CO_2 and the Convert to pure 100% O_2 and send to Exhalation tube.

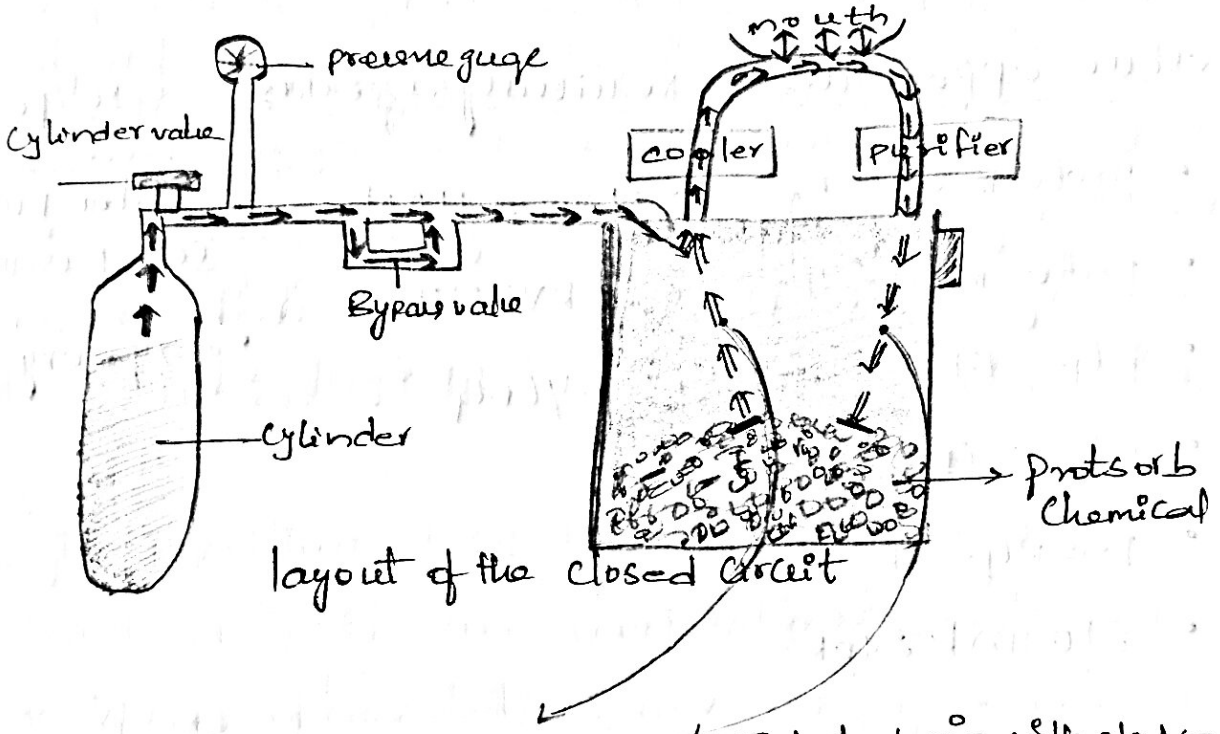
→ During the process the member should not breath with nose, and it should be suitably closed with clip.

In Simple :

→ The only oxygen in the Cylinder will not be Sufficient for Survey, so the Exhaled air by the wearer will be Converted and free from the CO_2 and N_2 and produces O_2 finally. The Both (from cylinder O_2 & Converted O_2) will be inhaled by the wearer by inhalation tube

Closed Circuit:

A self contained breathing apparatus is of the closed circuit type in that oxygen supplied to the wearer from the cylinder is not lost to the atmosphere during Exhalation but is rescued by him after the exhaled air is freed of the CO_2 by Chemical absorbents



layout of the closed circuit

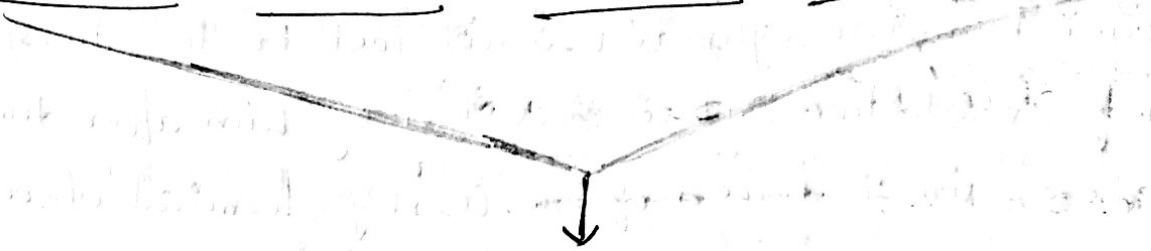
• Inhale pure oxygen • Exhaled air with N_2 & Co_2 ++ after purified from all gasseous By the chemical – protasorb (Calicium Hydroxide + Caustic soda)

Example:

let us Consider a volume of 20 liters of Exhaled air Containing 17% oxygen. The Exhaled air would Composise 3.4 liters of O_2, 15.6 liters of N_2 & 0.6 liters of the CO_2 Here CO_2 Can be Removed and same Equal Quantity 100% of oxygen supplied from both Cylinder and the Part of the Converted O_2 (Chemically).

Rescue Station :

All self Contained breathing Apparatus



Rescue apparatus

- proto mark 5 ✓
- proto mark 4 ✓
- BG- 174 ✓
- BG- 4
- PSSBG-4
- BIO PAK 240R
- Gas mask ✓
- Drager Self Rescuer - 810 ✓
  (or)
  NSA model - IW-65 ✓

Rewiring apparatus

- MAXA MAN
- KERVENT
- OXYLOG

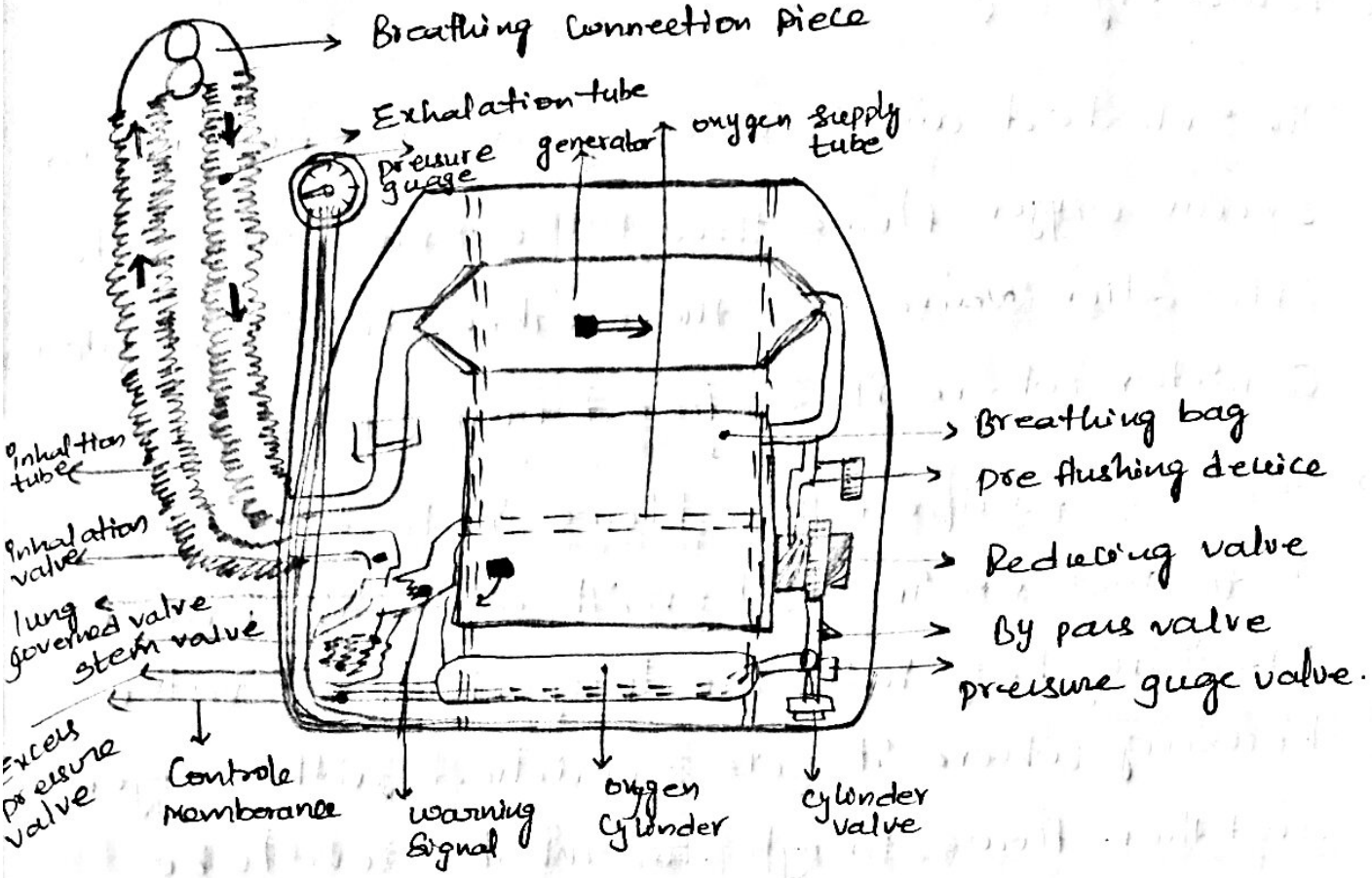
Escape

- filter Duet Self Rescuer
- Oxy Boy K

Drager BG-174 :

→ It is also as same as proto type and the Compressed oxygen type with closed Circuit for inhaled and Exhaled air

→ It is Completly atomatic and breathing Controlled by the respiratory valves.



Specifications :

Safe working period	:	4hrs
Cylinder capacity, Empty	:	two liters
Cylinder Capacity with O_2 at 200 kg cm^{-2}	:	400 liters
Breathing big Capacity	:	6 lit
Weight, Full charged	:	12-6 kg
Oxygen flow orate	:	1-5 lit/min
Oxygen feed by lung governed valve	:	As Required by valve
CO_2 absorbent	:	Anhydrous, NAOH (1.5kg)

Circulatory system :

→ The Exhaled air Containing Carbon dioxide and Excess oxygen flows through the exhalation tube, Exhalation valve into the Carbon dioxide absorption Canister where it is freed from Carbondioxide

→ The air purified then flows into the breathing bag and on inhalation, It is drawn from the Breathing bag into the lung-demand valve housing where it gets enriched with oxygen and then flows thrugh the inhalation tube into wearers lungs.

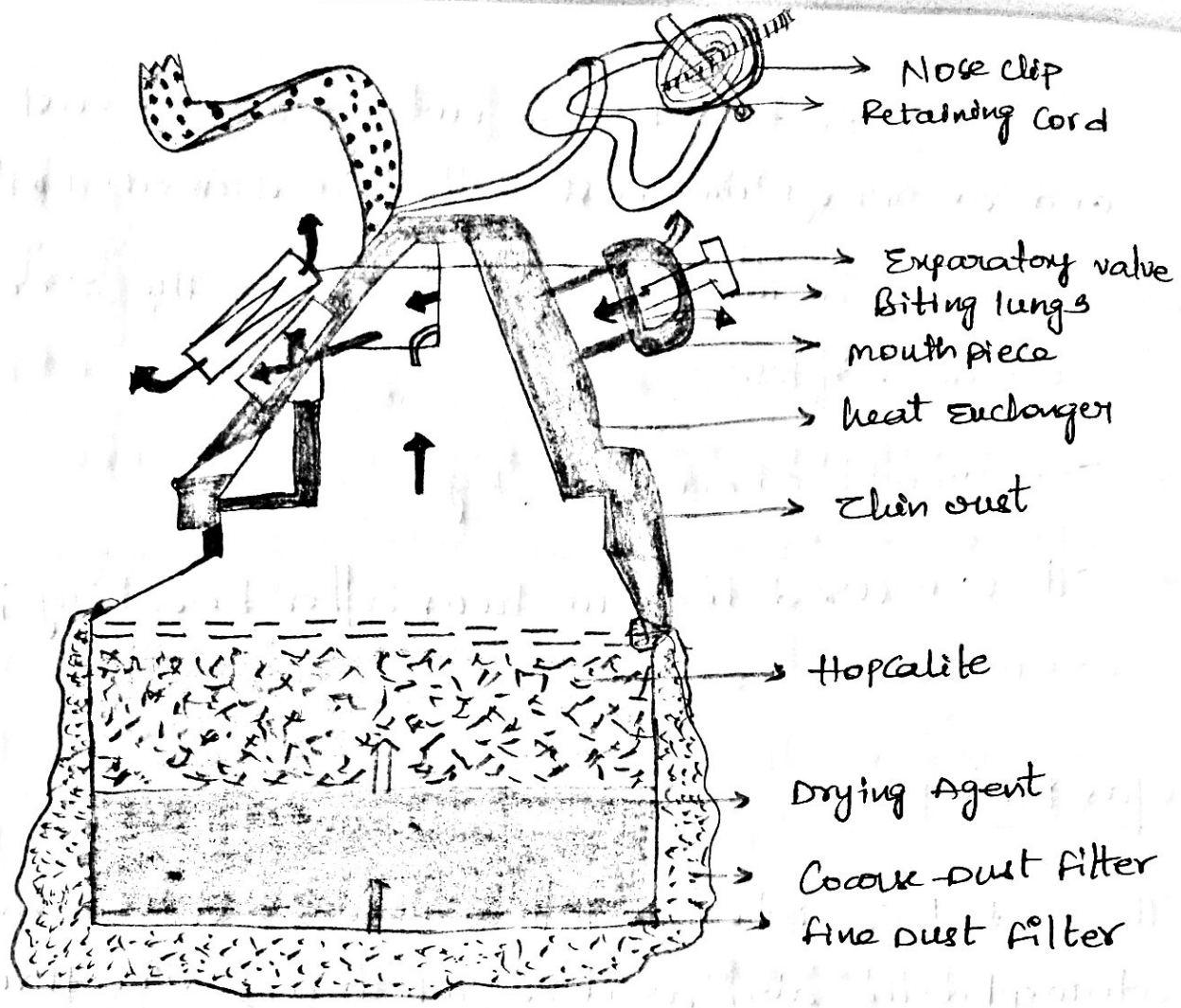
→ Excessive pressure build-up is prevented by the automatic relief valve.

→ If any needed oxygen additionally, provided by the lung-deamand valve.

Self Rescuer

→ It is a Essentially gas mask in simplified form without the Corrugated hose tubing and the mouthpiece is attached directly to the Canister.

→ Chemicals are 'Hopcalite' mixture of the manganese dioxide and the Copper dioxide used to catalyst to change $CO \rightarrow CO_2$



→ It dont supply oxygen but functions to convert Carbon monoxide to

→ The main purpose of it is to enable the wearer to Escape throughthe atmosphere surrelting after a fire or after an Explosion in a mine.

→ The Rescuers are stored on the surface in lamproom

→ A self Rescuer should be used immediately at the first sign of fire or Explosion - Even no smoke is visible.

→ The drying agent is charcoal impregnated with mixture of the calcium bromide and lithium Chloride.

→ The filter section has an outer Coarse-dust filter and an inner fine-dust filter to remove dust particles

→ Filter materials are seperated by the screens and the baffles.

→ Its weight about one kg

→ It can used for one hour after breaking its seal

*Gas Mask:

The metal canister is fitted with an valve and the atmospheric air, as it is inhaled, passes through an opening at the bottom of the canister through different layers.

gas mask consist of :- (filters)

→ Anhydrous Calcium Chloride as a drier to Remove water vapour (top most layer)

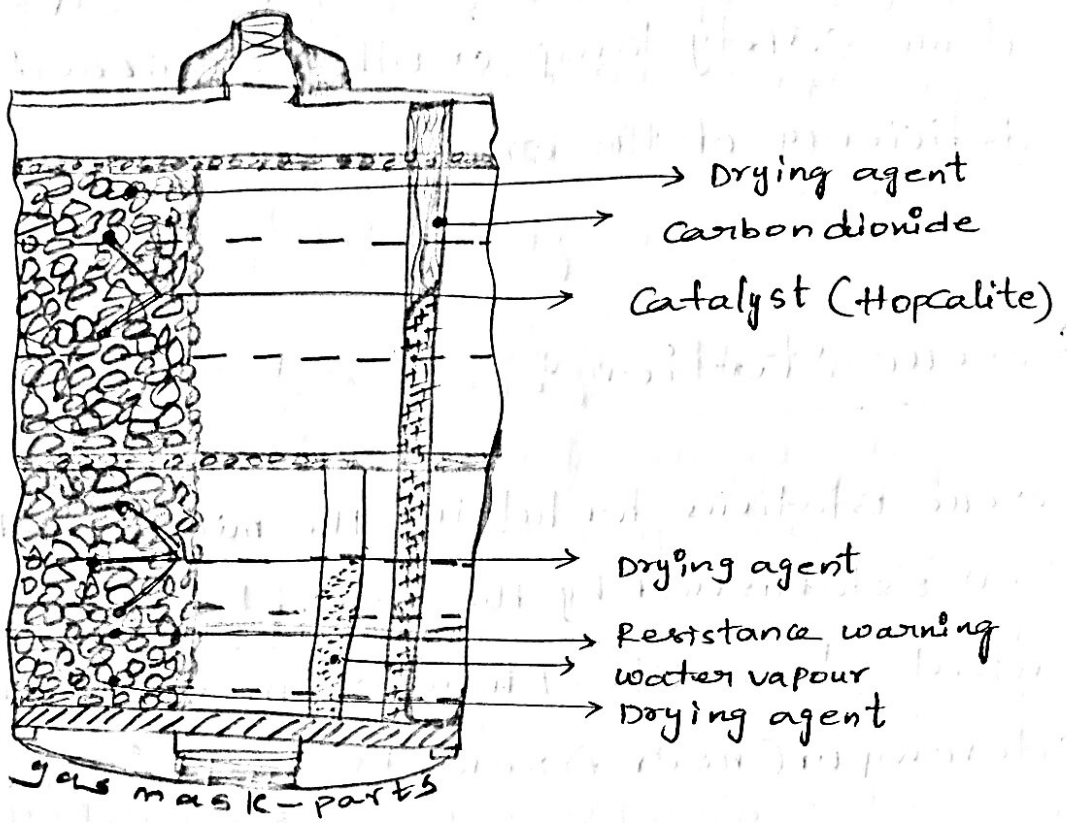
→ Hopcalite : It acts as a catalyst which changes $Co \rightarrow Co_2$. It also absorbs organic vapours

→ Cotton wool to remove dust and smoke.

→ Silica gel to remove ammonia and water vapour

→ Caustic (Caustic soda and pumice) to remove sulphuretted Hydrogen.

→ Impregneted activated charcoal to remove organic vapours and the acidic gases. (Bottom)



→ The above ~~face~~ Canister present at base of gas mask

→ A tube and face mask will be attached futhely

→ A face piece fitted with Eyepiece and an Exhalation valve and Conneeted to the Canister by a Corrugated hose pipe as Discussed.

→ Wide vision face mask is also available inplace of the facepiece with twin Eyepiece.

→ Its weight about 4kg, Easily worn by the wokar

→ Sealed Canister life about 2-4 years

→ Wearer Can use Canister for a service period of 1-2 hrs in an ~~o~~ irrespirable atmosphere

→ In general, in a mine of a team of rescue workers has to use gas mask and work in a poisonous atmosphere, it should always carry a lighted flame safety lamp or other devices to detect deficiency of the oxygen.

Rescue station :-

Rescue stations for helping the mining industry have been established by the Central goverment at the Central places like Dhanbad (near Dhanbad) Sitarampur (near Asansol) and in few other places. There are under the management of the coal India Subsidery Companies like BCCL, ECL, CCL etc..

→ A Rescue station is under Control of the Superintendent of Rescue station has in its Employment one or more rescue brigades which Consist of the trained workers and having Experience of the underground mining.

→ The members of the Rescue brigade are able to perform misscellaneous Jobs like that of mason, timber setter and others.

→ The Rescue station is Equipped with the following Equipments:

* Self Contained Compressed oxygen apparatus
* Reviving apparatus
* Gas mask
* Self Rescuer
* Smoke helmet
* pressure hose mask etc.

→ It needs (Rescue station) Regular inspection, Repairs and maintainence of the Equipment

→ Rescue Brigade Consist of 5-6 members, Including leader all of whom stay near the Rescue station and undergo regular training and Exercise daily at the Rescue station, sometimes at the mines.

→ The Brigade members have to be in Contact to attend any Emergency call demanding their services and and when a mine requires help of rescue stations (team).

→ The mine Authorities have to telephonically inform the Rescue station and brigade is available at the spot with in shortest possible time.

Principles of Risk Management:

In Mining operations, hazards Cannot be Entirely Eliminated. However, it is possible and desirable to manage the risks to keep them at acceptable level. Risk Management involves:

→ Identifying the areas of high risk Evaluating on the basis of likelihood and the potential consequences.

→ Devising and Implementing preventive actions to bring the risks to acceptable levels.

* finally the Risk management includes Risk Assessment and Implementation of the safety management plan.

Importance:

→ fatality rate in Coal mines in India has Remained static for last one and half decade.

→ In Indian Coal mines, after a steady decline over the last four decades. It is felt that the traditional occurance and followup measures arousing out of traditional approches has reached its limit of effectiveness to keep risks with in acceptable levels.

→ It has been thought that time is now ripe to introduce new initiative and stress upon areas of high risk by introducing the concept of the risk management.

Principles of Risk management:

* Designing a System of Evaluation of risk
* Identifying Hazards
* Analysing them interms of likelihood and seriousness of extent of consequences.
* Ranking the risk according to the gravity
* Developing specific management plan to Reduce
* Implementing the plan
* Monitoring and Reviewing.

Comprehend(4th Unit)

Topic name:

Date:

What you understand from the topic:

Rate yourself (10):

Rapid test

PPT Talks

- Topic:
- Subtopic:
- Extracted Core Stuff:
- Pen the Illustrations:
- Mathematical terms:
- What you understand?
- Rate your friend(10):

Journal Interpretations

- Journal name:
- Title:
- Authors names:
- Publishing year:
- Synoptic abstract

- Pen the Illustrations:

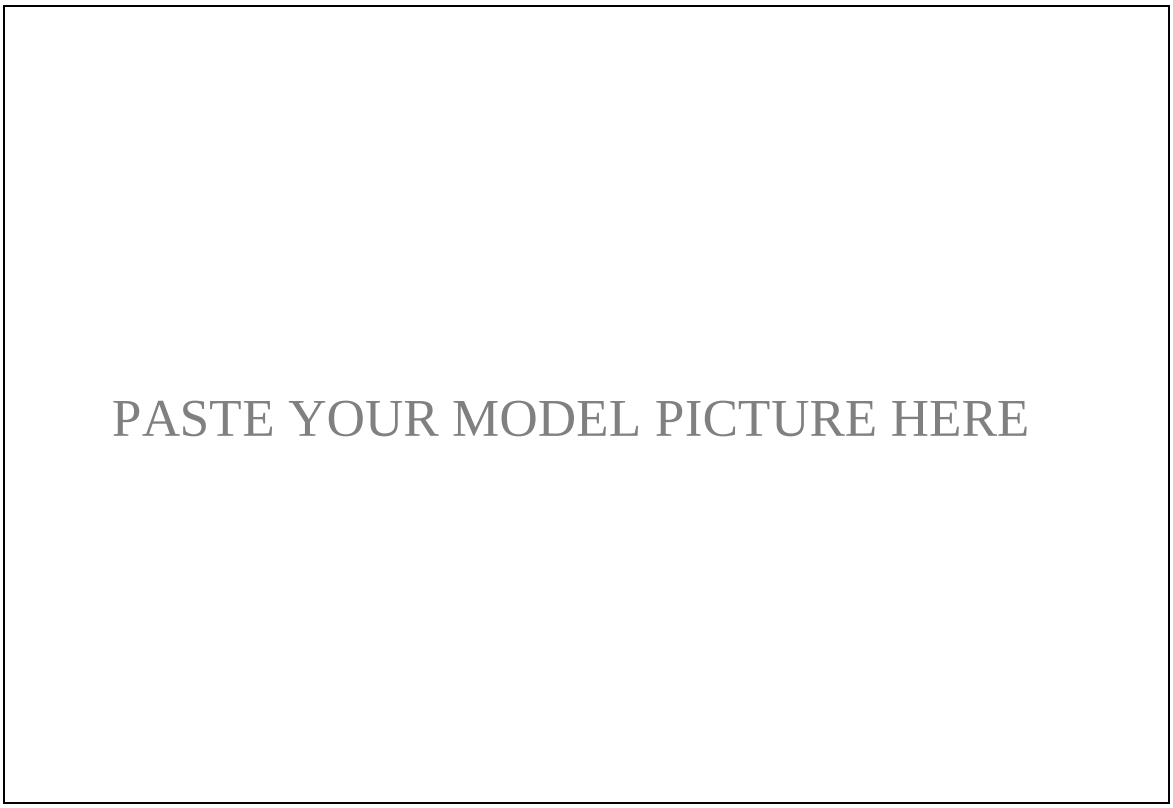
- Gross theme:

- What you understand?

Journal Interpretations

Prototype Replicas

- Topic:
- Days spent:
- Team names:
- Expenditure:
- Stuff Acquired:



14/12/17

Mine illumination

A mine worker under conditions of inefficient light over long periods not only impairs its efficiency but also develops an eye disease known as Nystagmus.

Before invention of miners flame safety lamp naked lights were used in coal and metal mines.

Nowadays electric cap lamps are used by every underground worker in coal mines and in a number of metal mines. Flame safety lamps are used by the supervisory staff in underground coal mine for the detection of the methane gas.

A flame safety lamp provides light in a mine without danger of igniting inflammable gas and, in the hands of trained workers, it is also a handy and very convenient device of detecting the presence as well as percentage of firedamp.

System of illumination :

System of mine may consist of :

(a) General lighting of the Quarry area and the overburden and coal dumps, Haul roads.

(b) local lighting of the operational areas of Equipment Ex- Shovel drills dragline etc—

Types of lamps

(a) Incandescent lamps

(b) Flourscent lamps

(c) High pressure mercury vapour lamps

(d) High pressure sodium vapour lamps

(e) Halogen lamps.

Illumination :

The illumination E, at a surface is measured in foot Candles or in meter candle (in the CGS units). One meter Candle is the intensity of illumination on the surface 1m distant from a source of one candela.

Illumination at a surface is inversely proportional to Sqre of the distance of the surface from the source of light, and directly propotional to $\cos\theta$ where θ is the angle between the normal to the surface and the direction of the light rays.

$$\text{Illumination of a surface (Meter Candle)} = \frac{\text{Candela of source}}{(\text{Distance in m})^2} \times \cos\theta$$

At 2m distance the illumination would be

$1/2^2 = 0.25$ meter Candle. It also known as Lux

The statement that the illumination at a surface is 4 meter Candle implies that it is the same as if it were illuminated by a point source of the four International Candles placed at a distance of 1m from it. Light is the means illumination the end Effect.

Lumen : This is the unit of light (luminous flux) Emitted by a light source.

Lumens : Emitted by a lamp = Mean spherical C.P × 4π

Lux : It is the unit of illumination in S.I units.

A lux is an illumination of 1 lumen/m²

⇒ The minimum amount of light required for reading, writing ect... is 10 lumen/m² i.e. The light given off by 10 international Candles at distance of the one m from the work. Much more every part where the persons are working or passing, illumination should be minimum 65 lux.

Luminous Efficiency : It is Expressed in lumens per watt Consumed and is from 10-20 in modern incandescent lamps, the Higher values being for the larger lamps.

Reflection :

When light falls up on a surface, part of it is Reflected and part absorbed. In the case of a transparent body majority of the light passes through. Only that part of light which is reflected is useful for the illumination. A white surface is good reflector of light and in underground mine, to improve the lighting effect, the following places have to be white - washed.

(a) Every shaft inset and Shaft Bottom or Siding and Every bypass which is in regular use:

(b) The top and Bottom of Every Haulage plane, every regular stopping place, Siding, landing, Passbye and Junction, Except with in 100 meters of the face.

(c) Every travelling roadway

(d) Every room and place Containing any Engine, motor or other apparatus

(e) Every first aid station below ground.

Standards of lighting :

The minimum standard of lighting for the opencast mine has been laid down by the DGMS

	location	(minimum illumination) Lux	(level in which illumination to be provided)
1.	Operational area of the dragline and shovels	5 10	Horizontal Vertical
2.	Operational area of drills	10	Vertical
3.	Operators Cabin of the Shovel, dragline & drills	30	Horizontal
4.	Dumper haul road	0-5-3.0	Horizontal
5.	OB and Coal Dumps	3	Horizontal
6.	Roadways & footpath from bench to bench	3	Horizontal.
7.	Coal handling plant, workshop and service Building.	As per the BIS Specifications	

Electric cap lamps :

The Electric lamp used in our mines are the popularly known Oldham cap lamps and also the Caplamps are manufactured by mine Safety Appliances Co., Ltd. In Both types of cap lamps the Entire Cap lamp unit consists of a 4-V lead-acid battery (Re-chargeble) a lamp can be hooked to the helmet and a Connecting cable. The lead acid battery consists of two cells.

Battery :

Cap lamp unit Each cell of the lead acid battery consists of a number of Composite lead-antimony tubes or plates Carrying the active materials and immersed in a 20% solution of sulphuric acid (H_2SO_4) and distilled water. The positive plate in Each cell is tabular Construction, the Negative plate is pasted to flat type and the insulating seperators are of Sponac (a highly absorbent type of wood) which absorbs about 55% of the total acid in the cell, so rendering the battery virtually unspillable

→ In full charged conditions, two conditions will takesplace — ~~Active~~ & positive & Negetive

* Positive plates in Brown lead peroxide (PbO_2)
* Negetive plates in Grey spongy lead (Pb)

→ During discharge, Negetive will be charge and positive Partly in to lead Sulphate.

The Reaction may be set out as follows

$$PbO_2 + 2H_2SO_4 + Pb = PbSO_4 + 2H_2O + PbSO_4$$

(+) Electrolyte (−) (+) Electrolyte (−)

→ In the charged condition, the sp grty acid is about 1.260 but this fall during discharge, 1.160

→ During charging, the reverse occurs and the sp-grity rises again. The end of the charge is marked by the liberation of the oxygen and Hydrogen from the Electrolyte, know as "gasing".

→ The two vent-holes in front of the Battery allow the gases to Exit. There should always kept free from Obstructions to Enable the battery to fouction Correctly.

→ once in 7-10 days the cells must be topped up with distilled water to ouplace the loss; acid should not be used for topping up.

→ Intial stage the lamp voltage is 4.4 volts but this falls progressively during use to 3.6 volts

→ <u>The headpiece</u>

→ The oldham lamp has a shell of moulded plastic fitted with a bulb, a know Knob-type-switch

a reflector which may have either a polished (or) a matt surface, a cap hook, a charging contact and a thick armour plate glass.

→ The bulb is krypton filled, 4-volts, 0.67 amp and give output 80 lumens.

→ Life of Bulb is 500 Hours

→ A fuse cartridge is incorporated at base of the Battery internally as a safety measure to guard against Excessive Current flow in the event of the short Circuit, Rated to Below at 4 amps.

→ In the lamp charging room the charging rack accomodates 100 lamps on a 10Q-type charger. All the lamps are Connected in parallel and are charged on a Constant potential system the 100 voltage of D.C power required at 5 volts

→ The Exact voltage Required for charging lamp is 4.8

→ <u>Charging</u> :

→ The Negetive charging Contact is a key mounted on the headpiece is fitted over this key and turned clockwise through 180 degrees.

→ The positive charging stud on the lamp then makes Contact with a spring clip assembly - also mounted on lamp makes contact with a spring clip assembly also mounted on the headpiece board.

→ The Rotation of headpiece brings the Key into Contact with the Negetive Contact, and charging starts

→ The current taken varies according to the state of the charge of battery gradually becoming less as the battery becomes more fully charged.

→ one is charged fully, Automatically cutoff.

→ The Miner himself have to put in lamp room for charging and Remove after 12-16 Hrs - sufficient charging of lamp

→ Caplamps are also powered by batteries having alkaline cells though such batteries are not manufactured in our Country for the Caplamps used generally by miners.

→ The Alkaline Cell Consists of a number of Composite plates or tubes of thin perforated Nickel steel Containing the active material and immersed in a 20% solution of the potassium Hydrate (Caustic potash, KOH) having a Constant S.G about 1.2.

→ The active material in positive plate is the Nickle Hydroxide, and that in the Negetive is iron or Cadmium oxide or Both Mixture.

→ All plates insulated from each other and from the steel Container.

The chemical Reaction are then

$$2NiO_2 + 2KOH + Fe = Ni_2O_3 + 2KOH + FeO$$

+ Plate ⊕ — Plate + plate — plate

→ During charge the battery with alkaline cells is similar to lead-acid battery but it has some advantages over the latter, viz

1) working life (5-6 years)
2) lower maintenance cost
3) withstand adverse treatment like overcharge

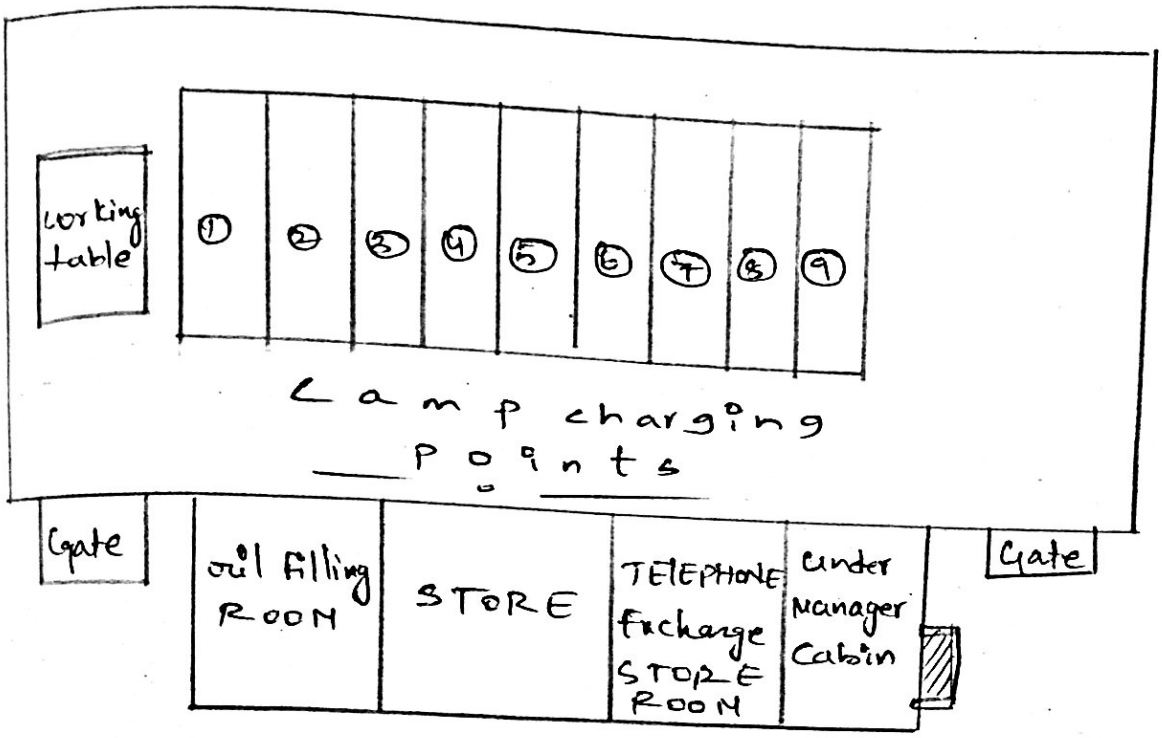
Maintenance and Examination :

Problems :

* Cam lamp does not give light
* Battery does not accept charge
* Battery power does not last a shift after a full charging cycle.

Causes	Solutions
* Battery was Not charged	– charge the Battery
* Damaged Cable	– Replace the Cable
* loose Connections	– Tighten all loses
* loose Non functional switch	– tighten and Replace if
* problem with LED PCB	–
* Worn out or damaged Cable	– Replace the Cable
* Worn out charging key	– Replace charging key
* Damaged charging circuit rack does not on the headpiece	– Replace the PCB
* Poor charging eg- charging rack Does not conform	– Make sure the rack Confirms to point 3.3 of this document
* Blocked charging Contacts	– Clear the charging contacts
* Damaged LED driver circuit on the headpiece PCB	– Replace the PCB
* Battery past its life	– Replace the Battery

Lamp room Design and Organisation :-



Lamp room :-

→ It is situated at the surface

→ In this room batteries of the Camp lamp are charged

→ The Batteries are of 4 volts

→ The Batteries are of lead acid battery, Rechageble

→ The Nominal voltage of led acid cell is of 2volts
So Both must be conneted in series → 4 volts

→ 5-6 volts D.C. powd is required to charge the battery, But 4.8 volts is the standard.

Comprehend(5th Unit)

Topic name:

Date:

What you understand from the topic:

Rate yourself (10):

Rapid test

PPT Talks

- Topic:
- Subtopic:
- Extracted Core Stuff:
- Pen the Illustrations:
- Mathematical terms:
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- Rate your friend(10):

Journal Interpretations

- Journal name:
- Title:
- Authors names:
- Publishing year:
- Synoptic abstract

- Pen the Illustrations:

- Gross theme:

- What you understand?

Journal Interpretations

STUDENT TRUE SELF ASSESSMENT SHEET