

Module 5: Maintenance and Waste Management

Introduction – Meaning – Objectives – Types of maintenance, Breakdown, Spares planning and control, Preventive routine, Relative Advantages, Maintenance Scheduling, Equipment reliability and Modern Scientific Maintenance Methods - Waste Management–Scrap and surplus disposal, Salvage and recovery.

Meaning :

Maintenance is the act of keeping property or equipment in good condition by making repairs and correcting problems.

Objectives :

1. Making Assets Reliable

Assets maintained are more reliable rather than unmaintained assets everybody knows it. If assets are given maintenance on time their performance improves. Maintenance is very important it ensures that assets are well-maintained and their performance can be boosted with calibration & adjustment.

2. Minimizing Maintenance Cost

Maintenance cost has always been an issue for organizations! When assets are not maintained chances of breakdown are increased. It results in expensive maintenance as lots of activities need to be done including changing the part which is not working. Furthermore, the maintenance team tries to bring the asset into running condition as soon as possible.

3. Decreasing Downtime and Minimizing Failure

Upkeep groups endeavor to amplify gear accessibility, and they are better ready to do so when preventive support occupations are overseen well. Maintenance professionals should have the option to keep steady over preventive upkeep to keep machines running so failures are minimized. So, when machines do require fixes, they should be done rapidly and productively.

4. Enhance Productivity Level

When work is done properly such as maintenance tasks are prioritized and issues are resolved quickly, the machine works for several hours without any issue. In that way the quality of work is more efficient, more productive, and when productive work is delivered return on investment increases. It also means that the bottom line is improved as well.

5. Comply with Rules & Regulations

It does not matter in which industry your business belongs to because rules & regulations are there for all business types. If your business assets are not maintained, it might risk your employees' lives and the environment will be not good.

Furthermore, if found that your assets are not maintained then your organization will end up paying penalties. But if assets are maintained your organization will face no issues of compliance or rules & regulations.

Types of maintenance:

The different types of maintenance strategies include:

- **Preventive maintenance :**

Preventive maintenance is the act of performing regularly scheduled maintenance activities to help prevent unexpected failures in the future. Put simply, it's about fixing things before they break. Specific examples of preventive maintenance within a manufacturing facility include ensuring equipment in the production line is working efficiently. Other examples include checking that your HVAC, heating, ventilation, or air conditioning systems are inspected, cleaned, and repaired if necessary, and your water, sanitation, and electrical systems are functioning properly within safety and compliance levels.

Corrective maintenance: Corrective maintenance is the category of maintenance tasks that are performed to rectify and repair faulty systems and equipment. The purpose of corrective maintenance is to restore systems that have broken down. Corrective maintenance can be synonymous with breakdown or reactive maintenance.

Corrective maintenance may be performed on a wide variety of equipment, systems, and processes. Here are a few examples:

- **Production line.** A technician is performing preventive maintenance on a line of production equipment and notices significant wear on a critical part or component. A corrective maintenance order can be initiated to repair or restore that part within the next month.
- **HVAC systems.** A technician responds to an emergency heating system repair in the middle of winter and notices partially clogged or dirty filters. This can trigger a corrective maintenance request to clean or replace filters in the near future to improve efficiency and prevent further heat loss.

- **Predetermined maintenance :**

Predetermined maintenance refers to preventive measures performed according to calendar schedule or operating time, e.g. the replacement of oil, belts, clutch discs and other wear parts. The term also includes scheduled overhauls where machinery and components are taken apart for inspection.

An example of predetermined maintenance is when machinery maintenance is scheduled at time intervals based on the manufacture's recommendations. For example, oil changes will be every fourth month. Transmission service will occur at X number of hours of run time.

- **Condition-based maintenance (CBM):** Condition-based maintenance is a form of proactive maintenance. It's a maintenance strategy that monitors the actual condition of an asset to determine what maintenance tasks need to be done. Condition-based maintenance dictates that maintenance should only be performed

when specific indicators show signs of decreasing performance or upcoming failure. For example, preventive maintenance will be scheduled when vibration on a certain component reaches a certain threshold, indicating that it should be replaced or lubricated.

- **Predictive maintenance (PdM):** Uses condition-monitoring tools and techniques to track the performance and condition of equipment. Maintenance is then performed when certain thresholds or parameters are breached. Examples include monitoring vibration in bearings or checking for thermal hotspots in electrical systems.
- **Reactive maintenance:** Also called “run-to-failure,” reactive maintenance refers to maintenance tasks performed after an asset has broken down. The focus is on restoring assets to operating conditions as quickly as possible.
- **Time-based maintenance (TBM):** A time-based approach schedules a preventive maintenance task using a set time interval, such as every 10 days. Other examples include triggering preventive maintenance (like a regular inspection of critical equipment) on the first day of every month or once in a three-month period.
- **Usage-based maintenance (UBM):** Usage-based preventive maintenance triggers a maintenance action when asset usage hits a certain benchmark. This can include after a certain number of kilometers, hours, or production cycles.

Breakdown:

Breakdown maintenance is maintenance performed on a piece of equipment that has broken down, faulted, or otherwise cannot be operated. The goal of breakdown-maintenance is to fix something that has malfunctioned. To the contrary, preventive maintenance is performed in order to keep something running.

Sometimes it is performed because of an unplanned event. For example, if a critical piece of machinery breaks, the maintenance is performed because of the imminent need for that machine to operate again. However, breakdown-maintenance can be planned for in advance, which is what we might call “good” breakdown-maintenance.

Spares planning and control:

Spare parts is a generic term for all parts that can be used as replacements. Most firms find it difficult to maintain effective spare parts management since there is a fear that stocking spares may not be in line with effectively controlling operating costs. As plant managers, various expectations to recognize ways to perform efficient spare parts management becomes important.

To be a successful plant manager, practical spare part inventory management remains the foundation for dependable plant operation. As a plant manager or supply chain manager is required to know the process of determining which spare parts are in need to make the system productive.

Spare parts management is a form of Risk Control; its purpose is to control the risk to business operations caused by equipment downtime by ensuring the availability of spares at optimum cost.

There are a few things to consider in controlling spare parts. The seven things to consider have been carefully analyzed to help in enhancing performance, the effectiveness of plant operations, and also reduce cost. Below are the seven things to consider:

1. Operation strategy
2. Standardizing the work order process
3. Effective parts inventory control
4. In-depth understanding of lead times for different parts
5. Calculating risk for every equipment
6. Stocking parts for new equipment
7. Adopting better security measures

These things, when taken into account, can result in reduced carrying costs, reduced performance interruption, and improved overall efficiency.

Preventive routine, Relative Advantages:

Advantages of Preventive Maintenance

- Less equipment downtime.
- Fewer interruptions to critical operations.
- Longer asset life.
- Improved efficiency (assets in good repair tend to operate better)
- Increased workplace safety and improved compliance

Maintenance Scheduling:

Maintenance scheduling is the process of making sure planned work is carried out. It involves bringing all the necessary resources together to make sure tasks are completed correctly and on time. Tip: Maintenance scheduling is often confused with maintenance planning. However, the two are different processes.

The maintenance scheduling process

Typically, maintenance scheduling may be completed by:

- Maintenance supervisors
- Maintenance planners

Maintenance teams need to take multiple factors into account when scheduling maintenance work. Following the steps listed below to be followed in maintenance scheduling process

1. Read the work order and clarify details with the maintenance planner.
2. Secure necessary resources, such as tools, people, supplies, spare parts, safety equipment.
3. Make sure the asset is available and ready for work.
4. Assign the task to a technician for completion.
5. Follow up and make improvements as needed.

Some tasks may be scheduled on a recurring basis, in which case the scheduler needs to make sure each work order is completed on time every time.

Equipment reliability and Modern Scientific Maintenance Methods:

Maintenance encompasses asset, equipment, and system management to prevent failure and sustain operational continuity. **Reliability** is the outcome of effective maintenance, which gauges an asset's ability to function as intended for a specific period.

The modern scientific methods of maintenance have varied widely, including visual inspection (i.e. human monitoring), thermal imaging, ultrasonic analysis, vibration analysis, power consumption and acoustic emission.

Waste Management:

Waste management refers to the various schemes to manage and dispose of wastes. It can be by discarding, destroying, processing, recycling, reusing, or controlling wastes. The prime objective of waste management is to reduce the amount of unusable materials and to avert potential health and environmental hazards.

Scrap and Surplus disposal:

Some scrap/surplus items are sometimes sold to employees of the enterprise. If the surplus is the result of technical obsolescence or overstocking due to various reasons but the materials are in new or good condition, these can be disposed of to employees in a satisfactory manner.

The objective of **Scrap and Surplus disposal** is to reduce the possibility of misappropriation of scrap, valuable waste, and salvageable material, or the perception that such material is being misappropriated during the course of normal Physical Plant work functions.

Salvage and Recovery:

Salvage means the controlled removal of materials from a covered project, for the purpose of reuse or storage for later reuse; Scrap means property that has no value except for its basic material content.

Recovering is the process of giving a value to a material believed to be waste. Recovering means to transform wastes into resources. The best example of recovering is composting. It transforms our **fruit and vegetable wastes** into rich soil conditioners, commonly known as **compos**

Proper waste disposal and management can be done by applying the **3R – Reduce, Reuse and Recycle**. Reducing means lessening the amount of trash/garbage produced. Reusing refers to using materials more than once while recycling means creating new material or product out of trash/garbage.
