Machine Maintenance Best Practices

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Summary

- Definitions and Goals
- Essential elements of preventive and predictive maintenance programs
- Role of Production and Sanitation in supporting maintenance efforts
- Maintenance activities: work orders and task lists
- Developing and refining best practices

Definitions- Maintenance

- Negative: Plant run down, maintenance and production don't get along, costs are high, "firefighter with bailing wire"
- Break-even: Maintenance works only when something breaks, Costs go up and down, some tape and bailing wire, few bad spots
- Preventive and Predictive Maintenance: Excellent communication and mutual respect, organization and accountability

Goals: Reduce Losses

1) Breakdown Losses
2) Changeovers and Adjustments
3) Minor stoppages

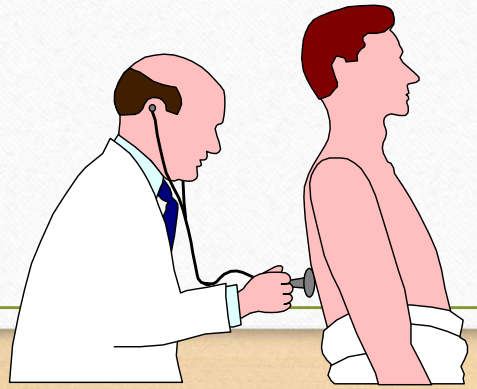
4) Speed losses
5) Yield losses
6) Quality defect losses

What is preventive maintenance?

- Prevent breakdowns
- Prevent product contamination
- Prevent quality problems (temperature, relative humidity, machine settings)
- Prevent employee injuries
- Prevent excessive repair costs

Predictive Maintenance

- Vibration analysis- bearing wear
- Infrared thermography- ID hot spots
- Oil analysis for gear boxes- contamination?
- Ultrasonic sound- metal stress



How can P.M. pay off?

- Increased efficiency of equipment- longer life and better yields per shift
- Increased level of safety and sanitation
- Reduced energy cost
- Reduced cost of repairs
- Improved quality of product
- Less waste
- Better spare parts control

Essential elements of PM program

- Routine external inspections of equipment
- Periodic internal inspections
- Systematic lubrication
- Prompt adjustment, repair, or replacement of defective parts
- Accurate record-keeping
- Spare parts inventory/control

More essential elements

- Scheduled major overhauls
- Cost/ benefit analysis
- Systematic work procedure
- Planning and scheduling
- On-going training

Role of Production Staff in P.M.

- Specific to plant
- Total Productive Maintenance (TPM) part of lean manufacturing tools
- T_____
- L_____
- C_____

Operators

- Notice changes in machines- Sound, temperature, belt tracking, safety, etc.
- Record downtime: amount and causes
- Dialog and communications
- Make minor adjustments
- Assist with repairs as needed

Safety around Equipment

- Compressed air use: Last resort for cleaning
- Electrical: only takes 20 mA for danger
- LOTO: Follow plant procedures
- Look for pinch points and sharp edges
- Should production be responsible for lubrication of equipment?

Role of Sanitation Staff in P.M.

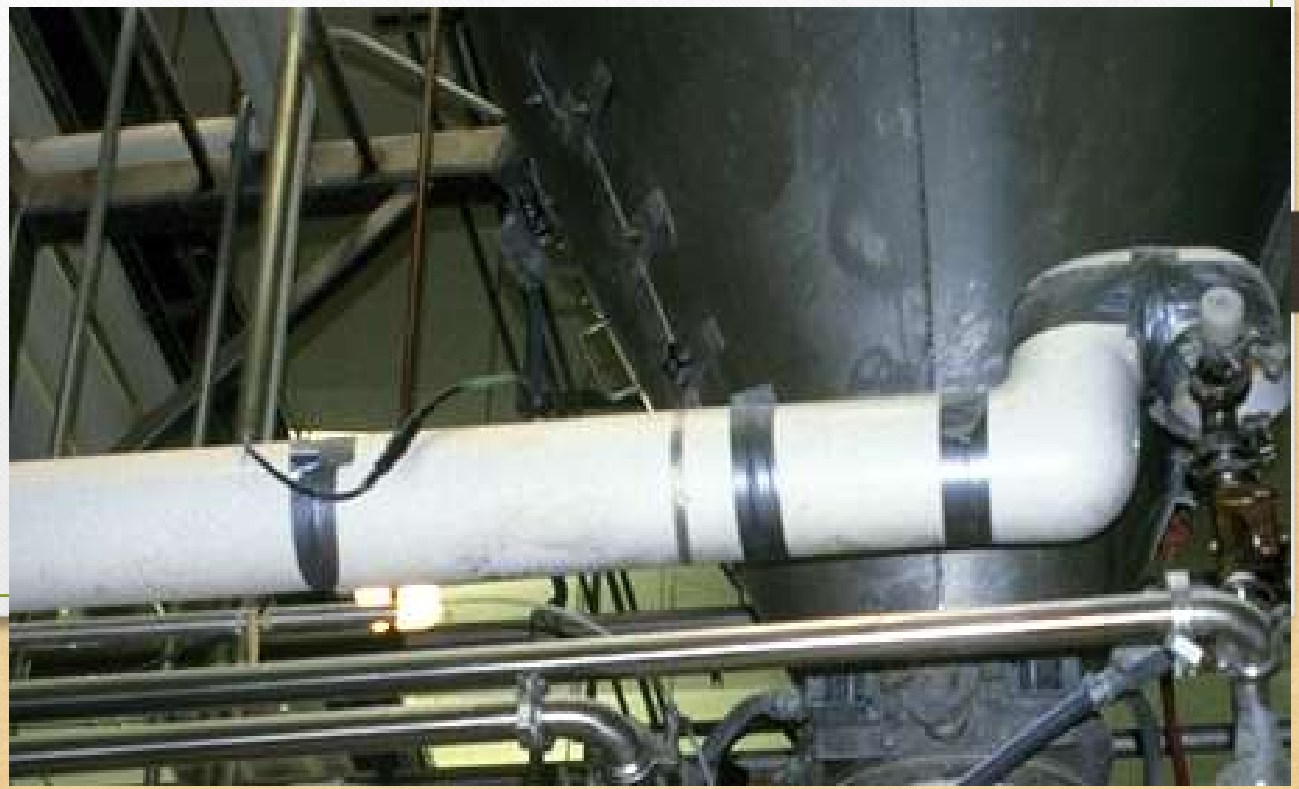
- Organized Assembly
- Assure motors have ventilation
- Keep dust out of electrical panels
- Keep moisture off of motors and circuits

Planned Maintenance

- Based on type of equipment, OEM recommendations, and plant experience
- Unplanned maintenance costs 4X the cost of planned maintenance.
- Work orders- Identify and define work
- Task lists- Prioritize work

Maintenance for Sanitation

Maintenance for Sanitation



Maintenance for Sanitation

Maintenance for Sanitation

What is a Task List?

- A list of all actions to be performed at a specific time
- Specific to each mechanic
- Can be unit-based or string-based

Repairs while Running

- Have parts at hand/PM carts
- Put safety first!
- Have “pit crew” mentality
- Accurate communications
- How to handle temporary repairs

Important questions

- How much scheduled down time is allowed?
- How much and what kinds of inventory will suppliers carry?
- What is the cost of one hour of unscheduled downtime?
- Do the people in the bakery have the skills to do timely repairs?

Costs of downtime

- Specific to plant
- Consider:
  - Materials wasted
  - Labor, other direct costs wasted
  - Overtime vs. straight time
  - Repair parts costs
  - Costs of re-doing
  - Other costs (utilities, outside purchase)

Unscheduled downtime- breakdowns

- Track on daily basis
- Industry standard= 5% or less per line
- If calculate costs of downtime per hour or per minute, easy to track costs of breakdowns
- Also consider reduction of equipment life with frequent breakdowns (depreciation)

Scheduled downtime

- 168 hours in a week
- Ideally, the plant is only scheduled for between 120 to 140 hours per week, which would allow 28-48 hours per week of scheduled downtime
- Recommend minimum of 16-24 hours per week for efficient operations

Scheduling repairs

- What can be done safely during production?
- What must be done during scheduled downtime? Can some pre-work be done before shutdown?
- What are the provisions for test-running once the job is completed?

Dollars spent in Maintenance Departments

- View in 3 major areas: payroll cost, repair parts, repair services
- Look at use of overtime
- Look at flexibility to do projects
- Look at hours needed to do proper PM
- Track use of parts
- Provide training to reduce service costs

Return on investment

- Parts usage?
- Life of equipment?
- Downtime?
- Turnover?
- Product quality?
- Other measures?

Getting the information

- Equipment suppliers
- Equipment manuals
- Experienced engineers
- Company/Industry benchmarks
- Software suppliers

Overall Equipment Effectiveness (OEE)

=

Availability X Performance X Quality X 100

OEE Calculations

Overall Equipment Effectiveness = Availability x Performance x Quality Yield

$$\text{Availability} = \frac{\text{time available for production - downtime}}{\text{time available for production}}$$

$$\text{Performance} = \frac{\text{units produced}}{\text{unit capacity}}$$

$$\text{Quality Yield} = \frac{\text{total number of units produced - defect number}}{\text{total number of units produced}}$$

Developing and Refining Best Practices

- Involve equipment operators
- Plan PM activities
- Maintenance skills training
- Certification and recertification
- Partner with vendors to improve reliability
- Recognition and rewards