Maintenance Report

March 2018

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Introduction and methodology

Objective
*Plant Engineering* performed this research to better understand maintenance practices and strategies currently in place in manufacturing facilities and the effects of maintenance on productivity and profitability.

Sample
The sample was selected from recipients of *Plant Engineering* for whom e-mail addresses were available. Only respondents responsible for maintenance for all or part of their facilities were asked about maintenance strategies, outsourcing maintenance, training, technologies, and unscheduled downtime.

Method
Subscribers were sent an e-mail asking them to participate in this study. The e-mail included a URL linked to the questionnaire.

- **Data collected:** January 12, 2018, through January 29, 2018
- **Number of respondents:** 202
  - Margin of error: +/- 6.9% at a 95% confidence level
- **Incentive:** Survey participants were offered the opportunity to enter a drawing for one Visa gift card valued at $100.00.
Respondents to the *Plant Engineering* 2018 Maintenance Study identified seven important, high-level findings impacting the manufacturing industries today:

1. **Maintenance strategies:** Eight in 10 manufacturing facilities follow a preventive maintenance strategy; 57% use a run-to-failure method and 51% practice a predictive maintenance (PdM) approach using analytical tools.

2. **Scheduled maintenance:** Fifty-two percent of facilities allocate up to 10% of their annual operating costs to maintenance processes; 35% devote more than 10% of this budget on maintenance. The average facility spends 19 hours each week on schedule maintenance.

3. **Attention to systems:** Rotating equipment (motors, power transmission, etc.) and plant automation systems are the two areas where facilities dedicate the most maintenance support, followed by fluid power systems, internal electrical distribution systems, and material handling equipment.

4. **Unscheduled downtime:** The leading cause of unscheduled downtime within respondents’ facilities remains aging equipment (44%), followed by operator error (16%) and lack of time (15%). Half of facilities plan to upgrade their equipment and improve/increase training.

5. **Training:** Maintenance teams are mostly trained on safety (84%) and basic electrical (68%) and mechanicals skills (67%). Other types of training include preventive maintenance (58%) and lubrication (57%).

6. **Technologies:** The most common technologies facilities use to monitor/manage maintenance are in-house spreadsheets/schedules (55%), computerized maintenance management systems (CMMS, 53%), and paper records of maintenance reports (44%).

7. **Outsourcing:** The average facility outsources 20% of their maintenance operations, and the leading causes are lack of time/manpower and lack of skills among current staff.
Respondent profile
Seventy-seven percent of respondents have engineering, maintenance, and/or supervisory responsibilities at their facilities.

Q: Which of the following best describes your job title? (n=202)
Industry experience, facility size

Respondents have worked in a plant or engineering-related position for an average of 25 years, with 41% having been in the industry for 30 years or longer. The average facility employs 437 people.

**Industry experience**
- Less than 5 years: 7%
- 5 to 9 years: 8%
- 10 to 19 years: 18%
- 20 to 29 years: 26%
- 30 to 39 years: 29%
- 40 year or longer: 12%

**Facility size**
- 1 to 19 employees: 18%
- 20 to 49 employees: 14%
- 50 to 99 employees: 13%
- 100 to 249 employees: 16%
- 250 to 499 employees: 12%
- 500 to 999 employees: 7%
- 1,000 or more employees: 20%

**Average**
- 25 years
- 437 employees

Q: For approximately how long have you worked in a plant or engineering-related position? (n=191); Q: How many people work at your location? (n=201)
Twenty-six percent of respondents are located in the North Central region of the U.S., and another 25% are based outside of the U.S. Other countries represented include India, Canada, Mexico, Brazil, and Spain.

*Data gathered by matching respondents to their Plant Engineering audience profiles.*
The top primary businesses represented by respondents are food, beverage, and tobacco (12%) and government or military (8%).

Q: What is the primary business at your location? (n=191)
Facility maintenance
Scheduled maintenance

The average respondent’s facility allocates approximately 9.7% of its annual operating budget to maintenance processes. Thirty-one percent of facilities spend 30 hours or more each week on scheduled maintenance; average is 19 hours/week.

Q: What percentage of your plant’s annual operating budget is spent on maintenance processes? (n=202); Q: Approximately how many hours per week does your plant spend on scheduled maintenance? (n=197)
Scheduled maintenance shutdown frequency

Thirty-nine percent of facilities shutdown their automated specialized production machinery only once or twice a year for scheduled maintenance, while 15% shutdown these systems quarterly and 14% monthly.

Q: How often are the following areas of your plant shutdown for scheduled maintenance? (n=201;198;194;194;198;196)

- Standard machinery used in production (automated):
  - Yearly: 17%
  - Twice a year: 18%
  - Quarterly: 13%
  - Every other month: 13%
  - Monthly: 5%
  - Every other week: 18%
  - Weekly: 5%

- Less automated (manual) systems:
  - Yearly: 14%
  - Twice a year: 13%
  - Quarterly: 16%
  - Every other month: 6%
  - Monthly: 19%
  - Every other week: 8%

- Specialized production machinery (automated):
  - Yearly: 22%
  - Twice a year: 17%
  - Quarterly: 15%
  - Every other month: 14%
  - Monthly: 6%

- Material handling equipment:
  - Yearly: 12%
  - Twice a year: 9%
  - Quarterly: 14%
  - Every other month: 4%
  - Monthly: 15%
  - Every other week: 5%
  - Weekly: 9%
  - Daily: 4%

- Conveyor and production line systems (automated):
  - Yearly: 9%
  - Twice a year: 13%
  - Quarterly: 15%
  - Every other month: 6%
  - Monthly: 12%
  - Every other week: 7%

- Packaging systems:
  - Yearly: 8%
  - Twice a year: 9%
  - Quarterly: 14%
  - Every other month: 5%
  - Monthly: 11%
  - Every other week: 7%
Attention to systems maintenance

More than half of facilities dedicate a significant amount of maintenance support to their rotating equipment (motors, power transmission, etc.) and plant automation systems.

Q: How much maintenance support do the following areas of your facility receive? (n=200;198;196;198;197)

<table>
<thead>
<tr>
<th>Area</th>
<th>A great deal</th>
<th>A lot</th>
<th>Some (little)</th>
<th>None at all (or N/A)</th>
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<tr>
<td>Plant automation systems</td>
<td>21%</td>
<td></td>
<td>34%</td>
<td>37%</td>
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<tr>
<td>Internal electrical distribution systems</td>
<td>12%</td>
<td></td>
<td>31%</td>
<td>48%</td>
</tr>
<tr>
<td>Fluid power systems (air, hydraulic, etc.)</td>
<td>15%</td>
<td></td>
<td>31%</td>
<td>48%</td>
</tr>
<tr>
<td>Rotating equipment (motors, power transmission, etc.)</td>
<td>19%</td>
<td></td>
<td>40%</td>
<td>36%</td>
</tr>
<tr>
<td>Material handling equipment</td>
<td>10%</td>
<td></td>
<td>32%</td>
<td>40%</td>
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Unscheduled downtime

Aging equipment (44%) and operator errors (16%) remain the leading causes of unscheduled downtime. In an effort to decrease downtime, half of respondents plan to upgrade equipment, improve/increase training efforts, and/or introduce/implement preventive strategies.

**Leading cause**
- Aging equipment 44%
- Operator error 16%
- Lack of time to perform maintenance 15%
- Lack of maintenance 10%
- Poor equipment design/engineering 9%
- Other 3%
- Don’t know 3%

**Plans to decrease downtime**
- Upgrade equipment 54%
- Improve training, increase frequency 50%
- Introduce preventive maintenance strategies 50%
- Expand monitoring capabilities 39%
- Other 5%
- None 2%
More than half of respondents’ maintenance personnel receives training in safety (84%), basic electrical skills (68%), basic mechanical skills (67%), predictive maintenance (58%), lubrication (57%), and motors, gearboxes, bearings (56%).

Q: What kind of training does your maintenance personnel receive? (n=167)
Maintenance technologies

More than half of respondents’ facilities use in-house created spreadsheets and schedules and/or a computerized maintenance management system to monitor or manage maintenance. Only 11% take advantage of IIoT for this purpose.

Q: What technologies are used to monitor or manage maintenance within your plant? (n=202)

- In-house created spreadsheets and schedules (e.g., Microsoft Excel): 55%
- Computerized maintenance management system (CMMS): 53%
- Clipboards and paper records of maintenance rounds: 44%
- Automated maintenance schedule generated by manufacturing scheduling system: 30%
- General computerized calendar (e.g., Microsoft Outlook): 27%
- Enterprise asset management (EAM): 19%
- Industrial Internet of Things (IIoT): 11%
- Other: 2%
- None: 1%
Percentage of operations that is part of maintenance

Looking at the relationship between operations teams and maintenance departments, an average of 20% of a facility’s operations personnel are also responsible for maintenance duties.

Q: What percentage of your plant’s operations team is part of your maintenance department? (n=202)
Outsourcing maintenance

The average facility outsources 20.4% of their maintenance operations, up from 18.6% in 2017. The top reasons for outsourcing continue to be lack of time/manpower, lack of skills among current staff, and too many specialized skills being required.

Q: How much of your plant’s maintenance operation is outsourced? (n=202); Q: Which factors led to the outsourcing of maintenance operation at your plant? (n=268;167)

Percentage outsourced

Reasons for outsourcing

Lack of time, manpower to dedicate to maintenance
Lack of skills among current staff
Too many specialized skills required to be practical
Skilled individuals simply not available
Lack of necessary equipment available
Desire to lower overall costs
Insufficient budget to hire/retain skilled individuals
Union considerations

Q: How much of your plant’s maintenance operation is outsourced? (n=202); Q: Which factors led to the outsourcing of maintenance operation at your plant? (n=268;167)
Attitude towards maintenance

Six in 10 respondents see maintenance as a cost center, most of whom understand that they need to spend in order to keep their equipment running. Another 34% see maintenance as a profit center that delivers greater capacity to their facility.

Q: Which of the following statements best describes your attitude toward maintenance? (n=202)

- It’s a profit center where we can deliver greater capacity to our plant. 44%
- It’s a cost center, but we need to spend in order to keep equipment running. 34%
- It’s a cost center, and we need to carefully control costs. 16%
- It’s a necessary evil. 6%

Q: Which of the following statements best describes your attitude toward maintenance? (n=202)
Key challenges to improving maintenance at respondents’ facilities include lack of resources or staff, lack of understanding of new maintenance options/technologies, lack of available funding, and lack of training.

Q: What are the key challenges for improving maintenance at your facility? (n=322;202)
Plant usage of handheld/mobile devices

The usage of handheld/mobile devices for communications between maintenance personnel and schedulers is on the rise (22% in 2018 versus 16% in 2017), while the number of devices being fully integrated into a plant-wide CMMS or IIoT systems has declined.

Q: To what extent is your plant using handheld/mobile devices for plant maintenance? (n=202)
Impact of the Industrial Internet of Things

Three in 10 respondents believe that adopting IIoT will help them to better understand machine health, and therefore keep up with planned routine maintenance. Twenty-five percent are unsure how or if IIoT would impact their plant’s maintenance operations.

Q: How will the Industrial Internet of Things (IIoT) impact plant maintenance operations? (n=202)

- Will help to better understand machine health: 30%
- Will help to better predict and prevent plant shutdowns: 29%
- Will change how plant maintenance personnel work and interact with all levels: 26%
- Will have no impact: 21%
- Don't know: 25%

Q: How will the Industrial Internet of Things (IIoT) impact plant maintenance operations? (n=202)
Industrial facilities use multiple maintenance strategies on the plant floor, depending on the equipment. Eighty percent use preventive maintenance, while 57% employ a "run-to-failure" strategy and 51% opt to use predictive maintenance with analytical tools.

Q: Which of the following maintenance strategies are present within your plant? (n=322;201)
Decreased downtime is the common top advantage (top 3) to preventive, predictive (PdM), and reliability-centered maintenance (RCM) strategies, according to respondents.

Q: What are the advantages to the maintenance strategy/strategies in place at your plant? (n=160;114;103;101;67)
Additional resources from *Plant Engineering*

Thank you for downloading the *Plant Engineering* 2018 Maintenance Study. Use the links below to access additional information on manufacturing facility maintenance strategies.

**Maintenance news, articles, products**
- Lubrication Guide
- Maintenance products
- Asset management
- Lean maintenance
- Contract maintenance
- Inventory
- Lubrication
- Material handling
- Maintenance strategy

**Editorial research studies**
- 2017 Safety Report
- 2017 Maintenance Report
- Additional studies available at: [www.plantengineering.com/research](http://www.plantengineering.com/research)

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