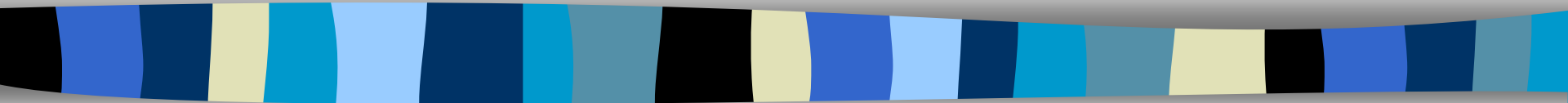


# Plant Maintenance





# Maintenance

- All actions necessary for retaining an item, or restoring to it, a serviceable condition, include servicing, repair, modification, overhaul, inspection and condition verification
- Increase availability of a system
- Keep system's equipment in working order



# Purpose of Maintenance

- Attempt to maximize performance of production equipment efficiently and regularly
- Prevent breakdown or failures
- Minimize production loss from failures
- Increase reliability of the operating systems



# Principle Objectives in Maintenance

- To achieve product quality and customer satisfaction through adjusted and serviced equipment
- Maximize useful life of equipment
- Keep equipment safe and prevent safety hazards
- Minimize frequency and severity of interruptions
- Maximize production capacity – through high utilization of facility



# Maintenance Objectives

- Must be consistent with the goals of production (cost, quality, delivery, safety)
- Must be comprehensive and include specific responsibilities



# Maintenance in Manufacturing Companies

- Electronic
- Automotive
- Petrochemicals
- Refinery
- Furniture
- Ceramics
- Food and beverages



# Types of Maintenance

- Breakdown maintenance
- Preventive maintenance



# Breakdown Maintenance

- Breakdown maintenance implies that repairs are made after the equipment is failed and can not perform its normal function anymore
- Quite justified in small factories where:
  - Down times are non-critical and repair costs are less than other type of maintenance
  - Financial justification for scheduling are not felt





# Break Down Maintenance

- Identification of broken, worn out or malfunctioning components.
- Reassembly and Checking to verify the correct operation of the equipment.



# Classification of Breakdown Repairs

## Break down repairs

- Emergency
- Normal
- Deferred

## Downtime cost

- High
- Medium
- Low



# Maintenance Costs

- Cost to replace or repair
- Losses of output
- Delayed shipment
- Scrap and rework



# Disadvantages of Breakdown Maintenance

- Breakdown generally occurs in inappropriate times leading to poor and hurried maintenance
- Excessive delay in production & reduces output
- Faster plant deterioration
- Increases chances of accidents and less safety for both workers and machines
- Direct loss of profit.



# Preventive Maintenance (PM)

- Principle – “Prevention is better than cure”
- It
  - locates weak spots of machinery and equipments
  - provides them periodic/scheduled inspections and minor repairs to reduce the danger of unanticipated breakdowns



# Scheduled Maintenance

- Scheduled maintenance is a stitch-in-time procedure and incorporates
  - inspection
  - lubrication
  - repair and overhaul of equipments
- If neglected can result in breakdown
- Generally followed for:
  - overhauling of machines
  - changing of heavy equipment oils
  - cleaning of water and other tanks etc.



# Advantages of PM

## ■ Advantages:

- Reduces break down and thereby down time
- Less odd-time repair and reduces over time of crews
- Greater safety of workers
- Lower maintenance and repair costs
- Less stand-by equipments and spare parts
- Better product quality and fewer reworks and scraps
- Increases plant life
- Increases chances to get production incentive bonus



# Predictive (Condition-based) Maintenance

- In predictive maintenance, machinery conditions are periodically monitored and this enables the maintenance crews to take timely actions, such as machine adjustment, repair or overhaul
- It makes use of human sense and other sensitive instruments, such as
  - audio gauge, vibration analyzer, amplitude meter, pressure, temperature and resistance strain gauges etc.



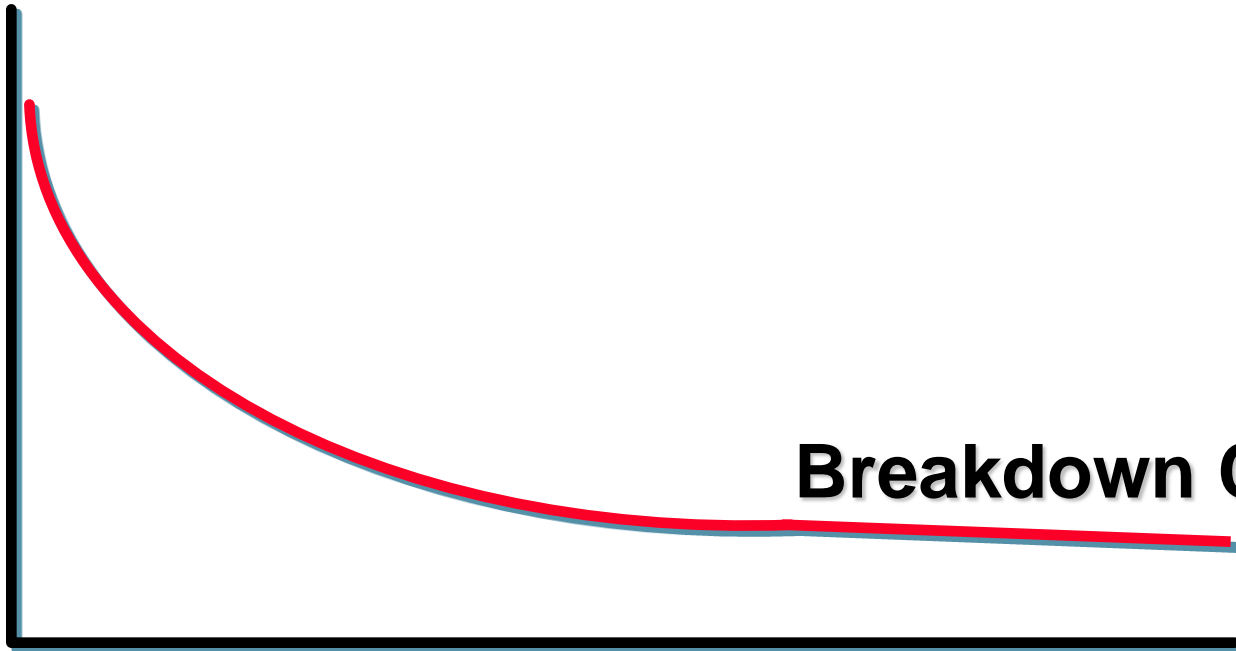


## Predictive Maintenance (Contd.)

- Unusual sounds coming out of a rotating equipment predicts a trouble
- An excessively hot electric cable predicts a trouble
- Simple hand touch can point out many unusual equipment conditions and thus predicts a trouble

# Maintenance Costs

**Cost**

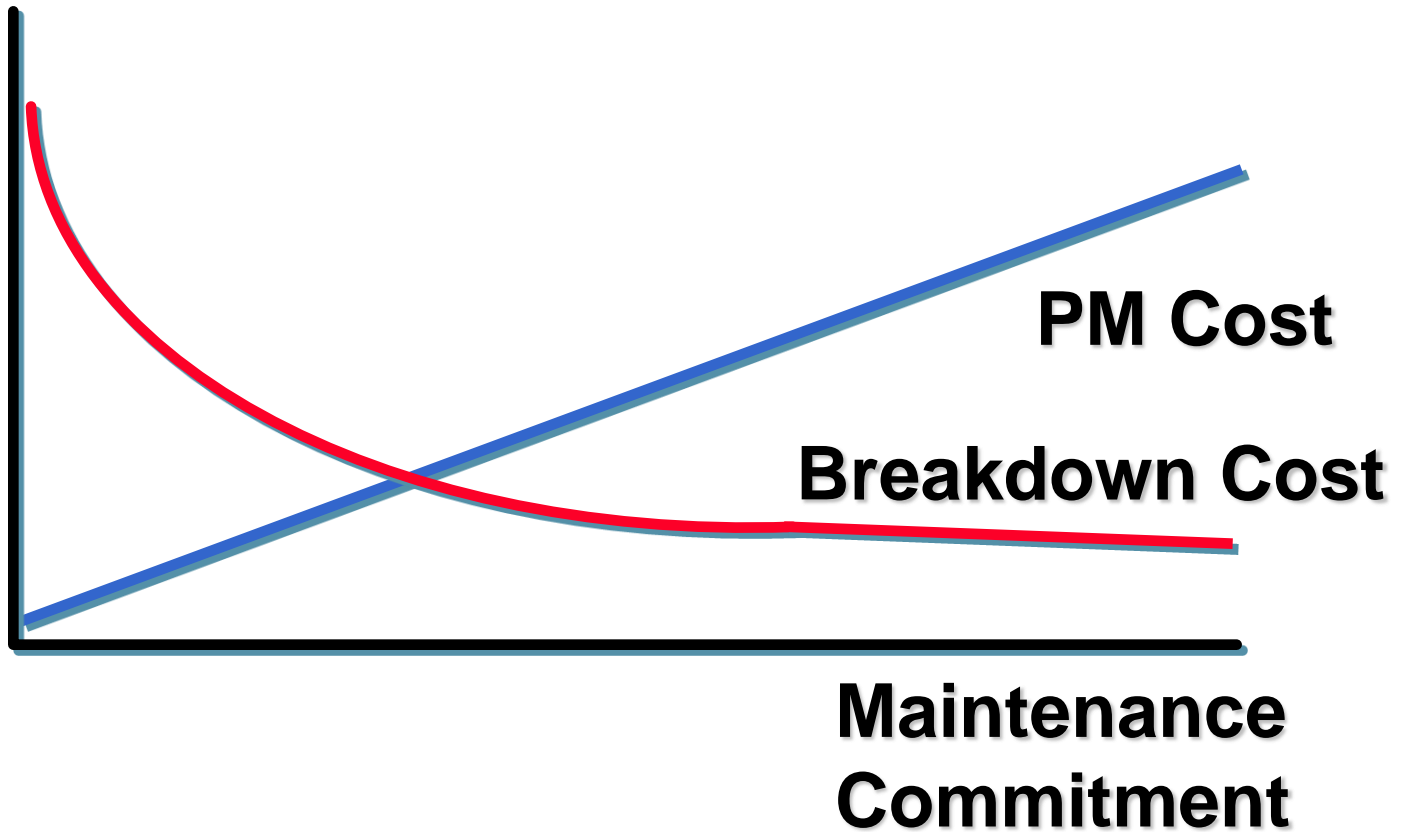


**Breakdown Cost**

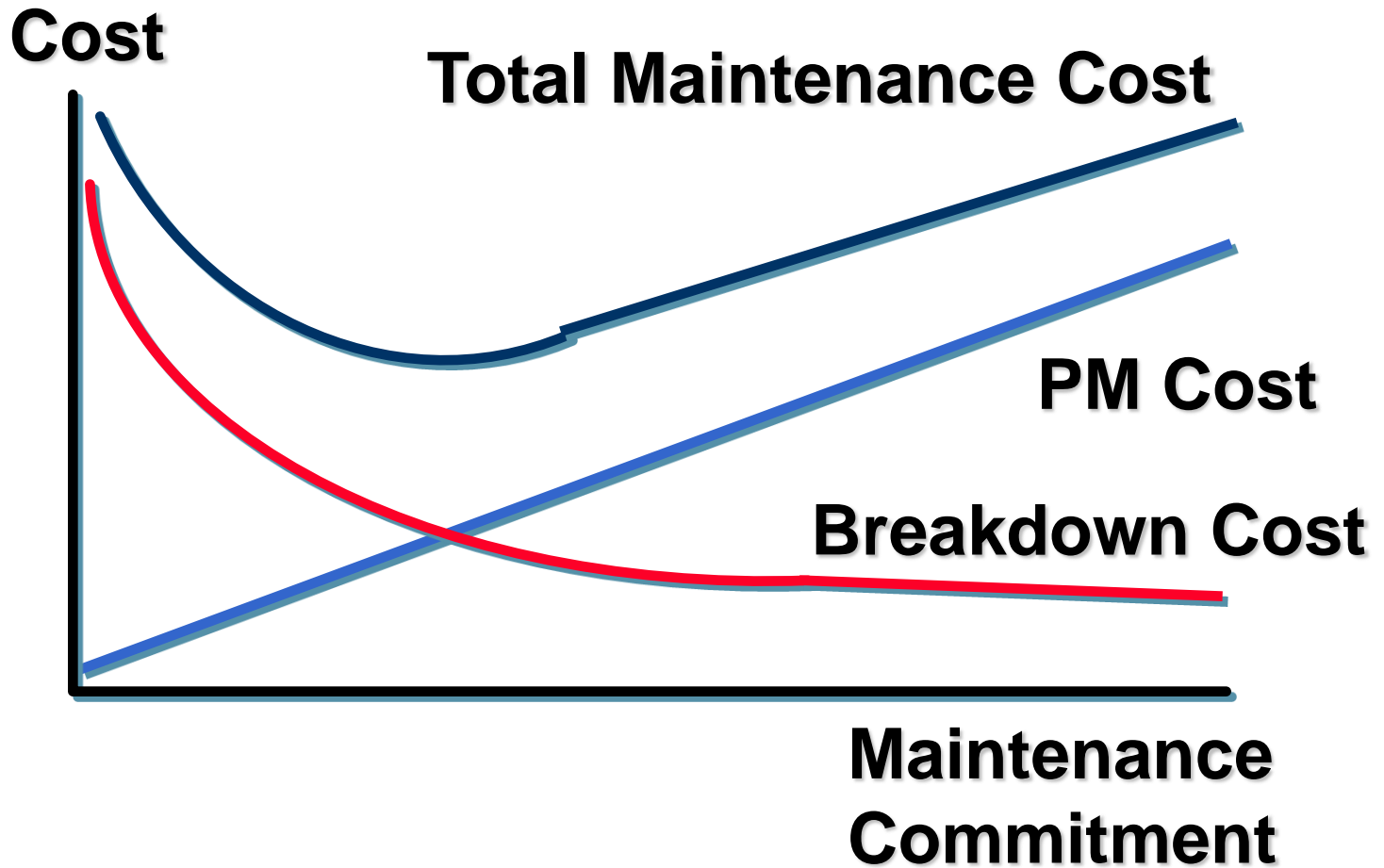
**Maintenance  
Commitment**

# Maintenance Costs

**Cost**



# Maintenance Costs



# Maintenance Costs

