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Mine Legislation and Management

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MINE LEGISLATION AND MANAGEMENT

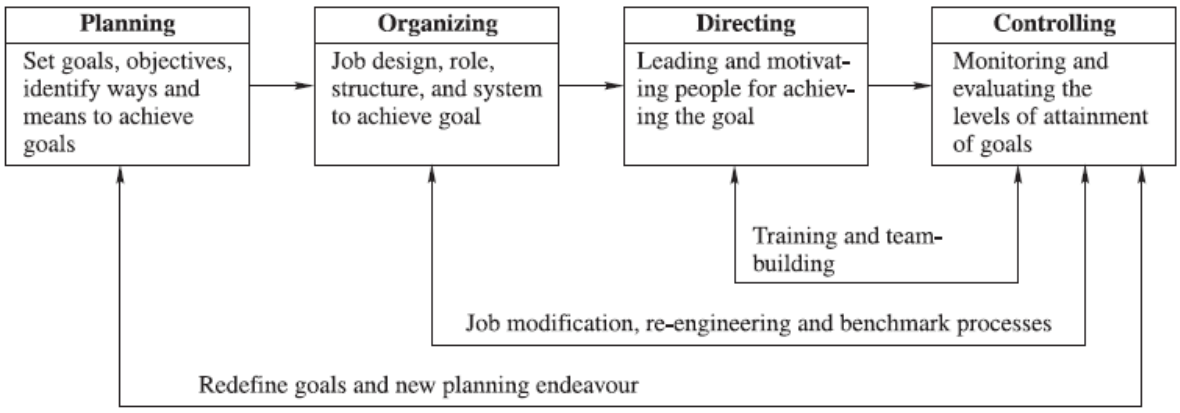
DEFINITION OF MANAGEMENT

According to G.R. Terry, *management is a distinct process consisting of planning, organizing, actuating and controlling, performed to determine and accomplish stated objectives by the use of human beings and other resources.*

This definition embodies four process of management which are planning, organizing, actuating and controlling. These processes are performed to attain certain objectives by people with the help of other resources. Thus, management is viewed by terry as an activity and those who perform this activity are designated as *managers*.

FUNCTIONS OF MANAGEMENT

Key functions of management are planning, organising, motivating and controlling.



ROLE OF MINE MANAGER

The Mine Managers are the ‘King Pin’ of the Coal Industry.

It is a very responsible position and therefore, a Mine Manager has to equip himself in such manner that he can handle all important functions satisfactorily.

The major functions are

- A realistic forecast of output-Short term as well as long term.
- Rate of development
- To ensure every man is gainfully employed and arriving at his working place with minimum delay

- To fix standard for the use of all materials.
- Co-ordination with marketing Deptt. on the size and grade of product.
- To fix a standard for effective industrial relation.
- There is no disagreement on the items to be considered in the cost of production.
- To establish an effective communication system. What is needed is the development of a right attitude of mind to economic production.
- To stimulate interest in all the officials at the colliery in the need for maximum efficiency and provide a means of controlling operations.

Managers have always realised their responsibility for production i.e. to produce the optimum maintainable output at minimum cost, consistent with a planned rate of development.

This is not only the Mine Manager's responsibility but it is his ambition and his career, as Manager is supposed to aim and striving to achieve it.

The Colliery Manager is supposed to be engaged in constant follow-up and implementation of various programmes scheduled as per activities related to aforesaid fields. As his routine work, daily control would start with analysis of :

- Daily Production Report
- Attendance Sheet - OMS
- Wage Cost and other allowances - EMS
- Saleable coal available
- Coal Despatched
- Failure of equipments
- The control section will supply other information necessary for control.
- Meeting with under officials at the end of the shifts, to set programme for advance action.

As weekly follow up measures, towards the end of each week, Manager consults with the Under Manager and Cost Assistants on any probable change in manning or output in the following week. The temporary adjustments to the standards are sometimes required due to changed conditions

At the beginning of each week, control section would provide statements which will allow the Manager to review the previous week's result.

ORGANIZATIONAL STRUCTURE

The basic principles of organization can be better understood by studying the four types of organization :

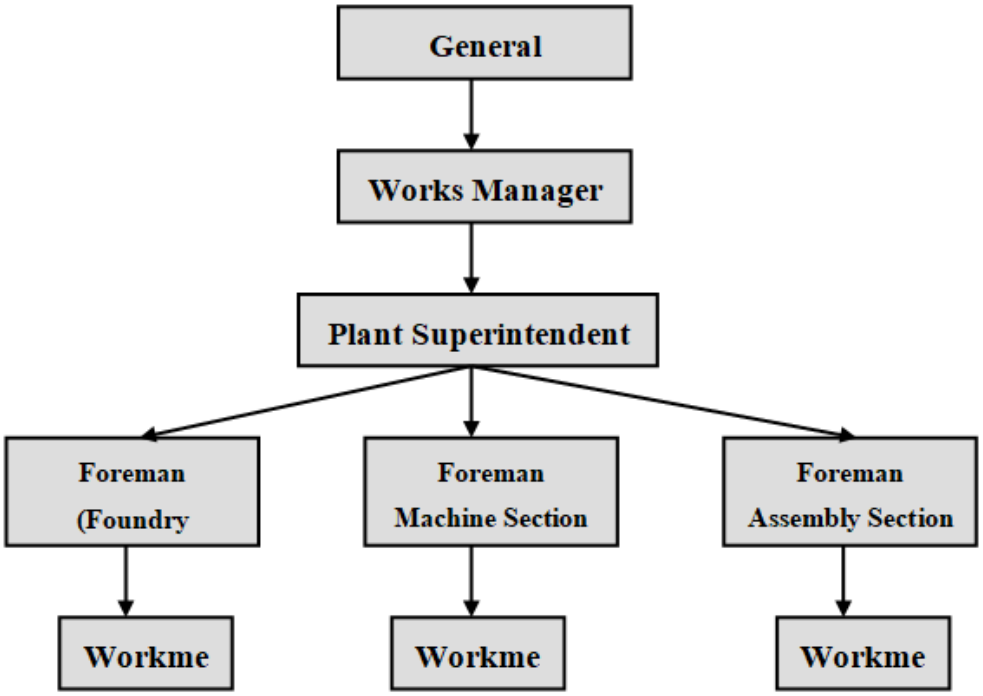
- Line organization which is often found in military and departments.

- Functional organization.
- Line and staff organization.
- Line, staff and committee organization.

Line Organization

It is the oldest type of organization in which authority flows directly from the general manager to various executives subordinate to him and then from them to the lower level managers. This will be clear from the diagram given below.

The basic point to be noted in this type of organization is that while authority flows from a higher to a lower level of authority , the line of responsibility moves upwards from the lower to higher level of authority. Everybody knows from whom he has to receive orders or instructions and to whom he has to submit his report. Besides being simple and easily understood it helps in taking quick decisions. But there are certain disadvantages that flow out of this system. Often executives are over-burdened with a diverse and multifarious duties and therefore, it is not possible to practice specialization.

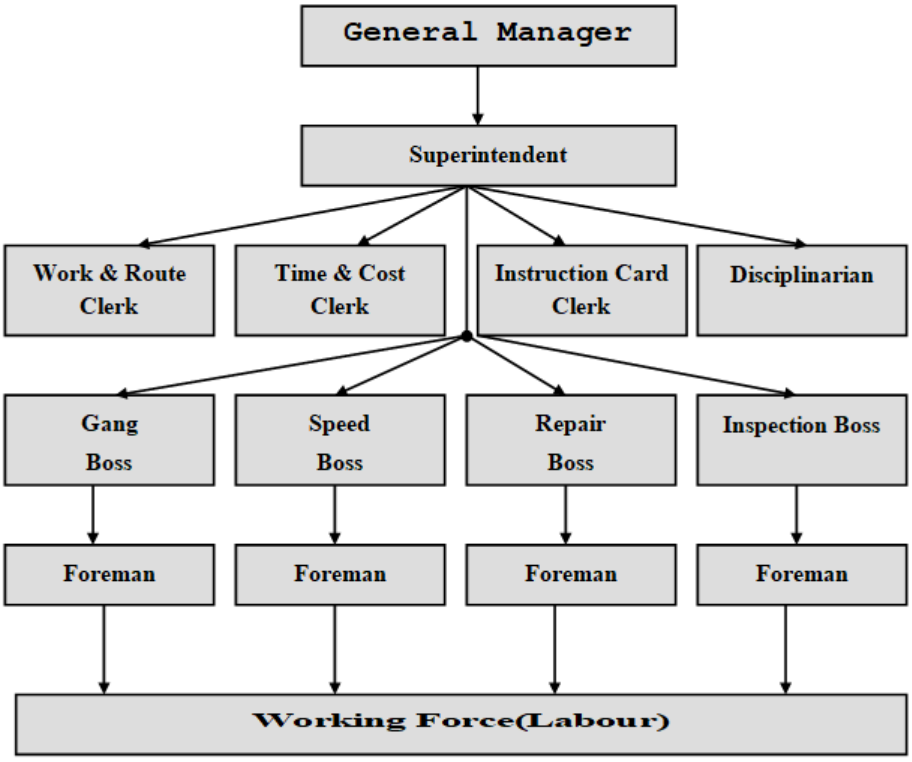


Functional Organization

The diagram will illustrate the structure of the functional organization.

This type of organization is based on specialization which contributes towards efficiency The right man is put on the right job and man required for managery ability and talent can be trained

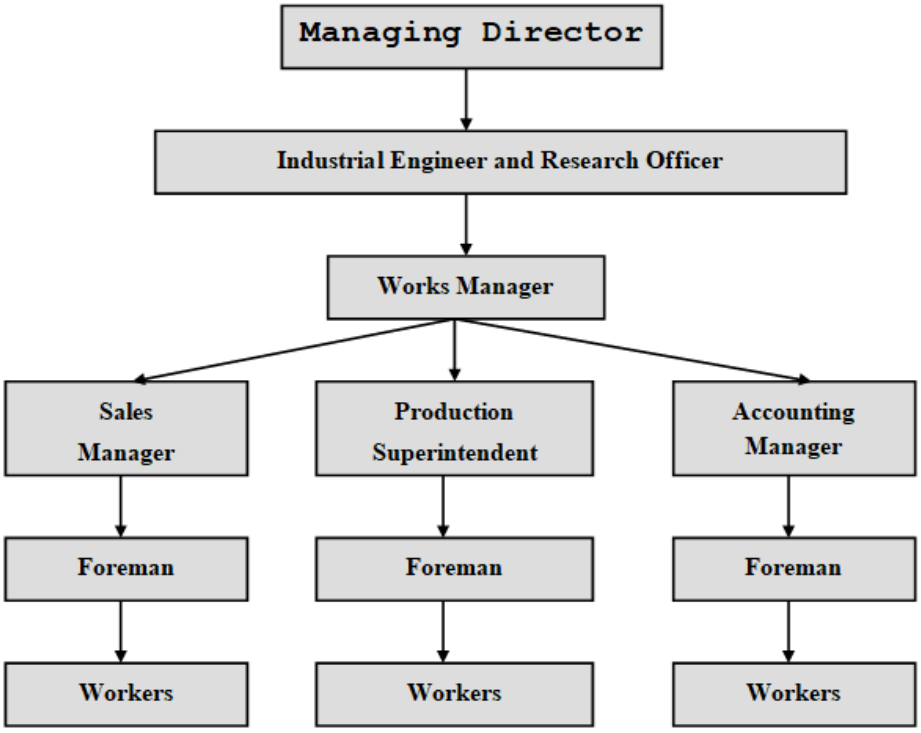
efficiently. It is no doubt more expensive, but the increase in cost is offset through savings resulting from management realizes that he is pursuing a particular function only co-operation between them is encouraged.



Line and Staff Organization

As the very name suggests this is a combination of the elements of the first two types of organizations. Under this system, a body of experts over the staff is employed to assist the line officials. Investigations are made, information is collected, plans are chalked out and schemes are prepared by this staff. Line officials select the best scheme and give instructions accordingly. The staff is advisory because they do not have any control over the workers or the foreman. The final decision is taken and passed on through the same line of authority as we find in a line type of organization. Suitable for medium and large scale industries such as automobile industries. The structure of this system will be clear from the diagram given on next page.

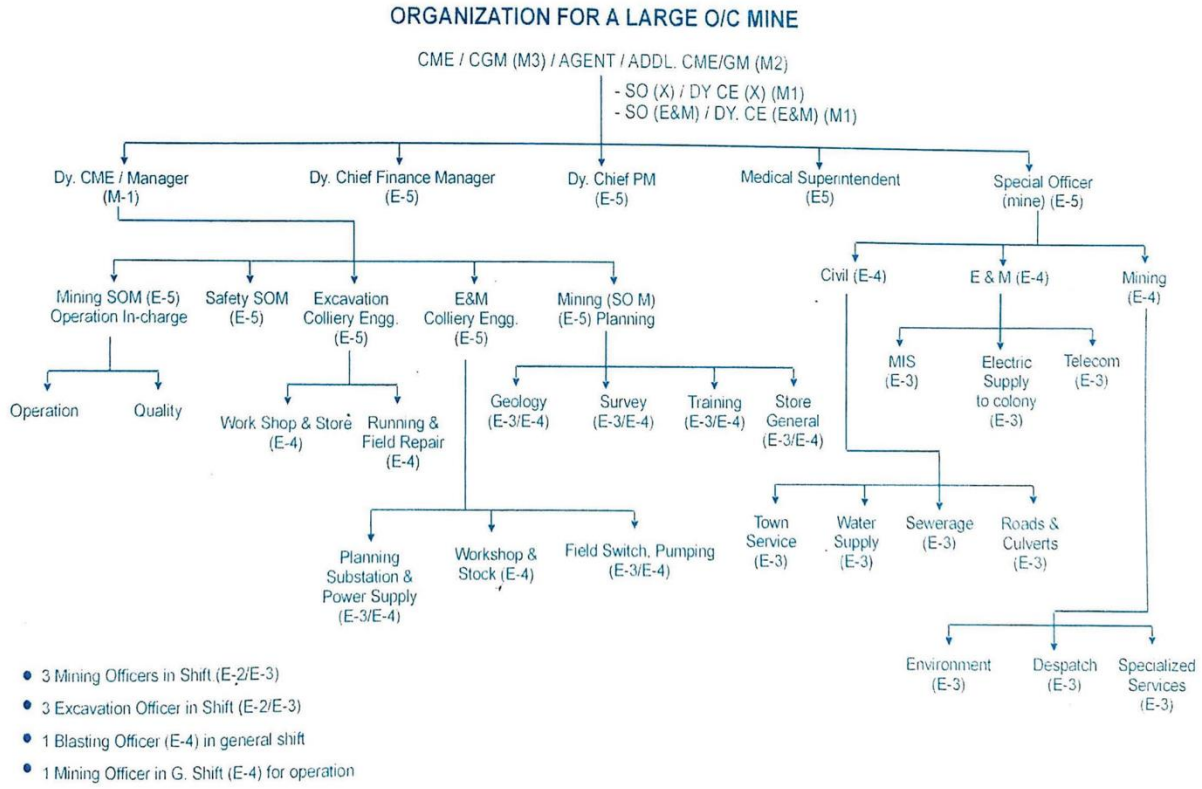
This type of organization brings efficiency in management achieves greater co-ordination and leads to quick action.



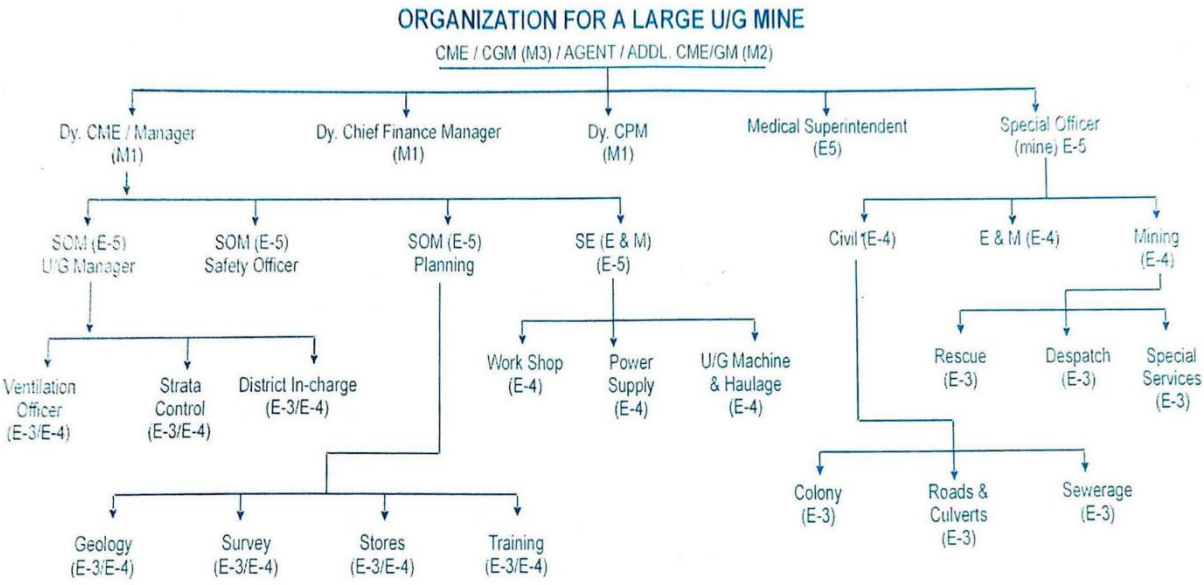
Line, Staff and Committee Organization

In highly complex and large-scale industrial enterprises, line, staff and committee organizational structure is found. Committees are used to supplement the line. the thoughts of several people on problems involving several functions are pooled together through these committees and as a result better plans and policies for operation come forth. The committee advises the line foreman, who ultimately translates these recommendations into action.

ORGANIZATIONAL CHART OF LARGE O/C MINE



ORGANIZATIONAL CHART OF LARGE U/G MINE



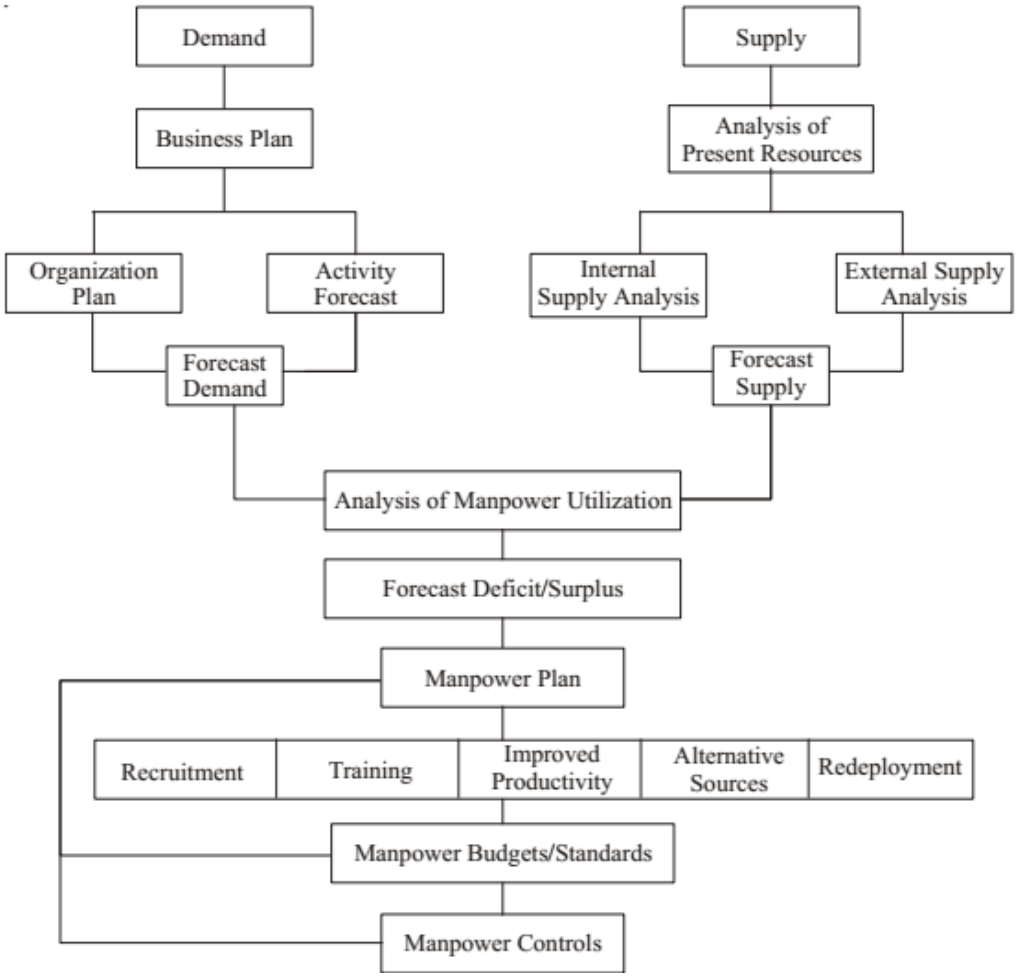
HUMAN RESOURCE PLANNING

Human resource planning (HRP) is the comparison of an organization's existing labour resources with forecast labour demand, and hence the scheduling of activities for acquiring, training, redeploying and possibly discarding labour. It seeks to ensure that an adequate supply of labour is available precisely when required.

Specific human resource planning duties include:

- Estimation of labour turnover for each grade of employee and the examination of the effects of high or low turnover rates on the organization's performance.
- Analysis of the consequences of changes in working practices and hours. Predicting future labour shortages.
- Devising schemes for handling the human problems arising from labour deficits or surpluses.
- Introduction of early retirement and other natural wastage procedures.
- Analysis of the skills, educational backgrounds, experience, capacities and potentials of employees. Effective HRP should result in the right people doing the right things in the right place at precisely the right time.

The process of human resources planning is illustrated in following figure.



Process of human resource planning

TASK ANALYSIS

The traditional approach to task analysis-formerly known as "job analysis" - is characterized by two models: the British model and the American model. The British model has emphasized analysis in terms of specific activities for which the job holder is held responsible whereas the American model has included an emphasis on the competencies needed for the job. With both models the analysis is usually carried out by management with the help of experts, and in other respects as well the two models are quite similar. Both have been found to be useful in analyzing semi-skilled and skilled work.

Task analysis can be defined as the process of identifying the tasks of a particular job in a particular organizational context by analyzing activities, establishing performance criteria, determining required competencies, and analyzing any discrepancies uncovered by this process.

The type of Task Analysis suggested here may be useful to the organization and the individual employees in several ways.

Selection and placement. Better recruitment and selection devices can be prepared on the basis of a task analysis (especially competency analysis). Competency analysis can also help an organization to place people in jobs in which they can be more effective (matching the role/job with people).

Work planning, including the following:

- Setting individual tasks for a specific period.
- Helping a job incumbent to decide priorities of task.
- Minimizing overlap between jobs
- Identifying neglected tasks in a work unit
- Planning delegation
- Job enrichment

Performance appraisal, including

- Negotiated tasks and activities to be performed
- Evaluation (by self and the supervisor) of the quality/quantity standards of task performance (both process and outcome effectiveness)

Potential appraisal, including preparation of a system on the basis of the competency analysis, and actual potential appraisal work.

Employee development , including

- feedback on strengths and weaknesses
- Performance counselling
- Training

Team building, especially

- Better understanding of each other
- Locating areas of task conflicts and dealing with them
- Building linkages an mutuality between jobs

TRAINING

After employees are selected, they enter an orientation program to be formally introduced to their jobs. A job is a specific position an employee holds in an organization. The orientation program expands on information received by the employee during the selection process. Orientation is a program that introduces new employees to the organization as a whole, their work unit and co-workers, and their job duties. It helps to reduce initial anxiety over starting a new job by facilitating the outsider-insider transition. Orientation sets a tone for new

employees' work by describing job-related expectations and reporting relationships. Employees are informed about benefits, policies, and procedures. Specific duties and responsibilities and performance evaluation are clarified. During orientation, the supervisor has the opportunity to resolve any unrealistic expectations held by the employee.

Formal orientation programs can include tours of facilities, discussions about the history of the organization, vision and mission, meeting with human resource representatives to discuss policy and compensation, and/or being assigned a mentor to introduce employees to processes and people. A successful orientation result is an employee transition where the new member feels comfortable and capable of performing well on the job.

A mentorship is a formal relationship between a newly hired employee and a veteran employee role model that provides support and encouragement to the new employee. Mentors serve as resources to new employees, helping them resolve personal problems and work-related issues and conflicts. A mentor helps employees become accustomed to the rules, norms, and expectations of the workplace and provides career insight and guidance based on personal career experience.

Training refers to improving an employee's knowledge, skills, and attitudes so that he or she can do the job. All new employees (or current employees in new jobs) should be trained. Cross training prepares an employee for a job normally handled by someone else. Also, training is advisable when new processes, equipment or procedures are introduced into the workplace. If an employee has been off work for more than 30 days, training may be needed.

Determinants of Performance

Organizations invest in training programs to improve employees' performance. Training can either be for general awareness (for example, safety or sexual harassment) or for the specific job or task. Supervisors must understand the determinants of task performance in order to design job-related training.

Performance = **Ability** x **Motivation** (Effort)

Ability = Aptitude x Training x Resources

Motivation = Desire x Commitment

The multiplication sign in these models signifies that all of the components are essential. **Performance** is the product of ability multiplied by motivation. **Ability** is the product of aptitude multiplied by training and resources. **Aptitude** refers to the skills and abilities an employee brings to the job. Training can enhance most inherent abilities and can improve employee performance. An assessment of ability should be made during the job-matching process by screening applicants against the skill requirements of the job. Low ability is generally associated with very difficult tasks, overall low individual ability, evidence of strong

effort, and lack of improvement over time. Employees must be given the technical and personnel resources to effectively perform assigned tasks. **Motivation** is represented by an employee's desire and commitment and is manifested as effort.

LAISSEZ-FAIRE LEADERSHIP

Laissez-faire leadership, also known as delegative leadership, is a type of leadership style in which leaders are hands-off and allow group members to make the decisions. Researchers have found that this is generally the leadership style that leads to the lowest productivity among group members.

Characteristics of Laissez-Faire Leadership

Laissez-faire leadership is characterized by the following:

- Hands-off approach
- Leaders provide all training and support
- Decisions are left to employees
- Comfortable with mistakes
- Accountability falls to the leader

Advantages of Laissez-Faire Leadership

- It encourages personal growth. Because leaders are so hands-off in their approach, employees have a chance to be hands-on. This leadership style creates an environment that facilitates growth and development.
- It encourages innovation. The freedom given to employees can encourage creativity and innovation.
- It allows for faster decision-making. Since there is no micromanagement, employees under laissez-faire leadership have the autonomy to make their own decisions. They are able to make quick decisions without waiting weeks for an approval process.

Disadvantages of Laissez-Faire Leadership

Because the laissez-faire style depends so heavily on the abilities of the group, it is not very effective in situations where team members lack the knowledge or experience they need to complete tasks and make decisions. This can lead to poor job performance and less job satisfaction.

This is leadership style is also not suitable for situations where efficiency and high productivity are the main concerns. Some people are not good at setting their own deadlines, managing their own projects, and solving problems on their own. Under this leadership style, projects can go

off-track and deadlines can be missed when team members do not get enough guidance or feedback from leaders.

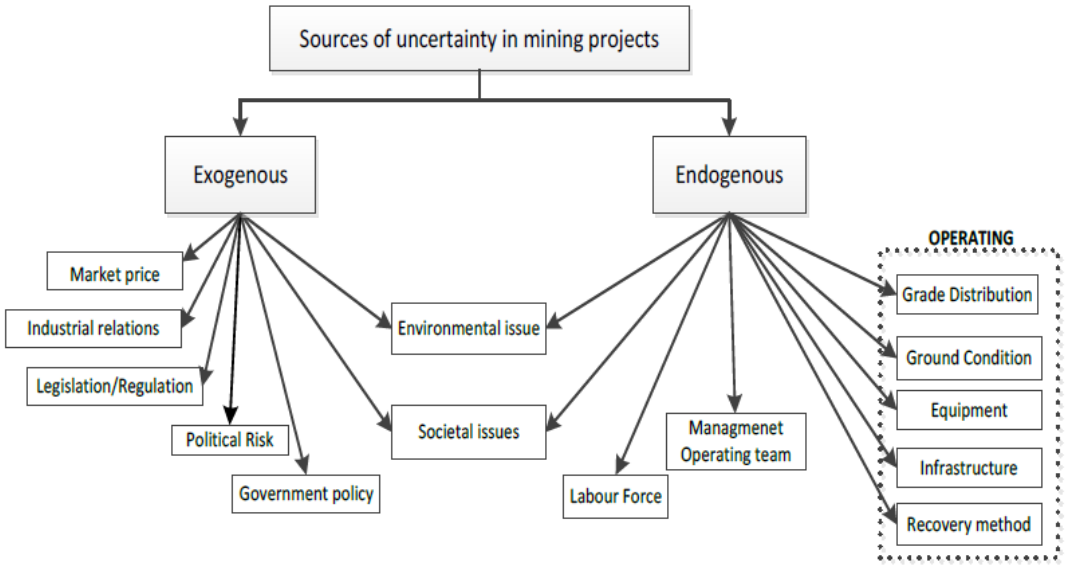
Some possible disadvantages of the laissez-faire style include:

- **Lack of role clarity**: In some situations, the laissez-faire style leads to poorly defined roles within the group.4 Since team members receive little to no guidance, they might not really be sure about their role within the group and what they are supposed to be doing with their time.
- **Poor involvement with the group**: Laissez-faire leaders are often seen as uninvolved and withdrawn, which can lead to a lack of cohesiveness within the group. Since the leader seems unconcerned with what is happening, followers sometimes pick up on this and express less care and concern for the project.
- **Low accountability**: Some leaders take advantage of this style as a way to avoid responsibility for the group's failures. When goals are not met, the leader can then blame members of the team for not completing tasks or living up to expectations.
- **Passivity**: At its worst, laissez-faire leadership represents passivity or even an outright avoidance of true leadership. In such cases, these leaders do nothing to try to motivate followers, don't recognize the efforts of team members, and make no attempts at involvement with the group.

UNCERTAINTY IN MINES

In order to increase the output and satisfy increasing market demand, mining re-search is focused on optimization which is branched off in many areas, such as automation, uncertainty analysis, equipment design and implementation.

In mining where production of ore is most important outcome, knowledge of operations is essential for the management of risk, maintenance of low costs, and increasing of the output. Uncertainties are inherent in the circumstances in which mines are planned, developed and operated. The uncertainties related to mining project are represented in given figure.



Larger the degree of uncertainty, more valuable it becomes to know effect of internal and external factors causing uncertainty. The sources of mining uncertainties could either be planned or unplanned and due to internal or external events.

Equipment production is affected by the factors causing uncertainties. These factors broadly can be divided in; mechanical properties of equipment such as design, shovel bucket size, operational and working plan for equipment, environmental factors such as temperature, rain, ice etc., human factors such as skill, competency, fatigue experienced by operator etc.

Causes of origin of uncertainties in mining are sometimes difficult to determine, they may be specific to environment, or system and context under study.

Economic uncertainties are another area studied and improved in mining research. Economic uncertainties include market volatility, demand and price fluctuations un certainty has been addressed with real options approach.

MATERIALS MANAGEMENT

Materials Management aims at reducing the cost of production so as to help the organisation in maximising its profits. Main objectives of materials management are:

- To reduce material cost.
- Efficient control of inventories, which helps in releasing the working capital for productive purposes.
- Ensure uniform flow of material for production
- Ensure right quality at right price.
- Establish and maintain good relations with supplier.
- Economy in using the. imported items and to find their substitutes.

Functions of Materials Management

Functions of the materials management department are grouped as follows:

1. Materials planning and programming
2. Purchasing.
3. Store-keeping
4. Inventory control
5. Material handling
6. Quality control and inspection
7. Value engineering
8. Standardisation, simplification, variety reduction, product
9. Development, make or buy decisions.
10. Disposal of obsolete, surplus and scrap.

INVENTORY MANAGEMENT

Inventory means all the materials (may be raw or finished parts/components, in process or finished products, castings and consumable tools, electrodes etc.) recorded on the ledgers/books of the organization and kept in its stocks (in the store or ware houses) for some period of time.

So inventory is an essential part of an organization. Every enterprise/business or manufacturing concern however big or small, has to maintain some inventory.

Functions Or Characteristics Of Inventory

From the definition of inventory, it is clear that it is related to stock of raw materials, semi finished and finished products items maintained by the enterprise/business/organization. The following points will explain the concept and functions of inventory.

Inventories Serve as Cushions. Against shocks due to demand/supply fluctuations, it separates different manufacturing operations from one another and make them independent so that each operation can be performed economically. For example, an organization has to deal with several consumers and vendors and due to their unpredictable behaviour there are always fluctuations in demand or supply of goods which disturbs the schedule of the enterprise. Inventories absorb these fluctuations and help in maintaining undisturbed production i. e. we decouple the manufacturing activities from the consumer and vendor successfully by cushions of stocks. Further more purchasing/order of raw material can be carried out independently of the finished products distribution and both of these activities can be made low cost operations say by ordering raw material and distributing products in one big lot than in small batches. Thus it leads to better utilization of men and machines besides economy.

Inventory, a Necessary evil for any Enterprise. Inventories require valuable space, capital and other overheads for maintaining it. The invested capital remains idle till the stocks are not consumed. On the other hand, smooth working of the organization is not possible without inventory so it is a necessity. Further it has been observed that costs of not having inventory (stock out conditions) are usually greater than costs of having them. Thus inventory is a necessary evil.

Inventory Provides Production Economies. Purchase in desired quantities nullifies the effects of change in prices or supply. Stocks bring economy in purchase of various inputs due to discounts on bulk purchase.

Maintenance of Smooth and Efficient Production Flow. Maintains smooth and efficient production flow thus keeps a process continually operating.

Creation of Motivational Effect in Decision Making. Creates motivational effect in decision and policy making e.g. a person may be tempted to purchase more if inventories are displayed in bulk.

Types Of Inventory

The term inventory includes all types of goods/items available in the stores, however, it excludes the machinery, jigs and fixtures. Inventories can be classified in different ways depending on their function or convention. The classification of inventory is mentioned below.

Classification According to Function or Material Flow

- **Production Inventory.** Items/goods going into final product such as raw materials, components finished parts/components sub assemblies procured from market or outside source.
- **Work In Process Inventory**. Items in semi finished stage or products required at different stages of manufacturing of the product.
- **Finished Goods Inventory**. These are finished goods or final products ready for dispatch to users or to distributors.
- **Operating and Maintenance Inventory**. These include the items which do not form the part of the final product but are either consumables used during the manufacturing process or items needed required for repair and maintenance functions.
- **Miscellaneous Inventory**. The items/goods other than those mentioned above such as obsolete and unsaleable products or scrap arising from main production process, stationery items used in office, other items required by office, factory and sales department etc.

In fact inventory is maintained for flow of operations only and as such remains in flow, like raw materials inventory maintained for smooth flow of production and finished goods inventory is maintained for smooth flow of goods under distribution.

Conventional Classification

Inventory may be classified according to convention in the following way:

- **Direct Inventories**. These include materials in any form and of any form after processing or finished components which becomes an integral part of the main/final product to be delivered to distributor or consumer.
- **Indirect Inventories**. These include materials which are not processed and do not become an integral part of the final product but without which the completion of the final product is not possible. These may be cutting fluids. lubricants and other consumables items required during production.
- **Finished Products Inventories**. Products ready for dispatch to the distribution system or market i.e. final products.
- **Purchased Parts Inventories**. Semi-finished, finished parts purchased from the market for utilisation at the time of assembly of the final product.

Objectives/Reasons for Holding Inventory

Any comprehensive system of control covering all types of inventory is directly or indirectly aimed at accomplishing a great variety of purposes. Most of them are as follows:

Financial Objectives. The major financial objective of holding the inventory is to keep the investment involved within the enterprise's cash position so that the working capital is not thrown seriously out of balance.

To Create a Buffer Stock Between the Input and Output. So that, the out going flow of products is as little dependent on the input material characteristics as possible.

To Ensure Against Delay in Deliveries. The delay in delivery of finished product to the buyer is avoided by holding inventory stock of finished goods.

To Allow for a Possible Increase in Output if so Required. Market requirements may disturb the manufacturing programme of the enterprise. Depending upon the production requirements stocks are to be maintained and supplied.

To Ensure Against Scarcity of Materials in the Market. Sometimes input materials may become scarce and difficult to get when there are large fluctuations in output and demand for them. A reserve stock of raw materials is must for smooth manufacturing operations.

To Make Use of Quantity Discounts. Input materials and components/parts may be cheaper when purchased in bulk quantities owning to quantity discounts and lower transportation costs/charges.

To Utilize to Advantage Price Fluctuations. Price fluctuation may have a marked effect on the procurement policy of an enterprise or organization. If these fluctuations are to be utilized to advantage of the unit, materials have to be purchased in adequate quantities when prices are lowest.

All the above reasons or objectives involve cost. The inventory control is mainly concerned with making optimum decisions regarding above variables which are subject to control.

INVENTORY COSTS

Ordering costs

Ordering costs, also known as setup costs, are essentially costs incurred every time you place an order from your supplier.

Examples include:

- Clerical costs of preparing purchase orders — there are many kinds of clerical costs, such as invoice processing, accounting, and communication costs
- Cost of finding suppliers and expediting orders — costs spent on these will likely be inconsistent, but they are important expenses for the business
- Transportation costs — the costs of moving the goods to the warehouse or store. These costs are highly variable across different industries and items
- Receiving costs — these include costs of unloading goods at the warehouse and inspecting them to make sure they are the correct items and free of defects
- Cost of electronic data interchange (EDI) — These are systems used by large businesses and especially retailers, which allow ordering process costs to be significantly reduced.

Holding costs

Also known as carrying costs, these are costs involved with storing inventory before it is sold.

- Inventory financing costs — this includes everything related to the investment made in inventory, including costs like interest on working capital. Financing costs can be complex depending on the business
- Opportunity cost of the money invested in inventory — this is found by factoring in the lost alternatives of tying money up in inventory, such as investing in term deposits or mutual funds

- Storage space costs — these are costs related to the place where the inventory is stored and will vary by location. There will be the cost of the storage facility itself, or lease payments if it is not owned. Then there are facility maintenance costs like lighting, heating, and ventilation. Depreciation and property taxes are also included in this
- Inventory services costs — this includes the cost of the physical handling of the goods, as well as insurance, security, and IT hardware, and applications if these are used. Expenses related to inventory control and cycle counting are further examples
- Inventory risk costs — a major cost is shrinkage, which is the loss of products between purchasing from the supplier and final sale due to any number of reasons: theft, vendor fraud, shipping errors, damage in transit or storage. The other main example is dead stock

Shortage costs

These costs, also called stock-out costs, occur when businesses become out of stock for whatever reason.

- Disrupted production — when the business involves producing goods as well as selling them, a shortage will mean the business will have to pay for things like idle workers and factory overhead, even when nothing is being produced
- Emergency shipments — for retailers, stock-outs could mean paying extra to get a shipment on time, or changing suppliers
- Customer loyalty and reputation — aside from the loss of business from customers who go elsewhere to make purchases, the company takes a hit to customer loyalty and reputation when their customers are unhappy

Spoilage costs

Perishable inventory stock can rot or spoil if not sold in time, so controlling inventory to prevent spoilage is essential. Perishability is a concern for many industries such as the food and beverage, pharmaceutical, healthcare and cosmetic industries, all of which are affected by the expiration and use-by dates of their products. Spoilage not only costs money but also means you fail to realise a return on your initial investment.

Inventory spoilage and waste is not simply a result of isolated cases of poor inventory control, spoilage is now a global environmental concern. When you consider that in the United States alone, an estimated $200 billion is spent growing, processing, transporting and disposing of food that is never eaten.

Solid inventory control is your front line to preventing spoilage and waste. With the right inventory system, you can improve forecasting, boost efficiency, access real-time inventory data and up-to-date information on the lifecycle of your stock, enabling staff to rotate and manage stock to ensure older products get sold first.

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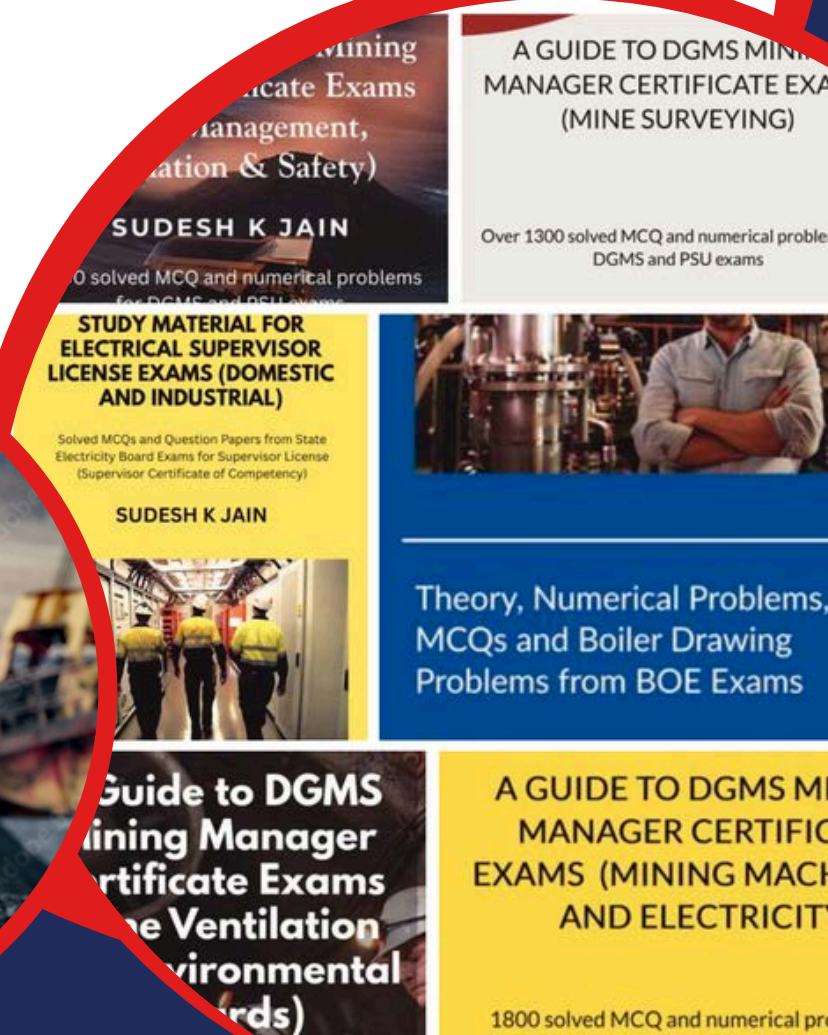


This approach is used in the grocery and FMCG sectors where products with shorter expiry dates are rotated to the front of the shelf. Items that are due to expire are often heavily discounted to clear the inventory stock.

INVENTORY CONTROL MANAGEMENT

It may be defined as the scientific way of finding out the quantities to be kept in stock to meet the production requirements and the systematic location, storage and recordings of the goods/items in such a way that desired degree of service can be provided at competitive prices or at minimum ultimate cost.

Causes of Poor Inventory Control

- Over buying without consideration of demand estimates in order to take advantage of favourable market conditions leads to poor control.
- Over production or keeping inventory stocks of finished products without consideration of customer requirements.
- In order to provide quick and better service to consumer over-stocking may take place. Also to cut down the cost of production, bulk production will result in huge inventories both these shall lead to poor inventory control.
- Cancellation of orders may also give rise to large inventories thus may result in poor inventory management.

Functions Of Inventory Control

The functions of inventory control are listed below:

- **To develop policies, plans and standards required**: So as to achieve the inventory control objectives.
- **Effective running of stores**: This may include problems of layout, utilization of storage space, issuing and receiving procedures of items kept in stock.
- **Technological responsibility for the state of different materials**: This may include the method of storage, maintenance procedures, studies of deterioration and obsolete materials and corrective action required.
- **Stock control system:** This includes purchase procedures of materials, ordering policies, physical verification and records of items stored.
- **To ensure the timely availability**: Of requisite input materials and avoid building up of stock levels of final product.
- **Maintenance of specified inputs:** Specified raw materials, finished components/parts work in process, general supplies in sufficient quantities are maintained to meet the production requirements of the enterprise.

- **Protection of inventories:** The inventories are to be protected from improper material handling; wrong and unauthorized removal from the stores.
- **Pricing:** Pricing of all input materials being supplied to various shops is essential for further cost estimation of final products.

Advantages of Inventory Control

- It creates buffer between input and output.
- It ensures against in deliveries.
- It allows for possible increase in output
- It allows advantage of quantity discounts
- It ensures against scarcity of materials in the market
- It utilizes the benefit of price fluctuations
- It avoids inventory build-up.

Economic Order Quantity

The economic ordering quantity is obtained by the quantity whose procurement cost is equal to inventory carrying cost.

Let A = total items consumed per year

P = procurement cost per year

C = annual inventory carrying cost per item

Q = economic order

Now $Q = \sqrt{(2AP/C)}$

Example

The rate of use of a particular raw material from stores is 20 units/year. The cost of placing and receiving an order is Rs. 40. The cost of each unit is Rs. 100. The cost of carrying inventory in percent/year is 0.16 and it depends on the average stock. Determine the economic order quantity.

Solution

A = Number of units consumed/year = 20, P = ordering and set up cost = Rs. 40

C = annual inventory carrying cost per unit

= Total annual inventory carrying cost/total items consumed in a year

= 20 x 100 x 0.16/20 = Rs. 16

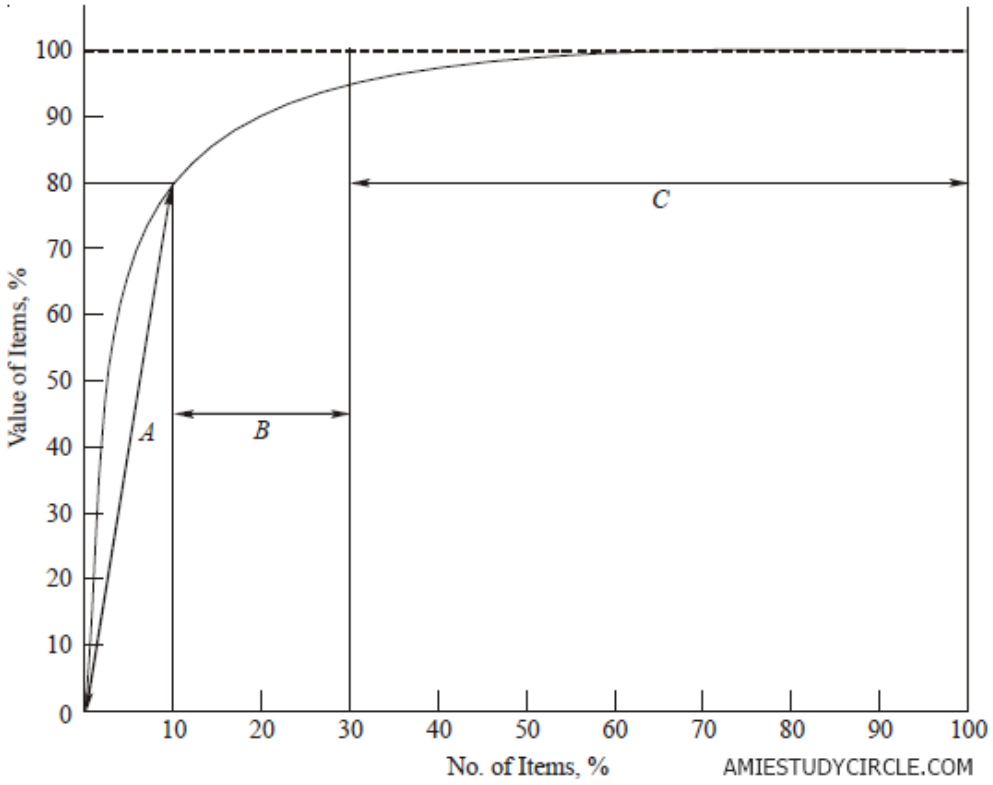
$\therefore$ $Q = \sqrt{2AP/C} = \sqrt{(2 \times 20 \times 40/16)} = \sqrt{100} = 10$ items

ABC Method of Inventory Control

This analysis is based on the universal Pareto's law that in any large number, there are 'significant few' and 'insignificant many.' For example, only 20 per cent of the items may be accounting for 80 per cent of the total material cost annually. The analysis is believed to have originated in the General Electric Company of America and is also known as Always Better Control (ABC) analysis.

In order to exercise more effective control over materials, A. B. C. (Always Better Control) method is of immense utility. Under this method materials are classified into three categories in accordance with their respective values.

Given figure shows a typical ABC analysis showing the relationship between the percentage of the number of inventory items and the percentage of average inventory investment (annual usage value).



Annual usage value is the demand multiplied by unit price, thereby giving the monetary worth of annual consumption. The figure shows that 10 per cent items claim 80 per cent of the annual usage value and thus constitute the 'significant few.' These items are classified as A-class items. Another 20 per cent items account for 17 per cent annual usage value and are called B-class items. The balance 70 per cent items account for only 3 per cent expenditure on material consumption and constitute 'insignificant many' and are called C-class items.

Procedure for drawing an ABC type curve

(a) Arrange items in the descending order of the annual usage value.

Annual usage value = Annual demand × Unit price.

(b) Identify cut-off points on the curve when there is a perceptible sudden change of slope.

Application of ABC Analysis

In the absence of ordering and carrying cost, the ABC analysis is also helpful in rationalizing the number of orders to be placed, and in reducing capital from inventory.

COST COMPONENTS OF A MINE

Variable cost

- Annual explosive cost
- Diesel, Petrol, Lubrication
- Stores and spares
- Power
- Repair and Maintenance
- Labour

Fixed cost

- Equipments
- Haul Road
- Buildings
- Electrical systems
- Engineering and management
- Working capital and contingencies

SURFACE VS. UNDERGROUND MINING COSTS

Inherently it is assumed underground mining costs to exceed surface mining costs.

Reasons cited for the alleged cost effectiveness of surface mining, based on hard rock industry. They include larger equipment, lower labour intensity, simpler development, higher energy efficiency, and less expensive auxiliary operations (ground control, ventilation, supplies etc). The analysis of unit operating-costs shows that for similar ore body configuration and comparable production rates, the major item of difference is **labour**. Aerials and supply costs (i.e. for explosives spare parts, fuels etc.) differ some – about 50% more - but labour costs are

five times higher in underground mining. To reflect this in approximating mining costs, use a lower labour productivity and lower ratio of labour to operating cost.

Continuing this analysis, using a relative cost basis it estimates operating, capital, and overall unit costs for comparable but hypothetical surface and underground mines. This time operating cost was investigated on a unit operation basis. Surprisingly costs for the production operations differ little: rock breakage and loading are lower but haulage is higher in surface mining (the latter because surface truck on a steep grade is more expensive than underground conveyor or rail haulage on a flat grade, plus hoisting). The major difference is for auxiliary operations and development work which are many times costlier underground. Comparing unit operation costs for the two categories demonstrates that underground mining typically is over **twice** as expensive as surface mining.

INVESTMENT PROPOSAL FOR A MINE

An investment proposal for a mine should contain the following information:

- Mineral information about the area in which the mine is being planned and location i.e.
- rails, roads, town villages in the vicinity, communication facilities.
- Specific information about the area selected for mining.
- Geology of the area –coal seams, thickness of the parting, gradient of seam and strata.
- Mine lay out, proposed boundary, coal extraction method of working of coal and OB removal layout for OB dumps for open cast mine.
- Transport system for the mine for main materials and unreal or OB.
- Coal producing and rock removal equipment.
- Ventilation system for the mine, mine gases, spontaneous heat of the coal.
- Type of explosives to be used, storage and transportation of the same.
- Pumping arrangement and dewatering systems.
- Sand collection and stowing arrangements.
- Infrastructure facilities such as roads, workshops, administrative building, training
- facilities.
- Environmental measures for minimizing pollution.
- Housing, water supply, banking facilities.
- Investment requirement, cost and project analysis.
- Possibilities of expansion and likely benefits.

ELEMENTS OF INVESTMENT IN MINING PROJECTS:

The various segments or areas of any premining investments are as follows:

- Exploration costs(mapping, drilling, sampling)

- Property acquisition costs.
- Mine development costs including development drilling and development such as roads,
- stripping, shaft sinking, drafts etc.
- Plant and equipment costs which include mining equipment, mill and processing
- equipments and building and structure, etc.
- Environment impact statement (EIS) legal.
- Working capital
- Expansion capital

ECONOMIC ASSESSMENT OF A MINE

Once a deposit has been identified, initial economic assessments can commence. Techniques for initial economic assessments have been developed for different types of deposits; however, the primary economic objectives are similar. Three techniques used as starting points for this are cutoff-grade analysis, pit optimization, and cost ranking:

- **Cutoff-grade analysis** is used in mines where ore boundaries are defined primarily by economic criteria, e.g., porphyry copper deposits, polymetallic ore bodies, most underground (bulk) mining projects.
- **Pit optimization** is used for most open pit hard-rock mines.
- **Cost ranking** is used for shallow surface mines in bedded deposits, e.g., coal, mineral sands, phosphates, oil shale, tar sands.

The three techniques deal primarily with the marginal costs of mining--the extra returns from the extra ore as the mine is extended laterally or deeper than with the base case plan. Capital costs and costs common to the whole operation (e.g., administration and marketing costs) are usually excluded.

Cutoff Grades

Cutoff grades are the key economic determinant governing the strategy for development of most underground hard-rock mines and mines where the grade of the ore body changes gradually over distance. Cutoff grades are extremely useful guidelines for short-term production operations. As grades decrease away from the main (higher-grade) ore, the cutoff grade determines whether the "next" block of material to be mined (either deeper or laterally) is classified as ore or waste

Cost Ranking

Cost ranking is the key economic tool for valuing reserves and controlling the strategy for development of most shallow surface mines--particularly surface coal mines. As mines

progress into deeper overburden cover or as grades (or seam thicknesses) change, the cost ranking determines whether the "next" block of material to be mined (either deeper or laterally) is classified as ore or waste (2) considered economic or not economic, and (3) included in or excluded from the mine plan.

Pit Optimization

Pit optimization is the key economic tool for valuing reserves and controlling the strategy for development of most open pit hard-rock mines. As mines get deeper and as grades and other ore body characteristics change, the pit optimization technique determines whether the "next" block of material to be mined (either deeper or laterally) is (1) classified as ore or waste (or something else), (2) considered economic or not economic, and (3) included in or excluded from the mine plan.

OVERALL MINING PROJECT EVALUATION

The evaluation of an overall project is usually undertaken by using discounted cash flow techniques. A technical study initially yields tabulations of the required equipment, personnel, and supplies necessary during each year of preproduction and production to produce a certain amount of mine output. The costs of purchasing and operating the equipment are combined with personnel and other costs to determine the overall cost structure of the mine. The expected revenue from the sale of the mine output is also estimated. A cash flow tabulation sets out all of these cash inflows and outflows year by year (including tax payments) to determine the annual cash flows for the project.

In most mining projects, there is a large cash outflow in the early years due to purchases of mine equipment, followed by cash inflows later in the mine life. After discounting of future cash flows back to their equivalent present values, the overall net present value (NPV) of the project is determined. If the owners consider that there is sufficient value in proceeding with the project compared to any alternative courses of action, then they can make a decision accordingly.

Every company has limited resources, and (unless the project is small compared to the resources of the company) the decision to proceed will be dependent on concurrent similar evaluations of alternative projects. For this reason, whole- project analysis is a time consuming procedure. In the end, support from company boards will be forthcoming only if the support from company boards will be forthcoming only if the funding for a given project fits into a time frame consistent with all other demands on the company's resources.

For a complete evaluation of a project or a feasibility study, many other costs must also be considered, including

- administration

- development (exploration and land purchase)
- mine site buildings, roads, and power supply
- freight
- royalties and government charges
- off-site infrastructure, such as townships, road access, power, and water supply

LABOUR NUMBERS AND COSTS

In the developed world, labour costs often represent 50% or more of controllable operating costs in a mine. This section sets out a step-by-step procedure to derive whole-mine labour numbers and costs from first principles. There are three steps in this process:

- Develop an organization chart showing all site personnel.
- Tabulate all the personnel on the chart who are not associated with specific equipment or already-defined cost centers.
- Tabulate all personnel directly associated with each cost center.

The organizational structure of the mine is usually the most logical categorization of labour. The organization chart shows responsibilities and reporting lines and subdivides the organization as a whole into cost centers and divisions that often correspond with cost centers used elsewhere in the mine costing. Typical divisions are

- production
- maintenance
- engineering
- administration
- safety, personnel, and industrial

These can further be subdivided into cost centers. For example, within the production division, cost centers would include

- drill and blast
- waste removal
- loading and hauling of ore (or coal)
- pit service activities (e.g., road maintenance)
- pumping

The hierarchy of the organization chart integrates the components and allows easy dissection of the costs at each level and/or cost center.

ERGONOMICS IN MINING

Ergonomics (physical aspects of environment) is a science, but it is also a philosophy—a way of thinking. It is a user-centred approach to design. It focuses on the design of equipment, processes and environments so that tasks and activities required of humans are within their limitations, but also make the best use of their capabilities. In the workplace, the application of ergonomics promotes health, efficiency and well being in workers. Ultimately, it is an applied science and it needs to respond to real-world needs.

Mining is similar to other heavy industries: the same principles apply to machinery and tool design, control rooms, lifting and heavy work, design to reduce the risks and consequences from slips, trips and falls, rough rides and errors. While the prevention of mining disasters and fatalities is still the highest priority in mining, the emphasis is now changing to a broader occupational health and safety (OHS) focus. However, there still appears to be a poor understanding about the contribution of ergonomics to mining, the range of factors that it includes and how these might be addressed. The differences in application lie in the different systems that have arisen specifically for mining and that may need to be accommodated through planning and design.

There are a range of emerging issues in ergonomics in mining, mainly arising from changes to work practices and a drive for greater productivity. Unfortunately, some of the practices appear to be at odds with the need to improve general OHS.

Changes in mining work practices

In the last many years the practice of mining has changed significantly. Physically heavy work is now likely to be intermittent and limited. Workers still manually install overhead pipes, cables, ventilation and roof support systems (in underground mines); dismantle and erect conveyor systems; clean up; and maintain machinery.

However, many of these jobs are partially or fully mechanized and much more time is spent operating machinery and driving vehicles. Appropriate machinery design is becoming more critical to successful mining, as is the training and skills of the mineworkers.

The move in mining towards longer work hours is part of a drive for greater worker productivity. A feature of many mining jobs now is extended work hours, i.e. shift lengths of 10–12 h and generally higher workloads. The issues of stress and fatigue are receiving much attention at present but the concerns go further than this. Longer shifts have highlighted the need for more research and information on the effects of daily exposures to different hazards for 8 h for which there are many standards and codes. While some can be adjusted mathematically, there appears to have been little appreciation of the difficulty of estimating the impact of physical under loading or overloading on workers and effects such as fatigue, monotony, errors and musculo-skeletal disorders. As well, there appears to have been little, if

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any, research into the role, design and efficacy of work breaks and their impact on different exposures. These could be critically important in the reduction of risks of injury and ill health and the improvement of worker well-being.

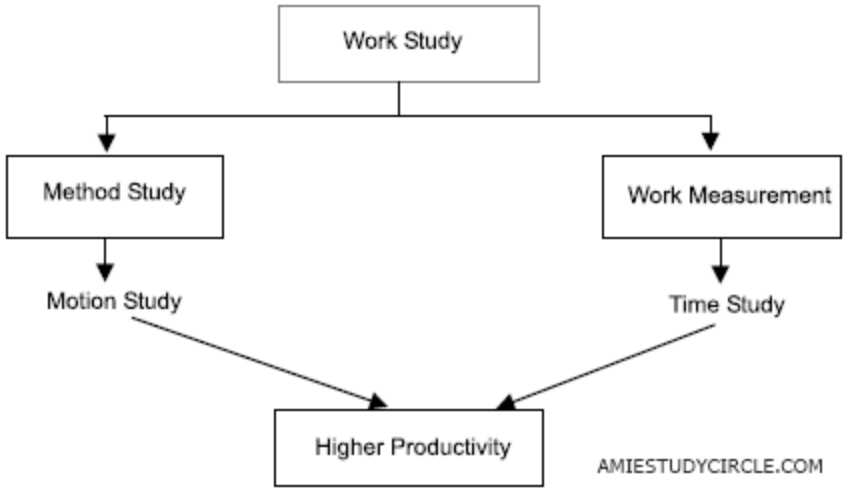
Ergonomics recommends varied work activities to help overcome the problems of prolonged sitting, heavy work or intense concentration. However, in mining the trend appears to be towards less rather than more task variety and many jobs are now much more sedentary. Longer hours of work and perceived increases in job demands both on a daily and weekly basis are compounding the negative effects of these.

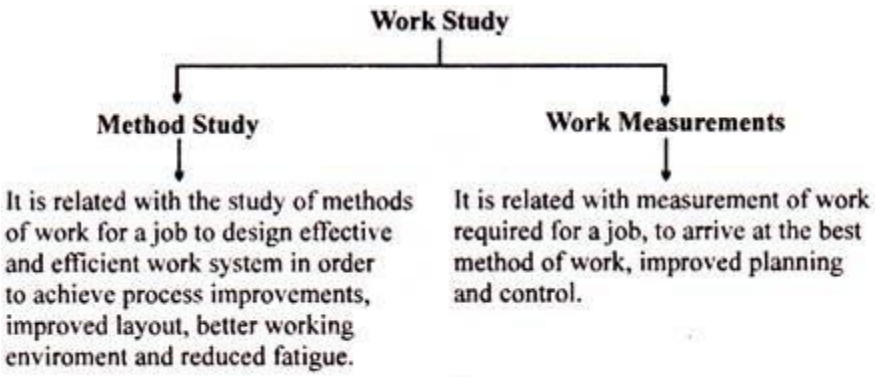
WORK MEASUREMENT STUDIES

Work Measurement Study is a general term used to describe the systematic application of industrial engineering techniques to establish the work content and time it should take to complete a task or series of tasks.

Work measurement is a productivity improvement tool. Before improvements can be made, the current productivity level of an organization must be measured. This measurement is then used as a baseline to determine if improvement projects have resulted in genuine improvement.

Work measurement helps to uncover non-value added areas of waste, inconsistency, and non-standardization that exist in the workplace. Work measurement studies uncover ways to make work easier, and to produce products or services more quickly and economically.





Work is measured for four reasons:

- To discover and eliminate lost or ineffective time.
- To establish standard times for performance measurement.
- To measure performance against realistic expectations.
- To set operating goals and objectives.

Work measurement involves the use of engineered labour standards to measure and control the amount of time required to perform a specific task or tasks.

Advantages of Work Study

The advantages of work study are the following:

- Work study ensures higher productivity,
- Better working conditions with less fatigue,
- Higher wages to workers,
- Uniform production flow,
- Job satisfaction and job security to workers,
- Reduction in unit cost of production,
- Quality products to consumers,
- Fast delivery schedule,
- Harmonious employer-employee relation, and
- Better service to customers.

Time and Motion Study

The time and motion study consists of two components – **time study (work measurement)** by Frederick Taylor and **motion study (method study)** by Frank B. and Lillian M. Gilbreth. Taylor began time studies in the 1880s to determine the duration of particular tasks occurring under specific conditions. A few other studies came before Taylor, but his had the most impact.

The time study was a component of the scientific management theory. Taylor's approach focused on reducing time wastage for maximum efficiency.

Motion study by the Gilbreths evaluated movements and how they can improve work methods. Frank and Lillian Gilbreth pursued the motion study in a bid to expound on scientific management. Taylorism, as the theory is called, had a **major flaw**. It lacked a human element. Critics said that Taylor's approach was solely about profits.

The Gilbreths included several variables while studying how to increase efficiency. Some of them are health, skills, habits, temperament and nutrition. In the book Gilbreth and Gilbreth, the two experts explain that motion study looks at the fatigue that workers experience then finds ways to eliminate it. They recommended solutions like rest-recovery periods, chairs and workbenches.

Implementation of the scientific management theory was one of the first instances that process improvement and process management were treated as a scientific problem.

Method study in a mine

In the case of a mine, it should be decided how thorough a study is needed in order to bring about the greatest possible return. Prior to actual work, all jobs should be classified into specific groups, such as stoping, haulage, etc. This would assist the methods engineer in drawing up a general plan, which could then be presented to top management in order to decide which groups and in what order they are to be studied.

These groups may be: Stoping; Development; Haulage; Shaft Sinking; Hoisting; Tool and supply distribution system; Ventilation conditions in the mine; Improvement and Standardization of all machinery; Ground Classification in order to obtain the strength, hardness of the rocks; Maximum ground arch; Nature of the ore body and the country rocks; Current methods being used in the operation with all past performances and records being scrutinized; Equipment and supplies throughout the mine; Improvements and Standardization of drilling.

Process Charts

Process charts have been defined by the A.S.M.E. standards as "a graphic representation of events and information pertaining thereto occurring during a series of action or operations."

The information included on these charts may include such facts as distance moved, operations performed, working and idle time, necessary and unnecessary delays, cost, machines used in the operation and other important data required.

These charts are invaluable in order to illustrate any operation in the most simple and clear way possible. Inefficiencies become so apparent in the process that it is difficult to see how they

could have been overlooked. The methods engineer finds that process charts are a great help if the facts about the operations and proposed changes have to be presented to top management.

Various charts are

- Operation Process Charts
- Flow Process Charts
- Man and Machine Charts
- Man and Helper Charts
- Single Operator Charts
- Combination Charts
- Micro motion (Simo) Charts

Time Study in a mine

Equipment necessary for the time study includes:

- Plain decimal stop watch. Two types may be used, one with the large hand revolving once per minute and the decimal hour type which reads in decimal part of an hour. For short time elements the former is preferable, while for constructing process charts in which elements are of long duration, the decimal hour type is preferable.
- Time study board, equipped with stop-watch holders and clamps for holding the observation sheets. A plastic cover is recommended for wet conditions.
- Pencil
- Slide rule
- Tape
- Chalk
- Observation sheets

The actual timing of the operative elements may be done by one of three principle methods:

- **Continuous**. In this method the watch is allowed to run continuously and the time at the end of each element recorded on the observation sheet. Since only the cumulative readings are recorded during the study, individual values must be calculated in the office. However, this method has the greatest advantage of being able to account for all the time of the study, eliminating the overlooking of delays.
- **Snap back**. At the end of each element the watch is read and snapped back to zero, hence the time for that particular element is read directly and recorded. This absence of any subsequent calculations is the main advantage over the continuous method.
- **Repetitive**. Two watches are required here, which are connected by lever mechanism so that when one watch starts, the other is automatically stopped. This is an accurate method

since both direct results are acquired and all time is accounted for. However, it is rather an expensive method.

Work Measurement Techniques

Under the work measurement umbrella there are a number of techniques for collecting the information necessary to develop engineered labour standards.

- **Time Study** is the most widely used work measurement technique that employs a decimal minute stopwatch to record and determine the time required by a qualified and well-trained person working at a normal pace to do a specific task under specified conditions. The result of the time study is the time that a person suited to the job and fully trained in the specified method will need to perform the job if they work at a normal or standard pace.
- **Predetermined Time Systems** are a technique of motion study and time standards development. The motions of the work or task performed are recorded. Each basic motion has a time value associated with it. Once all the motions for the task have been recorded, the time values are totalled and the standard time for the operation is developed.
- **Standard Time Data (Standard Data)** is a generic term given to a collection of time values. Standard data uses work elements from time studies or other work measurement sources making it unnecessary to restudy work elements that have been timed adequately in the past. These element times are extracted from studies and applied to jobs or tasks with the same element(s). Some examples of standard data development include graphs, tables, charts, formulas and spreadsheet programs.
- **Work Sampling** is a random sampling technique (statistical sampling theory) that involves observing the worker(s) at randomly selected times and recording the type of activity that is observed at that instance. Work sampling is most commonly used to collect information for allowance calculation, to determine the distribution of work activities, and to determine the productive and non-productive utilization of workers.

Formulas

1. $$N = \frac{Z^2 p(1-p)}{E^2}$$

where N = number of observations to be made

Z = Number of standard deviations associated with a given confidence level

p = Estimated proportion of time that the activity being measured occurs

E = Absolute error that is desired (s x p)

2. Normal time per part = (% of time working)(performance rating)/(number of units produced)
3. Standard time per part = normal time + allowances

Example

In a work sampling study, a mechanic was found to be idle for 20% of the time. Find out the number of observations needed to conform to the above figures with a confidence level of 95% and a relative error level by ± 5%.

Solution

$$N = \frac{Z^2 p(1-p)}{E^2} = \frac{1.96^2 (0.2)(0.8)}{(0.05x0.2)^2} = 6100 \text{ observations}$$

Here Z = coefficient of the confidence level (1.96 for 95% confidence)

Example

The following are the results of a work sampling study:

Observation period (in hours)	*300 hours*
Units processed	*27000 parts*
Workers working during observation time	*1600*
Workers idle during observation time	*400*
Performance rating	*80%*
Allowances	*10%*

Find the standard number of units the worker should process in an hour.

Solution

State	Number Of Observations	Percentage
Working workers	1600	1600/2000 = 80
Idle workers	400	400/2000= 20
Total	2000	100

Thus, actual working hours out of 300 hours = 80% of 300 = 240 hours.

Normal time = actual time x performance rating/100 = (240 x 80)/100 = 192 hours

Allowances @10% in 300 hours = 30 hours

Standard time = 192 + 30 = 222 hours

Standard number of units produced per hour = 27000/ 222 = 122 parts

Example

The work-study engineer carries out the work sampling study for 120 hours. The following observations were made for a machine shop:

Total number of observations	*7000*
No. of Idle activities	*1200*
Ratio between manual to machine elements	*3: 1*
Average rating factor	*120%*
Total number of jobs produced during study	*800 units*
Rest and personal allowances	*17%*

Compute the standard time for the job.

Solution

(a) Overall time per unit (T_o)

= (Duration of study / Number of jobs produced during study)

= (120 x 60) / 800 = 9 min.

(b) Effective time per piece (T_e)

= T_o × (Production observation / Total observation)

= 9 × (5800 /7000) = 7.46 min.

The effective time is to be segregated into *manual time and machine element time*.

Machine controlled time per piece (T_m) = 7.46 × 1/4 = 1.87 min

Hand controlled time per piece (T_h) = 7.46 × 3/4 = 5.59 min

Normal time per piece = T_m + T_h × performance rating = 1.87 + 5.59 × 1.2 = 8.58 min.
Standard time per piece = 8.58 (1 + 0.17) = 10.04 minutes.

LEGISLATIONS

Existing Regulations and Rule framed under the Mines Act

- Mines Act, 1952
- Coal Mines Regulations, 2017
- Metalliferous Mines Regulations, 1961
- Oil Mines Regulations, 2017
- Mines Rules, 1955
- Mines Vocational Training Rules, 1966
- Mine Rescue Rules, 1985

- Mines Creche Rules, 1966
- Central Electricity Authority Regulations (Relating to Safety and Electricity Supply), 2023
- Explosives Rules, 2008

MINES ACT, 1952, 1955 AND 1957

India has a cultural history of contributing most of its economy through ‘Mining’. A country with 80 percent being produced by public sector companies and rest by private companies; legislation was needed to regulate and examine the scams or haphazard prevailing in the mining industry. Therefore, the Central Govt in 1952 and in 1957, simultaneously promulgated The Mines and Minerals (Development & Regulation) Act and The Mines Act.

The Mines Act, 1952 contains provisions for measures relating to the health, safety, and welfare of workers in the coal, metalliferrous and oil mines. The Act prescribes the duties of the owner to manage mines / mining operation and the health, safety in mines. It also, prescribes the number of working hours in mines, the minimum wage rates, and other related matters. The Act is administered by the Ministry of Labour and Employment.

The Mines Rules, 1955, were formulated according to the powers conferred under Section 58 of the Mines Act, 1952. The Rules give detailed and specific provisions for the maintenance of health, safety and welfare of the mine workers and the schedules for necessary filings of the industry.

Aims, Objects, and Commencement

To understand the aims, objectives, and limitations of this Act, it is necessary to define what ‘Mines’ are called. Sec 2(i) of the Act defines ‘Mines’ as any kind of evacuations or extraction operated upon earth’s crust in order to obtain minerals.

Hence, the basic objective of the Act is to provide labour and safety of the mines as well as to amend and regulate the legislation for the betterment of labourers and workmen employed in it.

The regulatory framework of the mining industry is taken care of by both central and state governments. Generally, there are two types of minerals. One is called ‘Major minerals’ and another is called ‘Minor Minerals’. Policies are made in relation to the exploration, extraction, and process of all minor minerals (such as building stones, clay, and sand) by State Governments whereas, the federal government takes the charge of revision, fixing of royalty, issuing regulations, etc of major minerals.

‘The Ministry of Mines’, an apex body that is handled by the Government of India is responsible for legislation in regards to the mining sector, its policy formulation for proper

functioning and administration of mines and minerals in the country. It is principally composed of four departments namely:

- The Geological Survey of India (GSI);
- The Indian Bureau of Mines;
- The Controller of Mining Leases; and
- The Directorate General of Mines Safety.

Chief Inspector and Inspectors

The Central Government may, by notification in the Official Gazette, appoint such a person as possesses the prescribed qualifications to be Chief Inspector of Mines for all the territories to which this Act extends and such persons as possess the prescribed qualifications to be Inspectors of Mines subordinate to the Chief Inspector.

No person shall be appointed to be Chief Inspector or an Inspector, or having been appointed shall continue to hold such office, who is or becomes directly or indirectly interested in any mine or mining rights in India.

The district magistrate may exercise the powers and perform the duties of an Inspector subject to the general or special orders of the Central Government.

Functions of Inspectors

The Chief Inspector may authorise any Inspector named or any class of Inspectors specified in the order to exercise such of the powers of the Chief Inspector.

The Chief Inspector may, by order in writing, prohibit or restrict the exercise by any Inspector named or any class of Inspectors specified.

Chief Inspector shall declare the local area or areas within which or the group or class of mines with respect to which Inspectors shall exercise their respective powers.

Powers of Inspectors of Mines

The Chief Inspector and any Inspector may

- make such examination and inquiry as he thinks fit in order to ascertain whether the provisions of this Act and of the regulations, rules and bye-laws and of any orders made thereunder are observed in the case of any mine;
- with such assistants, if any, as he thinks fit, enter, inspect and examine any mine or any part thereof at any time by day or night:
- examine into, and make inquiry respecting, the state and condition of any mine or any part thereof, the ventilation of the mine, the sufficiency of the bye-laws for the time being

in force relating to the mine, and all matters and things connected with or relating to the health, safety and welfare of the persons employed in the mine.

- exercise such other powers as may be prescribed by regulations made by the Central Government in' this behalf:
- The Chief Inspector and any Inspector may, if he has reason to believe, as a result of any inspection, examination or inquiry under this section, that an offence under this Act has been or is being committed, search any place and take possession [of any material or any plan, section, register or other record] concerning to the mine.

Workmen's Inspector

Qualifications and Eligibility

- For every mine wherein 500 or more persons are ordinarily employed, the owner, agent or manager shall designate three suitably qualified employees of the mine in consultation with the registered trade union in the mine.
- When the number of persons employed in a mine exceeds 1500, the Workmen's Inspector shall be assisted by one additional Workmen's Inspector in mining discipline for every additional 1000 persons or part thereof.
- He has at least five years of experience in mines including at least two years in workings of the mines for which he is nominated.
- He has undergone an orientation training course for Workmen's Inspector consisting of not less than thirty lectures and demonstrations, of not less than two hours' duration each, in accordance with the syllabus specified by and at a centre approved by the Chief Inspector by a general or special order.
- The Workmen's Inspector shall not exercise his powers to impede or obstruct the working of the mine.
- No owner, agent or manager shall take any action against a Workmen's Inspector for any of his actions in the discharge of his duties and functions laid down in these rules.

Duties of Workmen's Inspector

- To inspect all shafts, inclines, roads, workplaces and the equipment thereat including the equipment for conveyance and transport of workers;
- In case of any urgent and immediate danger that comes to his notice ; (i) to inform the manager and the Inspector about the same; and (ii) to suggest remedial measures necessary to avoid the danger
- To accompany the Inspector in the course of complete inspection of the mine and also during such other inspections as may be considered necessary by the Inspector.

- The Workmen's Inspector shall record a full report of the matters ascertained as a result of his inspection in an interleaved paged and bound register kept for the purpose in the mine in Form U. The Workmen's Inspector making the entry in the register aforesaid shall duly sign such entries with date and take a copy of the entries for his record.

Certifying Surgeons

Eligibility

The Central Government may appoint qualified medical practitioners to be certifying surgeons for the purpose of this Act within such local limits or for such mine or class or description of mines as it may assign to them respectively.

Subject to such conditions as the Central Government may think fit to impose, a certifying surgeon may, with the approval of the Central Government, authorise any qualified medical practitioner to exercise all or any of his powers under this Act.

No person shall be appointed to be or authorised to exercise the powers of certifying surgeon, or, having been so appointed or authorised, continue to exercise such powers, who is or becomes the owner, agent or manager of a mine.

Duties

The certifying surgeon shall carry out such duties as may be prescribed in connection with

- The examination of persons engaged in a mine in such dangerous occupations or processes as maybe prescribed:
- The exercise of such medical supervision as may be prescribed for any mine or class or description of mines where-
- Cases of illness have occurred which it is reasonable to believe are due to the nature of any process carried on or other conditions of work prevailing in the mine.

Welfare Officer

For every mine wherein 500 or more persons are ordinarily employed the owner, agent or manager shall appoint a suitably qualified person as Welfare Officer, and where the number of persons so employed in a mine exceeds 2500 ,such Welfare Officer shall be assisted by one suitably qualified additional Welfare Officer for every additional 2000 persons or part thereof employed.

Eligibility

- A university degree ;

- A degree or diploma in social science, or labour welfare recognised by the Government for the purpose of this rule, and preferably practical experience of handling labour problems in any industrial undertaking for at least three years; and
- A knowledge of the language of the district in which the mine is situated or the language understood by the majority of persons employed in the mine; Provided that in case of a person already in service as a Welfare Officer in a mine, the above
- qualifications may, with the approval of the Chief Inspector, be relaxed.
- The Labour Officers included in the Central Pool under the provisions of the Labour Officers (Central Pool) Recruitment and conditions of Service Rules, 1951, shall be eligible for appointment as a Welfare Officer in a mine.
- Where by reason of temporary absence, illness or any other similar cause, the Welfare Officer is unable to perform his duties, the owner, agent or manager shall authorise in writing person whom he considers competent, to act in his place.
- A written notice of every appointment, authorisation, discharge, dismissal, resignation or termination of service of every Welfare Officer and of the date thereof shall be sent by the owner, agent or manager to the Chief Inspector within seven days from the date of such appointment, authorisation. discharge, dismissal, resignation or termination of service.

Duties of Welfare Officer

- to establish contacts and hold consultations with a view maintain harmonious relations between the management and persons employed in the mine ;
- to bring to the notice of the management the grievances of employees, individual as well as collective, with a view to securing their expeditious redressal ;
- to promote relations between management and employees, which will ensure productive efficiency as well as amelioration in the working conditions, and to help workers to adjust and adapt themselves to their working environments ;
- to assist in the formation of Work and Joint Production Committees, Co -operative Societies and Safety First and Welfare Committees and to supervise their work ;
- to help the management in regulating the grant of leave with wages and explain to the workers the provisions relating to leave with wages and other leave privileges and to guide the workers in the matter of submission of applications for grant of leave for regulating authorised absence.
- to advise on welfare provisions such as housing facilities, food-stuffs, social and recreational facilities, sanitation, individual personnel problems and education of children;

- to supervise welfare activities, statutory or other wise including education and training of employees;
- to suggest measures which will tend to raise standard of living of workers and in general promote their being ; and
- to perform any other duty connected with the welfare of the persons employed in the mine.
- Every Welfare Officer shall keep a record of his day to day work and shall at the end of every year forward to the Chief Inspector through the manager of the mine, concerned summary of the report of his work during the year.

Conditions of service

- A Welfare Officer shall be given appropriate status corresponding to the status of the other executive heads of the mine.
- The conditions of service of Welfare Officer shall be the same as of other members of the staff of corresponding status in the mine ; Provided that before the owner, agent or manager discharges of dismisses a Welfare Officer who has satisfactorily completed a probationary period of six months, he shall consult the Chief Inspector or an Inspector authorised in this behalf by the Chief Inspector.
- A Welfare Officer shall not be given less than two hundred rupees as his basic pay per month.

Appointment of undermanagers or assistant managers

In every mine the average output of which exceeds 7,000 tonnes, the manager shall be assisted by undermanagers or assistant managers on the following scale:

Average output	Number of undermanagers or assistant managers
Upto and including 10,000 tonnes	One
Above 10,000 tonnes	One additional undermanager or assistant manager for every 5,000 tonnes output or part thereof in excess of 10,000 tonnes

Ventilation Officer

In the case of any mine having extensive workings below ground, if the Chief Inspector by an order in writing so requires, the manager shall be assisted by a Ventilation Officer, holding such qualification as the Chief Inspector may specify in the order, who shall be responsible for supervising the maintenance of the ventilation system of the mine in accordance with the provisions of these regulations.

Qualifications and appointment of ventilation officer

In every mine consisting of gassy seams of first degree, the average output of which exceeds 5,000 tonnes or of second or third degree the average output of which exceeds 2,500 tonnes, the manager shall be assisted in the work of supervising the maintenance of the ventilation system of the mine in accordance with the provisions of these regulations by a ventilation officer who shall be a person holding the following qualifications:

- in the case of a mine consisting of gassy seams of first degree and having an average output in excess of 15,000 tonnes or a mine consisting of gassy seams of second or third degree and having an average output in excess of 10,000 tonnes, a Manager's Certificate; and
- in every other case, a Manager's Certificate or a Degree, Diploma or Certificate in Mining or Mining Engineering approved for the purpose of the proviso to sub-regulation (1) of regulation 16:

Duties of ventilation officer

A ventilation officer has the following functions

- to ensure adequate ventilation of the mine;
- to ensure the quality of the mine air is measured and recorded under section 362;
- to take charge of any ventilation system change in the mine by giving directions, or by being present, when the change is happening;
- to ensure all ventilation control devices at the mine are properly constructed and maintained.

Committees

'The Ministry of Labour and Employment', under the Government of India, constitutes a committee to handle the powers and functions with respect to the said act. The committee constitutes of a chairman and its members who look after taking the decisions regarding various functionalities to the territory this act extends and most of the time its decision is considered final and binding.

Functions of the Committee

A Committee should be constituted which will look after:

- proposals, for making rules, regulations, and recommendations for the Central Government;
- enquiring into accidents or other matters which are referred to it by the Central Government and make reports upon; and

- hearing and deciding appeals or objections against notices or orders or the regulations, rules or bye-laws thereunder.
- The Chief Inspector is not supposed to take part in the proceedings of the Committee regarding any appeal or objection against an order or notice made or issued by him or act in relation to any matter pertaining to such appeal or objection as a member of the Committee.

Powers, etc., of the Committees

A Committee is constituted should be exercise the powers of an Inspector for discharging its functions, have the same powers as are vested in a court under the Code of Civil Procedure, 1908 (5 of 1908) when trying a suit in respect of the following matters, namely:

- discovery and inspection;
- enforcing the attendance of any person and examining him on oath;
- compelling the production of documents; and
- such other matters as may be prescribed.

Safety Committee

For every mine wherein more than 100 persons are ordinarily employed, the owner, agent or manager shall constitute a Safety Committee for promoting Safety in the mine.

Composition of Safety Committee

The Safety Committee shall consist of

- the manager who shall be the Chairman ;
- five officials or competent persons of the mine nominated by the Chairman ;
- five workmen nominated by the workmen of the mine in accordance with the procedure prescribed for nomination of Workmen's Inspector;
- Workmen's Inspector where so designated; and
- the Safety Officer, or where there is no Safety Officer, the senior most mine official next to the manager, who shall act as Secretary to the Committee;

Functions of Safety Committee

- to discuss remedial measures against the unsafe conditions and practices in the mine as pointed out in the reports of Workmen's Inspector or otherwise brought to the notice of the Committee and make appropriate recommendations;
- to consider, before commencement of operations in any new district of mine or commissioning of new electrical or mechanical installation or introduction of new mining

technique, the proposed Safety and health measures including related codes of practice and to make appropriate recommendations;

- to discuss the report of inquiry into accident and make appropriate recommendations;
- to formulate and implement appropriate Safety campaign based on analysis of accidents;
- to meet at least once in 30 days to consider the matter placed before it and any other matter that may be raised by the members and make such recommendations as it may deem fit; and
- to serve as a forum for communication on Safety and occupational health matters.

Managers

Every Mine is required to have a sole manager who will have the prescribed qualification for holding a post of that importance and the owner or agent of every mine shall appoint a person having such qualification to be the manager. Further, the owner or agent may appoint himself also as manager if he possesses to have such prescribed qualifications.

The manager has to take responsibility and also, he can be held liable for the overall management, control, supervision and direction of the mine and all instructions when given by the owner or agent.

In case of an emergency, the owner or agent of a mine or anyone on his behalf shall not give, otherwise without the consent of the manager any kind of instructions affecting the fulfilment of his statutory duties, to a person, employed in a mine, who is responsible to the manager.

Duties and responsibilities of owners, agents and managers

- The owner and agent of every mine shall each be responsible for making financial and other provisions and for taking such other steps as may be necessary for compliance with the provisions of this Act.
- The responsibility in respect of matters provided for in the rules made under clauses (d), (e) and (p) of section 58 shall be exclusively carried out by the owner and agent of the mine.
- If the carrying out of any instructions given under sub-section (2) results in the contravention of the provisions of this Act, every person giving such instructions shall also be liable for the contravention of the provisions concerned.
- Subject to the provisions of sub-sections (1), (2) and (3), the owner, agent and manager of every mine shall each be responsible to see that all operations carried on in connection with the mine are conducted in accordance with the provisions of this Act.
- In the event of any contravention by any person whosoever of any of the provisions of this Act, each of the following persons shall also be deemed to be guilty of such contravention unless he proves that he had used due diligence to secure compliance with

the provisions and had taken reasonable means to prevent such contravention: (i) the official or officials appointed to perform duties of supervision in respect of the provisions contravened; (ii) the manager of the mine; (iii) the owner and agent of the mine; (iv) the person appointed, if any, to carry out the responsibility under sub-section (2).

- It shall not be a defence in any proceedings brought against the owner or agent of a mine under this section that the manager and other officials have been appointed in accordance with the provisions of this Act.

Mine Surveyor

Appointment of surveyors

At every mine, one or more persons not less than 23 years of age and holding a Surveyor's Certificate shall be appointed to be the Surveyor for carrying out the surveys and levelling and for preparing the plans and sections required under the Act or the regulations, or orders made thereunder.

No person shall be appointed as a surveyor of more than one mine or in any other capacity in the same mine, without the previous permission in writing of the Regional Inspector and subject to such conditions as may be specified therein.

The number of surveyors required to be appointed shall be on the following scale namely:

The average monthly output in tonnes	No. of Surveyors
8,000 tonnes and below	One
Above 8,000 tonnes	One for every additional 15,000 tonnes or part thereof

Duties and responsibilities of surveyors

The surveyor shall

(a) make such accurate surveys and levelling, and prepare such plans and sections and tracings thereof, as the manager may direct or as may be required by the Act and shall sign the plans, sections and tracings and date his signature.

(b) be responsible for the accuracy of any plan and section, or tracings thereof that has been prepared and signed by him.

(2) The surveyor shall record in a bound-paged book kept for the purpose (a) the full facts when workings of the mine have approached to about 75 metres from the mine boundary, or from disused or waterlogged workings; (b) any doubts which may exists concerning the accuracy of the plans and sections prepared under these regulations; and (c) any other matter relating to the preparation of the plans and sections that he may like to bring to the notice of the

manager. Every entry in the book shall be signed and dated by the surveyor and countersigned and dated by the manager

Special Officers

Powers of special officers to enter, measure, etc.

- Any person in the service of Government duly authorised in this behalf by a special order in writing of the Chief Inspector or of an Inspector may, for the purpose of surveying levelling or measuring any mine; or any output therefrom after giving not less than three days' notice to the manager of such mine, enter the mine and may survey, level or measure, the mine or any part thereof or any output therefrom after giving not less than three days' notice to the manager of such mine, enter the mine and may survey, level or measure, the mine or any part thereof or any output therefrom at any time by day or night:
- Provided that, where in the opinion of the Chief Inspector or of an Inspector an emergency exists, he may by order in writing, authorise any such person to enter the mine for any of the aforesaid purpose without giving any such notice.

Provisions as to Health and Safety

Drinking water

Effective arrangements should be there in every mine to provide and maintain good content and a sufficient supply of cool drinking water at suitable points for all persons employed there. For all persons employed below the ground, the Chief Inspector should, in lieu of drinking water, provide, maintain or permit suitable points for any other effective arrangements.

Also, all such points shall be legibly marked 'Drinking Water' in a language understood by a majority of the persons employed in the mine and no such drinking point shall be situated near any washing place, urinal or latrine.

The Central Government can make rules for securing compliance with the provisions of the supply and distribution of drinking water with respect to all mines or any class or description of mines.

Conservancy

There shall be a sufficient number of latrines and urinals provided separately for both males and females in every mine.

Further, all latrines and urinals provided should be adequately lit, ventilated and at all times maintained in a clean and sanitary condition.

The Central Government can specify the total number of latrines and urinals to be built in any mine with respect to the number of males and females employed in the mine.

Medical appliances

First aid boxes should be provided in every mine to be readily accessible during all working hours.

Every first-aid box has to be kept in charge of a responsible person, who is medically trained in the first-aid treatment of any kind of hurt which can cause in the course of employment and who will always be readily available during the working hours of the mine to treat such suffered workers.

Arrangements have to be done beforehand, for the conveyance to hospitals or dispensaries, of persons who while in employment in the mine, suffer any kind of bodily injury or become ill.

In every mine where more than one hundred and fifty persons are employed, a maintained first-aid room of such size with such equipment and in the charge of such medical and nursing staff as may be prescribed.

QUANTITY OF DRINKING WATER

- The quantity of drinking water to be provided in a mine or any part thereof shall be on a scale of at least two litres for every person employed at any one time and such drinking water shall be readily available at conveniently accessible points during the whole of the working shift.
- Where 100 persons or more are employed, either above ground or in opencast workings, at any one time, an Inspector may by order in writing require the drinking water to be effectively cooled by mechanical or other means available.
- No charge shall be made for the drinking water so supplied.

Powers of Inspector when causes of danger not expressly provided against exist or when the employment of persons is dangerous

- The chief inspector or an inspector, by giving notice to the owner, agent or manager of the mine can state the particulars about the threat which he can foresee or defect he has discovered in any mine or part of it, in order to control, supervise, manage or direct the danger and can rectify the threat causing any kind of bodily injury.
- In the case where the owner, agent or manager fails to comply with the terms of notice, the Chief Inspector or the Inspector, through his writing, can prohibit the employment of any person for ensuring compliance in any manner in any mine.

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- The Chief Inspector or the Inspector through his writing can also prohibit the extraction or reduction of pillars or blocks of minerals in any mine if he discovers the continuance of such work to be endangering the mine or the people employed there.
- Every person who is prohibited from employment in such hazardous conditions is entitled to get paid with full wages as if they were in term with work they would have done otherwise and the payment should be done by the owner, agent, and manager of the mine or part of the mine. Also, in such case, such manager, agent or the owner can provide the worker with alternative employment at the same wage allowance than paying full wages to such worker who has been prohibited to work.
- If the owner, agent or manager of the mine objects to a notice sent by the Chief Inspector or an order made by the Chief Inspector he may, within twenty days after the receipt of the notice containing the requisition or of the order or after the date of the decision on appeal, whatever the case be, can send his objection in writing stating the grounds there to the Central Government which shall, ordinarily within a period of two months from the date of receipt of the objection, refer the same to a Committee.
- Also, Nothing with respect to the powers of Inspectors or Chief Inspectors will affect the powers of a Magistrate under section 144 of the Code of Criminal Procedure, 1898.

Power to prohibit employment in certain cases

In a situation, where any owner, agent or manager fails to comply with the provisions laid in this act in matters relating to safety; the Chief Inspector can give notice in writing stating the same to comply within the time limit he wishes to specify in the said notice.

Every person whose employment is prohibited is entitled to payment of full wages for the period for which he would have been, but for the prohibition, in employment, he couldn't fulfil his course of work, and the owner, agent or manager shall be liable for payment of such full wages of that person. The owner, agent or manager instead of paying such full wages, can provide such person with alternative employment at the same wages with which such person was receiving in the employment which was prohibited.

Power of Government to appoint a court of inquiry in cases of accidents

If in the opinion of the Central Government, a formal inquiry is needed into the causes and circumstances attending the accident ought to be held; an appointment of a competent person to hold such inquiry should be done and may also be appointed one or more persons possessing legal or special knowledge to act as assessor or assessors in holding the inquiry.

The person appointed to hold any such inquiry shall have all the powers of a civil court under the Code of Civil Procedure, 1908 (5 of 1908), for the purpose of enforcing the attendance of witnesses and compelling the production of documents and material objects.

Any person holding such inquiry may exercise the powers of an Inspector under this Act as he thinks it necessary or expedient to exercise for the purposes of the inquiry held.

The person holding an inquiry is supposed to make a report to the Central Government stating the causes of the accident and its circumstances and adding any observations which he or any of the assessors may think fit to make under their observation.

Notice of certain diseases

- Where any person employed in mine contracts any disease notified by the Central Government as a disease connected with mining operations, the owner, agent or manager of the mine, in such case, are obligated to send a notice to the Chief Inspector and to such other authorities, in the desired form and within the desired time.
- And If any medical practitioner attends on a person who is employed in a mine and who is or is believed by the medical practitioner to be suffering from any disease, the medical practitioner should without delay send a report in writing to the Chief Inspector stating: (i) the name and address of the patient; (ii) the disease from which the patient is suffering or diagnosed, and (iii) the name and address of the mine in which the patient is or was last employed.
- After this report has been sent, the Chief Inspector is required to pay the medical practitioner such fee as prescribed, and the fee so paid shall be recoverable as an arrear of land revenue from the owner, agent or manager of the mine in which the person contracted the disease.
- Further, If any medical practitioner fails to comply with the provisions, he shall be punishable with fine which may extend to fifty rupees.

Power to direct investigation to cause of disease

The Central Government can appoint a competent person to inquire into and make a report of it on any case where a disease has been or is suspected to have been contacted in a mine, and may also appoint one or more persons possessing legal or special knowledge to act as assessors in such inquiry.

Hours and Limitation of Employment

A weekly day of rest

A person is required not to work in any mine for more than six days in any given week.

Compensatory days of rest

A person employed in any mine who in the course of his duty, is deprived of any of the weekly days of rest, then in such circumstances, they will be allowed to rest for such extra work done,

within a month or two months immediately following that month, as compensatory days of rest equal in number to the days of rest of which he has been deprived.

Penalties and Procedure

Obstruction

Any person who is obstructed to do his duty is liable for punishment with imprisonment for a term which may extend to three months, or with fine which may extend to five hundred rupees, or with both.

Also, any person who refuses to produce any registers or other documents, or prevents, is liable to be punishable with fine which may extend to three hundred rupees.

Falsification of records, etc.

Any person or persons:

- intentionally makes a false statement in any certificate/ any official copy, or
- counterfeits such false certificate, or
- produce/ use/ make any false declaration, statement or evidence or
- falsifies any plan, section, register or record such false register, or
- make/ give/ deliver any plan, return, notice, record or report containing a statement, entry or detail which is not true.

All such persons will be made liable for punishment with imprisonment for a term which may extend to three months, or with fine which may extend to one thousand rupees, or with both.

Use of false certificates of fitness

Anyone who uses a certificate of fitness granted to self or allows it to be used by another person, intentionally, is punishable with imprisonment for a term which may extend to one month, or with fine which may extend to two hundred rupees, or with both.

Penalty for the employment of persons below eighteen years of age

If a person is below eighteen years of age and is employed in a mine, the owner, agent or manager of such mine shall be punishable with fine which may extend to five hundred rupees.

Failure to appoint a manager

If any person fails to appoint a manager, such person shall be punishable with imprisonment for a term extending to three months, or with fine extending to two thousand and five hundred rupees, or with both.

Notice of accidents

When anyone fails to give notice of any accidental occurrence or to post a copy of the notice, it will be punishable with imprisonment for a term extending to three months, or with fine extending to five hundred rupees, or with both.

Prosecution of the owner, agent or manager

A prosecution shall not be instituted against any owner, agent or manager for any offence under this Act except when the Chief Inspector or of the district magistrate or of an Inspector authorized in this behalf, states to do so, by general or special order in writing.

Exemption of owner, agent or manager from liability in certain cases

When the owner, agent or manager of a mine, is accused of an offence alleging that another person is the actual offender, in that case, he will be entitled to get a prosecutor in not less than three clear days to have that other person brought before the court on the date appointed for the hearing of the case.

CMR 2017

The CMR, 2017, is published in the Gazette, vide no. G.S.R., 1449(E), dated, 27th November, 2017, in supersession of CMR,1957, by the GoI, in exercise to the powers under section 57 of the Mines Act,1952 and shall,

- in force from date of publication in official Gazette
- apply to every Coal Mine & extend to whole of India.

☞ *There is a marked similarity in Mines Rules 1957 and CMR 2017 with a few differences.*

Board of Mining Examination

Board structure and conduct of meetings

- The Board shall consist of the Chief Inspector, who shall be its Chairman (ex officio), and five members possessing degree in mining engineering; with (a) first class Manager's Certificate granted under regulation 11; or (b) practical experience of not less than two years in management, control, supervision and direction of a coal mine or part thereof; or (c) service in an institution imparting education in mining engineering at the degree or equivalent level; or (d) engagement in mining research or planning, to be appointed by the Central Government.
- Every member of the Board other than its Chairman shall hold office for a period of three years from the date of appointment, or until his successor is appointed, whichever is later.

- A person who holds, or who has held, office as member of the Board shall be eligible for re-appointment to that office.
- A member of the Board other than the Chairman shall receive such remuneration as the Central Government may fix.
- An Inspector nominated in this behalf by the Chief Inspector shall act as the Secretary to the Board.
- The Central Government may re-constitute the Board even though the term of office of all or any of the members thereof has not come to an end.
- Meetings of the Board shall be held as and when the Chairman considers them necessary, and unless otherwise decided by the Chairman, all meetings of the Board shall be held at Dhanbad.
- The Chairman shall preside at every meeting of the Board. If the Chairman is absent for any reason, members present shall elect one from among themselves to preside over the meeting; and the member so elected shall, for the purposes of that meeting, have all powers of the Chairman
- No business shall be transacted at a meeting of the Board unless at least three members, including the Chairman, are present.
- All matters which the Board is required to consider shall be considered at its meeting, or if the Chairman so decides, by circulation of the papers, to every member who is not absent from India.
- The Secretary shall place before the Board a list of business to be transacted at the meeting.
- Every matter at a meeting shall be decided by the majority of votes of the members present at such meeting.
- The Secretary shall record the minutes of each meeting in a bound-paged book kept for the purpose and copies of such minutes of meeting shall be circulated to all members present in India.

Certificate granted by Board

- **Manager's first class certificate** of competency to manage a coal mine (First Class Manager's Certificate)
- **Manager's second class certificate** of competency to manage a coal mine (Second Class Manager's Certificate)
- **Surveyor's certificate of competency** to survey the working of a mine
- **Overman's certificate of competency** to carry out inspections and duties as required under these regulations

- **Sirdar's Certificate of competency** to carry out inspections and duties as required under these regulations
- **Winding engineman's certificate** (Engine Driver's Certificate) to drive a winding engine of any type or class
- Certificate of competency to test for the presence of inflammable gas (Gas Testing Certificate):

Exchange Certificate

- The Board may grant to any person, holding a Manager's, Surveyor's, Engine driver's, Foreman's, Mate's or Blaster's Certificate granted under any law for the regulation of mines in force in any other country or under the Metalliferrous Mines Regulations made under this Act, a corresponding certificate of a similar class under these regulations, [if he possess such experience and passes] such examination as the Board may stipulate.
- Every application for the grant of an Exchange Certificate shall be accompanied by (i) a medical certificate obtained not more than two years prior to the date of his application, from a qualified medical practitioner not below the rank of a Civil Assistant Surgeon or from a Certifying Surgeon certifying the candidate to be free from deafness, defective vision or any other infirmity, mental or physical, likely to interfere with the efficient discharge of his duties; and (ii) a certificate from some person of good repute as to the general good conduct and sobriety of the candidate.
- Fees on the scale laid down in regulation 20 shall be paid in respect of every examination under this regulation.

Slope stability in a mechanised opencast working

- Before starting a mechanised opencast working, the owner and agent of the mine shall ensure that the mine, including its method of working, ultimate pit slope, dump slope and monitoring of slope stability, has been planned, designed and worked as determined by a scientific study and a copy of the report of such study has been kept available in the office of the mine:
- The owner, agent and manager of every mechanised opencast mines shall ensure that the recommendations made in the report of scientific study are complied with.
- The height of the benches in overburden consisting of alluvial soil, moorum, gravel, clay, debris or other similar ground shall not exceed 3 meters and the width thereof shall not be less than three times the height of the bench.
- The height of benches in coal and overburden of rock formation shall not be more than the digging height or reach of the excavation machine in use for digging, excavation or removal, and the width thereof shall not be less than (a) the width of the widest machine

plying on the bench plus two meters; or (b) if dumpers ply on the bench, three times the width of the dumper; or (c) the height of the bench, whichever is more.

Spoil-banks and dumps

- While removing overburden, the top soil shall be stacked at a separate place, so that, the same is used to cover the reclaimed area.
- The slope of a spoil bank shall be determined by the natural angle of repose of the material being deposited but, in any case, shall not exceed 37.5 degrees from the horizontal.
- Loose overburden and other such materials from opencast workings or other rejects from washeries or from other sources shall be dumped in such a manner that there is no possibility of dumped material sliding.
- Any spoil bank exceeding 30 metre in height shall be benched so that no bench exceeds 30 metre in height and the overall slope shall not exceed 1 vertical to 1.5 horizontal.
- The toe of a spoil-bank shall not be extended to any point within 100m of a mine opening, railway or other public works, public road or building or other permanent structure not belonging to the owner.
- A suitable fence shall be erected between any railway or public works or road or building or structure not belonging to the owner and the toe of an active spoil bank so as to prevent unauthorised persons from approaching the spoil-bank.

METALLIFERROUS MINES REGULATIONS, 1961

Duties and responsibilities of mine managers

- In every mine daily personal supervision shall be exercised by the manager; and in case of workings belowground, he shall visit and examine the workings belowground on at least four days in every week to see that safety in every respect is ensured. Of these inspections one at least in every fortnight shall be made during the **night shift**:
- Provided that the case of a mine where an assistant manager or underground manager holding a First Class Manager's Certificate visits and examines the workings belowground on not less than five days in every week, it shall suffice if the manager visits and examines the workings belowground on not less than two days in every week:
- Provided further that when owing to any unavoidable cause the manager or the assistant manager or under ground manager aforesaid is unable to carry out the aforesaid duties or inspections, he shall record the reason for the same in the book.
- The manager, the undermanager and the assistant manager, if any, shall each maintain, in a bound paged book kept for the purpose, a diary; and shall record therein the result of

each of his inspections and also the action taken by him to rectify the defects mentioned, if any.

- The manager shall make arrangements for all overmen and other officials to meet him or an undermanager, or assistant manager once in every working day for the purpose of conferring on matters connected with their duties.
- The manager shall see that a sufficient supply of proper materials and appliances for the purpose of carrying out the provisions of the Act for ensuring the safety of the mine
- The manager shall assign to every competent his particular duties, shall on his appointment make over to him a copy of the regulations, rules and bye-laws and of any orders and shall take all possible steps to ensure that every such person understands, carries out and enforces the provisions therein contained in a proper manner.
- The manager shall provide every overman with a tracing, upto the date of the last survey, showing the workings of the district belowground assigned to him. Where any work of reduction or extraction of pillars is being carried out, such tracing shall show clearly the order in which such reduction or extraction is to be carried out.
- The manager shall examine all reports, registers and other records required to be made or kept in pursuance of the Act and shall countersign the same and date his signature. He may, however, by an order in writing, delegate this duty an undermanager or assistant manager except in certain cases.
- The manager shall give attention to, and cause to be carefully investigated, any specific representation or complaint that may be made to him in writing by an employee of the mine as to any matter affecting the safety or health of persons in or about the mine.
- When any accident, resulting in serious bodily injury to any person or in loss of life, occurs in a mine, the manager shall inspect the site of accident as soon as possible, and shall also either himself or through an undermanager or assistant manager, have an inquiry made into the cause of and circumstances attending the accident. The result of every such enquiry and a plan of the site of the accident showing details, shall be recorded in a bound paged book kept for the purpose.
- The manager shall perform such other duties as have been prescribed in that behalf under the Act, the regulations, or orders made thereunder.
- The manger may suspend or take such disciplinary action against any employee for contravention of any of the provisions of the Act, these regulations or orders made thereunder.

Ladder and Ladderways

Provision of ladderways

- Every shaft or winze, including shaft or winze in the course of being sunk, which has an inclination exceeding 25 degrees from the horizontal, shall be provided with a ladderway from the top to the bottom.
- Every working place shall be provided with platforms or other means of keeping a foothold, and where necessary, with ladders from climbing.

Provision of Ladders

- Every ladder used in a mine shall (a) be of strong construction; (b) be securely fixed in the shaft, winze or stope at an inclination of not more than 80 degrees from the horizontal; (c) be made continuous (d) project at least one metre above the mouth of the shaft, winze rise of stope and above every platform; (e) have rungs equally spaced and at a sufficient distance from the wall; and (f) be maintained in good repair.
- Except in respect of the lowest 10 metres or a sinking shaft or winze, no ladder shall be placed at an inclination of more than 80 degrees from the horizontal.

Transport of Men and Materials – Winding in shafts

New winding installations

- When it is intended to bring into use any new winding installation for lowering and raising persons, the owner, agent or manager shall, not less than 30 days before such use, give notice of such intention to the Chief Inspector and the Regional Inspector. The notice shall contain detailed specifications of the installation.
- Every part of a winding installation, including headgear shall be of sound construction and adequate strength, and shall be maintained in safe working order.
- The engine shall be firmly connected to a rigid foundation.
- The diameter of the drums or sheaves of the winding engine, and of the pulleys and sheaves used in connection with the winding shall be not less than 80 times the diameter of the rope in the case of winding installations installed before the coming into force of there regulations and not less than 100 times the diameter of the rope in other cases.
- At every shaft, including a shaft in the course of being sunk, where winding is effected by means of an engine There shall be provided one or more brakes on the drum which :
- if there are two cages or other means of conveyance, will hold such cages or other means of conveyance when the maximum torque is applied in either direction; or

- if there is only one cage or other means of conveyance, will hold the loaded cage or other means of conveyance in midshaft when the maximum torque is applied downwards.
- Every engine shall be equipped with a reliable depth-indicator

Provisions for Manwinding

- At every shaft or winze, other than a shaft in the course of being sunk, where a winding engine is used for the purpose of lowering or raising persons, the following provisions shall have effect:
- In respect of every part of the winding installation, including pulleys or sheaves, cages, chains, distribution plates and detaching hooks, the following particulars shall be recorded in a bound paged book kept for the purpose (a) Name of the manufacturer and the year of manufacture; (b) Specifications and dimensions; (c) Reference to every certificate supplied with the part; and (d) Any other detail that may be necessary or required by the Regional Inspector.
- Where drum-clutches are provided, the following provisions shall have effect, namely (a) The operating gear of the clutch of the drum shall be provided with locking gear to prevent inadvertent withdrawal of the clutch (b) Every engine used for the lowering or raising of persons shall have a suitable interlocking device (c) Unless the cage or other means of conveyance attached to the drum is resting at the bottom of the shaft, the drum shall not be unclutched.
- If the shaft or winze is vertical, except in the 'Koepe' system or winding, there shall be provided between the rope and the cage or other means of conveyance a detaching hook. The space between such detaching hook shall be not less than 3.6 metres where a geared engine is used, and not less than 7.5 metres where a direct acting engine is used.
- If the shaft or winze exceeds 300 metres in depth, there shall be a clear over-run space of not less than 7.5 metres below the lowest landing place. The sump below the lowest landing place shall be kept free from water.
- In the case of every shaft or winze exceeding 100 metres in depth the engine shall be fitted with an automatically recording speed indicator.
- In case of every shaft or winze exceeding 100 metres in depth, there shall be provided an effective automatic contrivance to prevent over speeding and over winding.
- Where the only means of egress in a mine is by apparatus worked by steam or electricity, precautions shall be taken to ensure that the two winding engines do not fail simultaneously.

Duties of banksman and onsetter

- Every banksman or onsetter shall subject to the orders of a superior official, have full control of the top or bottom of shaft or the inset
- thoroughly acquaint himself with, and carefully attend to, the prescribed code of signals, and shall properly transmit the signals.
- immediately report to his superior official any defect in the signalling installation;
- devote the whole of his time to his duties, and shall not leave his post during the period of his duty.
- after any stoppage of winding for repairs or for any other cause for a period exceeding two hours, not allow any person to ride in the cage or other means of conveyance of conveyance unless it has been run at least one complete trip up and down the working portion of the shaft
- see that all fences and gates provided at the top of the shaft or at any inset are in position;
- not permit any unauthorised person to remove a fence or gate and if he notices any defect in such fence or gate, immediately inform his superior official.
- keep the top of the shaft or the inset and the floor of every cage free from loose materials
- when long timber, pipes, rails or other materials projecting over the top of a cage or other means of conveyance are lowered or raised, ensure that the projecting ends are securely fastened to the rope, chains or bow;
- when he suspects that the cages are not working smoothly in the shaft or when he hears anything unusual happening in the shaft while the winding engine is working, immediately give signal to the winding engineman to stop the engine.
- at the beginning of his shift, see that the keps are in proper working order
- not permit any person descending the shaft to carry any intoxicating drink or drug, or allow any intoxicated person to descend.
- The banksman shall not leave his place of work unless duly relieved by his successor.

Underground workings

Provisions for Underground workings

- The height of every main drive shall b not less than 1.8 metres.
- The dimensions of pillars or blocks formed in any vein, load, reef or mineral bed or deposit shall be such as to ensure stability of the workings during the development and stoping stages ad between such stages.
- No extraction or splitting or reduction of pillars or blocks of minerals shall be commenced, conducted or carried out except with the prior permission in writing of the Chief Inspector. An application for such permission shall be accompanied by an up-to-

date plan of the area where the pillars or blocks of mineral are proposed to be extracted or reduced, showing the proposed extent of extraction or reduction, the manner in which such extraction or reduction is proposed to be carried out, the thickness and other characteristics of the mineral deposit, the rate and direction of general dip and of the pitch of the vein, the nature of hangwall, and footwall, the stoping width, the depth of the workings, and such other particulars as the Chief Inspector may require. A copy of the application and the plan shall simultaneously be sent to the Regional Inspector.

- Nothing shall prevent the splitting or reduction of any pillar or block of mineral bed or deposit where, in the opinion of the manager such work is necessary for haulage, ventilation, drainage or any other purpose necessary for the proper working of the mine, if 14 days' previous notice in writing of the intention to commence such work has been given to the Regional Inspector.
- Proper provision shall be made to prevent the premature collapse of workings; and adequate steps shall be taken to isolate, control or remedy any such collapse which may occur.

INDIAN ELECTRICITY RULES, 1956: PRECAUTIONS TO BE ADOPTED IN MINES

Voltage limits

Energy shall not be transmitted into a mine at a voltage exceeding 11000 volts and shall not be used therein at a voltage exceeding 6600 volts:

Provided that:

- Where hand-held portable apparatus is used, the voltage shall not exceed 125 volts;
- Where electric lighting is used:- (i) in underground mines, the lighting system shall have a mid or neutral point connected with earth and the voltage shall not exceed 125 volts between phases; (ii) on the surface of a mine or in an open cast mine, the voltage may be raised to 250 volts, if the neutral or the mid point of the system is connected with earth and the voltage between the phases does not exceed 250 volts;
- Where portable hand-lamps are used in underground working of mine, the voltage shall not exceed 30 volts;
- Where any circuit is used for the remote control or electric inter-locking of apparatus, the circuit voltage shall not exceed 30 volts:

Provided that in fixed plants, the said voltage may be permitted upto 650 volts, if the bolted type plug is used.

Cables

All cables, other than flexible cables for portable or transportable apparatus, shall comply with the following requirements:

- All such cables (other than the outer conductor of a concentric cable) shall be covered with insulating material and shall be efficiently protected from mechanical damage and supported at sufficiently frequent intervals and in such a manner as to prevent damage to such cables;
- no cables other than concentric cables or two core or multicore cables protected by a metallic covering or single core cables protected by a metallic covering and which contain all the conductors of a circuit shall be used where the voltage exceeds 125 volts.
- Where a medium voltage direct current system is used, two single core cables may be used for any circuit provided that their metallic coverings are bounded together by earth conductors so placed that the distance between any two consecutive bonds is not greater than 30 metres measured along either cable;
- The metallic covering of every cable shall be (i) electrically and mechanically continuous throughout; (ii) earthed (iii) where there may be risk of igniting gas, coal-dust, or other inflammable material, so constructed as to prevent, as far as practicable, the occurrence of open sparking.
- Cables and conductors where connected to motors, transformers, switchgear and other apparatus, shall be installed so that : (i) they are mechanically protected by securely attaching the metallic covering to the apparatus; and (ii) the insulating material at each cable end is efficiently sealed so as to prevent the diminution of its insulating properties;
- Unarmoured cables or conductors shall be conveyed either in metallic pipes or metal casings or suspended from efficient insulators by means of non-conducting materials. If separate insulated conductors are used, they shall be installed at least 3.75 cm. apart and shall not be brought together except at lamps, switches and fittings.

Flexible cables

- Flexible cables for portable or transportable apparatus shall be two-core or multi-core, and shall be covered with insulating material which shall be efficiently protected from mechanical injury.
- Every flexible cable intended for use with portable or transportable apparatus shall be connected to the system and to such apparatus by properly constructed connectors.
- At every point where flexible cables are joined to main cables, circuit breaker shall be provided which is capable of automatically disconnecting the supply from such flexible cables.

- Every flexible cable attached to a portable or transportable machine shall be examined periodically by the person authorised to operate the machine, and if such cable is used underground, it shall be examined at least once in each shift by such person. If such cable is found to be damaged or defective, it shall forthwith be replaced by a cable in good condition.
- If the voltage of the circuit exceeds low voltage, all flexible cable attached to any transportable apparatus shall be provided with flexible metallic screening or pliable armouring.
- Flexible cable exceeding 90 metres in length shall not be used with any portable or transportable apparatus:
- Flexible cable, when installed in a mine, shall be efficiently supported and protected from mechanical injury.
- Flexible cables shall not be used with apparatus other than portable or transportable apparatus.
- Where flexible cables are used they shall detached or otherwise isolated from the source of supply when not in use, and arrangements shall be made to prevent the energising of such cables by unauthorised persons.

Precautions where gas exists

- In any part of a coal-seam of the first degree gassiness (i) all cables shall be constructed, installed, protected, operated and maintained in such a manner as to prevent risk of open sparking; (ii) all apparatus including portable and transportable apparatus including lighting fittings used at any place which lies in bye of the last ventilation connection shall be flame-proof.
- At any place which lies in any part of a coal-seam of second and third degree gassiness (i) all signalling, telecommunication circuits shall be so constructed, installed, protected, operated and maintained as to be intrinsically safe; (ii) all cables shall be constructed, installed, protected, operated and maintained in such a manner as to prevent risk of open sparking; (iii) all apparatus, including portable and transportable apparatus used at any place within 90 metres of any working face or goaf in case of a second degree gassy mine and within 270 metres of any working face or goaf in case of third degree gassy mine or at any place which lies in-bye of the last ventilation connection or in any return airways shall be flame-proof; (iv) all electric lamps shall be enclosed in flame-proof enclosures.
- In any oil mine or oil-field, at any place within the Danger Areas, (i) all signalling, telecommunication circuits shall be so constructed, installed, operated, protected and maintained as to be intrinsically safe; (ii) all cables shall be so constructed, installed, operated and maintained as to prevent risk of open sparking; (iii) all apparatus including

portable and transportable apparatus shall be flame-proof; (iv) all electric lamps shall be enclosed in flame-proof enclosures.

- In any coal-seam of degree second and degree third gassiness or the danger zone of oil-mine the supply shall be discontinued, (i) immediately, if open sparking occurs; (iii) during the period required for examination or adjustment of the apparatus, which would necessitate the exposing of any part liable to open sparking; (iii) the supply shall not be reconnected until the apparatus has been examined by the electrical supervisor or one of his duly appointed assistants until the defect, if any, has been remedied or the necessary adjustment made; (iv) a flame safety lamp shall be provided and maintained in a state of continuous illumination near an apparatus which remains energised.
- In any part of a coal-seam of any degree of gassiness or in any hazardous area of an oil-mine, if the presence of inflammable gas in the general body of air is found any time to exceed one and one quarter, the supply of energy shall be immediately disconnected from all cables and apparatus in the area and the supply shall not be reconnected so long as the percentage of inflammable gas remains in excess of one and one quarter.

ABANDONED MINE PLAN (AMP)

When any mine or seam or section is abandoned or the working has been discontinued over a period exceeding 60 days. Reg. 61 requires the Owner of the mine to submit, within 30 days of abandonment or 90 days of discontinuance, to the DGMS, 2 copies of Abandoned Mine Plan and sections. These are true copies of upto date underground plan and section of the mine or pail, with additional information regarding location of the mine etc.

When an adjacent mine is worked at a later date, the AMP is utilized to leave adequate barriers to avoid danger of inrush of water/liquid matter or gas or ingress of fire. It helps in assessing danger to surface structures also.

Requirements of AMP

The AMP should be submitted on tracing cloth or polyester tracing film with index number of the original plan from which it is traced. It should be certified to be a true copy of the original plan by the surveyor and countersigned by the manager.

The AMP shall show the following:

- Name of owner, name of mine, name of the plan, true north or magnetic meridian with date of the latter, a scale at least 25cm long and suitably divided; conventions as per the Second Schedule.
- Distance and bearing of at least one shaft or opening of the mine in relation to tri-junction or revenue pillar or any other permanent surface feature.

- Up-to-date position of workings belowground; ends of workings to be marked with dotted lines and last date of survey.
- General direction and rate of dip of strata. Section of the seam(s).
- Position of every fault, dyke and other geological disturbance with amount of throw and direction.
- An abstract of all statutory restrictions in respect of the workings (with DGMS letter number)
- If the plan has not been updated up to the time of abandonment, this fact should be recorded on the plan. If barriers with adjacent mines are not adequate, this fact should be recorded on the plan and, where necessary, management of the adjacent mines should be warned.
- If any workings lie beneath railway, public road and buildings not belonging to the owner, and are inaccessible, the fact should be recorded on the plan.
- Position of all pumps and lodgements underground together with information concerning the quantity of water being pumped out before abandonment. Also position and extent of known water logging.
- A certificate of correctness of the plan (as printed in the original plan).
- In case of coal mines only (i) degree of gassiness of the seam (ii) particular section of the seam being worked (iii) abstract of precautions taken against heating or fire or explosion, if any.

MINE CLOSURE PLAN (MCP)

As per these amendments all the existing mining lessees are required to submit the "Progressive Mine Closure Plan" along with prescribed financial sureties within 180 days from date of notification. Further, the mining lessee is required to submit "Final Mines Closure Plan" one year prior to the proposed closure of the mine. In the notification it has been enumerated that the "Progressive Closure Plan" and "Final Closure Plan" should be in the format and as per the guidelines issued by the Indian Bureau of Mines.

Mine closure encompasses rehabilitation process as an ongoing programme designed to restore physical, chemical and biological quality disturbed by the mining to a level acceptable to all concerned. It must aim at leaving the area in such a way that rehabilitation does not become a burden to the society after mining operation is over. It must also aim to create as self-sustained ecosystem.

Mine closure operation is a continuous series of activities starting from day one of the initiation of mining project. Therefore, progressive mine closure plan will be an additional chapter in the present mining plan and will be reviewed every five years in the Scheme of Mining.

Final mine closure plan as per statute, shall be considered to have its approval at least nine months before the date of proposed closure of mine.

Closure plan

- **Mined-Out Land** Describe the proposals to be implemented for reclamation and rehabilitation of mined-out land including the manner in which the actual site of the pit will be restored for future use. The proposals should be supported with relevant plans and sections depicting the method of land restoration / reclamation / rehabilitation.
- **Water Quality Management** Describe in detail the existing surface and ground water bodies available in the lease areas and the measures to be taken for protection of the same including control of erosion, sedimentation, siltation, water treatment, diversion of water courses , if any, measures for protection of contamination of ground water from leaching etc. Quantity and quality of surface water bodies should also be indicated and corrective measures proposed to meet the water quality conforming the permissible limits should also be described. Report of hydrological study carried out in the area may also be submitted. The water balance chart should be given. If there is potential of Acid Mine Drainage the treatment method should be given.
- **Air Quality Management** Describe the existing air quality status. The corrective measures to be taken for prevention of pollution of air should be described.
- **Waste Management** Describe the type, quality and quantity of overburden, mineral reject etc. available and their disposal practice. If no utilisation of waste material is proposed, the manner in which the waste material will be stabilised should be described. The protective measures to be taken for prevention of siltation, erosion and dust generation from these waste material should also be described. If toxic and hazardous elements are present in the waste material the protective measures to be taken for prevention of their dispersal in the air environment, leaching in the surface and ground water etc, should be described.
- **Top Soil Management** The top soil available at the site and its utilisation should be described.
- **Tailing Dam Management** The steps to be taken for protection and stability of tailing dam, stabilisation of tailing material and its utilisation, periodic desilting, measures to prevent water pollution from tailings etc., arrangement for surplus water overflow alongwith detail design, structural stability studies, the embankment seepage loss into the receiving environment and ground water contaminant if any should be given.
- **Infrastructure** The existing infrastructural facilities available such as roads, aerial ropeways, conveyer belts, railways, power lines, buildings & structures, water treatment plant, transport, water supply sources in the area etc. and their future utilisation should be evaluated on case to case basis. If retained, the measures to be taken for their physical

stability and maintenance should be described. If decommissioning proposed, dismantling and disposal of building structures, support facilities and other infrastructure like electric transmission line, water line, gas pipeline, water works, sewer line, telephone cables, underground tanks, transportation infrastructure like roads, rails, bridges, culverts etc., electrical equipments and infrastructures like electric cables, transformers to be described in connection with restoring land for further use.

- **Disposal of Mining Machinery** The decommissioning of mining machineries and their possible post mining utilisation, if any, to be described.
- **Safety and Security** Explain the safety measures implemented to prevent access to surface openings, excavations etc., and arrangements proposed during the mine abandonment plan and upto the site being opened for general public should be described.
- **Disaster Management and Risk Assessment** This should deal with action plan for high risk accidents like landslides, subsidence flood, inundation in underground mines, fire, seismic activities, tailing dam failure etc. and emergency plan proposed for quick evacuation, ameliorative measures to be taken etc. The capability of lessee to meet such eventualities and the assistance to be required from the local authority should also be described.
- **Care and maintenance during temporary discontinuance** For every five yearly review (as given in the mining scheme), an emergency plan for the situation of temporary discontinuance or incomplete programme due to court order or due to statutory requirements or any other unforeseen circumstances, should include a plan indicating measures of care, maintenance and monitoring of status of unplanned discontinued mining operations expected to re-open in near future. This should detail item wise status monitoring and maintenance with periodicity and objective.

INUNDATION IN MINES

Provisions regarding danger from surface inundation as per MMR 1961

- Where any mine or part thereof is so situated that there is any danger of inrush of surface water into the mine or part, adequate protection against such inrush shall be provided and maintained. If any dispute arises as to whether such protection is adequate or not, it shall be referred to the Chief Inspector for decision.
- No workings shall be made in any mine vertically below (a) any part of any river, canal, lake, tank or other surface reservoir; or (b) any spot lying within a horizontal distance of 15 metres from either bank of a river or canal or from the boundary of a lake, tank or other surface reservoir.
- Every application for permission under shall be accompanied by two copies of a plan and section showing the existing position of the workings of the mine, the proposed layout of

workings, the depth of the workings from the surface, the position and depth of any stoped -out area in the neighbourhood, all faults and other geological disturbances and such other particulars as may affect the safety of the mine or of the persons employed therein.

Provisions regarding danger from underground inundation as per MMR 1961

- Proper provision shall be made in every mine to prevent irruption of water other liquid matter from the workings of the same mine or of an adjoining mine.
- No working which has approached within a distance of 60 metres of any disused or abandoned workings, whether in the same mine or in an adjoining mine, shall be extended further except with the prior permission in writing of the Chief Inspector and subject to such conditions as he may specify therein
- Every application for permission shall be accompanied by two copies of a plan and section showing the outline of such disused or abandoned workings in relation to the workings which are approaching the said workings and such other information as may be available in respect of the said workings.
- Except where otherwise permitted by the Chief Inspector by an order in writing and subject to such conditions as he may specify therein, no such working shall exceed two metres in width or height; and there shall be maintained at least one bore-hole near the center of the working face, and sufficient flank holes on each side and where necessary , bore- holes above and below the workings, at intervals of not more than five metres. All such bore-holes shall be, an shall be constantly maintained, at sufficient distance in advance of the working and such distance shall in no case be less than three metres. These precautions shall be carried out under the direct supervision of a competent person specially authorised for the purpose.
- The precautions shall also be observed in any other working where any heavy seepage of water is noticed whether approaching disused or abandoned workings or not.

Intentional flooding

When the owner, agent or manager intends or proposes, by introducing water from the surface or from any other part of the mine or from an adjacent mine, to flood any part of the workings of his mine, he shall give, in writing, not less than fourteen days notice of such intention or proposal to the Chief Inspector and the Regional Inspector and to the management of all adjoining mines and of such other mines as might be affected by such flooding.

If the operations in respect of which notice is given under sub-regulation (1) are not commenced within sixty days from the expiry of the said notice period of fourteen days, the notice shall be deemed to have lapsed.

NOISE IN MINES

Many sounds are unpleasant or unwanted. These are called noise.

Types of noises

- Continuous noise as in case of surface fan.
- Impact noise (single impulse of short duration) as in blasting.
- Repetitive noise as produced by a type writer.

Noise in mines

Noise is produced in mines generally due to operation of machines like mechanical ventilator, booster fan, auxiliary fans, coal cutting, drilling and loading machines, transport machinery at surface, opencast or belowground, crushing and loading operations and blasting operations etc.

Noise Hazards

- It interferes with communication. This may lead to safety problems besides operational difficulties thereby affecting production and productivity.
- It may affect hearing. Exposure to noise over a long period of time may lead to temporary or permanent hearing loss.
- Exposure to noise may also result in irritability, high blood pressure, headache, neurological disorders, anxiety, fatigue and loss of working efficiency.

Noise Dose

Noise exposure of individuals who move between different noisy environments during the working day can be obtained using 'Noise Dose Meters.' They can be carried in person's pocket. The International Standards Organisation (ISO) defines one method, which uses only the energy criteria and makes no allowance for recovery of hearing.

Thus an increase in sound level from 90 dB (A) to 93 dB (A) must be accompanied by halving the permissible exposure duration from 8 hours to 4 hours.

There are no statutory provisions in the Mines Act. However, DGMS has recommended through Circular No. 17 of 1975 the following norms:

- Warning level for 8 hours daily exposure - 85dB(A)
- Danger limit for 8 hours daily exposure - 90dB(A)
- Compulsory use of ear protection - 115dB(A)
- No work - 140dB(A)

Noise abatement (control)

Noise can be controlled by:

- Reducing noise at the source
- Interrupting the path of the noise
- Providing protection to the workers (Ear muffs, ear plus, helmets).

Noise abatement techniques

- Lubrication, maintenance and speed rating of the machines;
- Proper design of equipment; use of silencers; damping sound by use of sound absorbents;
- Restricting time exposure of persons to noisy environment;
- Controlled blasting, covering D.F. with soil; blasting under favourable weather conditions.

RESCUE OPERATIONS OF TRAPPED MINE WORKERS

- Fires, explosions, inundations and roof falls can result in cutting off escape route from the working place, thereby trapping mine workers.
- Various measures of rescue could be
- Telephonic communication should be provided in all underground workings at strategic places.
- Modern techniques of Geophones and mini-transmitters should be introduced in Indian mines.
- Miners should be trained to give signals.
- A Disaster Management Plan should be prepared for every mine, necessary infrastructural facilities should be provided and all concerned should be trained in its effective execution. Mock rehearsals should be held at regular intervals.
- Rescue stations should be connected to mines by radio telephones/wireless for speedy intimation of emergency.
- A set of submersible pumps should be provided in the rescue station or kept available at a central place in the company.
- Workers and supervisors should be educated about the network of mine workings and ventilation as also safe escape routes so that in the event of workings getting filled with smoke or noxious gases, they do not panic and can. come out safely or can withdraw to the nearest fresh air zone.
- Workers should also be trained in the procedure of conserving their energy and cap lamp lights and conducting themselves to keep up morale of one another.
- Speedy transport of drilling rig to the mine,

- Rapid drilling to make first contact with trapped men,
- Supplying trapped workers air, water, food, medicines, telephone and morale boosting articles.

RESCUE STATIONS

Ref: The Mines Rescue Rule 1985

Establishment and location of rescue station

- The Chief Inspector may permit or require; the owner of a below ground mine or a group of below ground mines to establish and maintain rescue station, stations with such designs and specifications and at; such place/ places as may be considered necessary in consultation with the owner:
- At every rescue station there shall be appointed one Superintendent and at least two instructions and also, there shall be maintained a rescue brigade of not less tan eighteen rescue trained persons.
- In case where the absence of the Superintendent at a rescue station exceeds 60 days, the owner shall appoint another Superintendent.
- The owner shall, within seven days from the date of assumption or relinquishment (abandon, resign etc.) of charge by the Superintendent, inform the Chief Inspector and; the Inspector in-charge of the region where the mine is situated.

Functions of rescue stations

The functions of rescue station

- imparting initial training in rescue and recovery work;
- imparting refresher training to rescue trained persons;
- providing support by its own rescue teams and equipment in case of major accidents or long-lasting rescue and recovery operations; and
- carrying out the functions of rescue room in respect of these below ground mines where there is no rescue room.

Functions of rescue room

A rescue room shall provide facilities for the storage, assembly, testing and adjustments of breathing apparatus and other rescue equipment and apparatus and for their speedy transport to mines.

Establishment and location of rescue rooms

- At every below ground mine where, more than 100 persons are ordinarily employed below ground and there is no rescue station within its radius of 35 kms. The owner, shall establish and; maintain on surface close to mine entrance a rescue room.
- At each rescue room, there shall be appointed such number of rescue trained persons as may be necessary and one of them possessing the qualifications specified in rule 10 shall be made incharge of the rescue room. At least one rescue trained person shall always be in attendance at the rescue room.

Qualifications, experience etc. of Superintendent

After coming into force of these rules, no person shall be appointed as Superintendent unless he:

- is a rescue trained person ;
- has 5 years practical experience of below ground work in mines; and
- holds a First Class Manager's Certificate of a type not restricted to open cast workings.

Qualifications, experience etc., of Instructors

No person shall be appointed as Instructor unless he:-

- is a rescue trained person;
- has 3 years practical experience of blow ground work in mines; and
- holds a Manager's certificate of a type not restricted to open cast workings.

Selection of rescue trained persons for posting at rescue stations

- The rescue trained persons for posting at a rescue station shall be selected, from amongst the rescue trained persons employed in mines served by the rescue station, by the Superintendent in consultation with the managers of such mines.
- A person selected shall be posted for not less than one year and not more than five years at a rescue station at any one time.

Qualifications, experience etc. of rescue room incharge

No person shall be appointed as rescue room incharge unless he

- is a rescue trained person;
- has 3 years practical experience of below ground work in mines ; and
- holds a Manager's , Overman's or Foreman's Certificate of a type not restricted to open cast workings.

Rescue Equipments

- At every rescue station there shall be provided and maintained for immediate use, apparatus and equipment as specified in Schedule I and II.
- At a below ground mine, where no rescue room is located, apparatus and equipment as specified in Schedule III, shall be maintained at the entrance of such mine.
- Self- contained breathing apparatus provided at a rescue station.
- The following apparatus and equipments shall be of a type or standard approved by the Chief Inspector, namely: (a) breathing apparatus; (b) smoke helmets and apparatus serving the same purpose; (c) reviving apparatus; (d) electric safety lamps and flame safety lamps; (e) gas detector; and (f) self rescuers.
- All breathing apparatus and every flow meter shall be adjusted; and tested and the purity of oxygen for use in breathing apparatus shall be tested.
- In case of an accident in a below ground mine arising out of the use of any rescue apparatus, a written report thereof shall be sent, within 24 hours of such accident, by the manager of the mine to the Chief Inspector and Regional Inspector in Form II appended to mines rules.
- No absorbent charges, chemicals, self-rescuer and gas detector tubes shall be kept at al rescue station, rescue room or below ground mine for use *beyond* the *expiry date*, which shall be legibly marked on the boxes thereof.

FIRST AID STATIONS

First aid/medical centre at the site of disaster-Disaster Management Plan of ever/mine should provide for a first aid/medical centre for use in emergency. All casualties would be registered here and given first aid. Minor cases would be discharged; uncomplicated cases would be referred to nearest hospital and the complicated cases to the 'central' referral hospital.

The centre should have facilities for first aid and minor treatment, resuscitation, ambulance and transport. The equipment may consist of oxygen cylinders, respirators, suction apparatus, splints, dressing sets, disposable syringes, adequate number of stretchers etc. It should also have proper telephone/wireless set for quick communication with hospitals where the cases are to be sent. The centre is to be properly manned as it is a very useful and sensitive relief centre.

At every mine there shall be provided and maintained first-aid equipment where injured persons may receive

Requirement of first-aid station

Above ground, a first- aid station

- at the top of every shaft or incline where men or material are normally wound or hauled;

- in every workshop;
- at every screening plant and loading place; and
- at every other place where more than 50 persons are employed at any one time.

In every opencast working

One first-aid station for every 50 persons or part thereof, employed at any one time; and

Below ground, one first-aid station

- at the bottom of every shaft where men or material are normally wound, and at or near every plant;
- near the drive end of every haulage;
- in or at the entrance to every district or section of the mine;

It shall be the duty of the persons appointed to be in charge of a first-aid station under rule 42, to see that the equipment provided at the station is kept in good order and that it is replenished whenever necessary.

An up-to-date list of all first-aid stations provided in the mine shall be kept in the office of the mine and also displayed prominently at the first-aid room.

STANDARDS OF LIGHTING IN OPENCAST MINES

V = vertical; H = horizontal

Area to be illuminated	Minimum standards of illumination to be provided (in Lux)
Work place of Heavy Machinery	15 H, 25 V
Places where manual work is done	15 H, 25 V
Places where loading, unloading or transfer, loading of dumpers, trucks or train is carried on	15 H, 15 V
Operators cabins of machines or mechanisms	50 H
Haul roads for Trucks and Dumpers	10 H
Permanent paths for use of persons employed etc.	10 H
First Aid station	50 H
Workshop	100 H, 50 V
General working areas as determined by the Manager	10 H