FLUKE

Developing an inspection program

White Paper

Thermography

There are no easy solutions to the high costs of maintenance. The amount of time and effort required to select predictive methods that will provide the most cost-effective means to evaluate the operating condition of critical plant systems; establish a program plan; create a viable database; and establish a baseline value is substantial. The actual time and manpower required will vary depending on plant size and the complexity of process systems. For a small company, the time required to develop a viable program will be about three manmonths. For large, integrated process plants, this initial effort may be as much as 15 manyears. Are the benefits worth this level of effort? In almost every instance, the answer is an absolute yes.

Here are 10 steps that can help you implement a successful total plant predictive maintenance program:

1. Determine existing maintenance costs

The most difficult step in the initial justification of a predictive maintenance program is the determination of actual maintenance costs. Most plants do not track all controllable costs that are directly driven by the maintenance operation. In most cases, the cost-accounting function limits cost tracking to actual labor and material used to maintain plant equipment. They do not include the impact of maintenance on availability, production capacity, operating costs, product quality and the myriad of other factors that limit plant effectiveness.

In addition to maintenance labor and material costs, your evaluation should include all maintenance-related costs associated with delays, reduced capacity operation, overtime premiums, and product quality. Safety and environmental compliance should be included in your evaluation.

In some cases, your accounting department can help develop a close approximation of the true costs of maintenance. Explain the reason for your request and let them help quantify the historical plant costs.

The cost history developed at this time is extremely important. Initially it will be used to develop a cost-benefit analysis and justification for your predictive maintenance program. Later, this data set will become the baseline for quantifying the actual benefits derived from the program. Plants should not shortcut this part of the program implementation. Accuracy and completeness of this data set is critical to the long-term success of your program. The majority of programs that failed in the first two years following implementation can be directly attributed to the lack of quantified results.

2. Select predictive systems and vendors

Another major contributor to program mortality is the selection of either the wrong predictive technologies or a vendor who cannot provide long-term program support. Extreme care must be used during this selection process.

A total plant predictive maintenance program must use a combination of monitoring and diagnostic techniques to achieve maximum benefits. None of the individual technologies, such as thermal imaging and vibration, provide all of capabilities that are required to evaluate critical plant process and systems. What combination of technologies is best for your plant?

Unfortunately, there is no easy answer to this question. The predictive requirements of each plant are different. As a minimum, your program should include (1) key operations processes analysis, (2) thermal imaging, (3) process parameters, and (4) visual inspection. Lubricating oil and wear particle analysis (tribology) should be used only where the added information derived will justify the costs.

Care should be exercised when selecting predictive systems and vendors. As a minimum, the following should be considered when selecting predictive maintenance systems:

a. Adequacy to your specific needs

None of the predictive maintenance systems are perfect. Each has its unique strengths

and weaknesses. For example, many of the vibration monitoring systems cannot handle machine speeds below 600 RPM or lack the ability to use a variety of transducers. Either or both of these limitations will reduce the benefits that can be derived from your program. Define the specific requirements for your systems and make sure that the selected systems will fulfill all requirements.

b. Stability of system and vendor
Predictive maintenance programs are intended to be life of plant, continuous improvement programs. Therefore, it is essential that the systems you select for your plant will remain viable for an extended time period. Competition within the predictive maintenance arena is fierce and many of the early players have gone out of business, merged with other companies or constantly change their system structure. All of these factors will affect the long-term status of your program. Your evaluation should include:
- Financial strength of the vendor;
- History of product development;
- Technical support and
- Existing client base.

3. Training requirements and support
Most predictive maintenance vendors will offer some level of training. However, most of these training programs are directed toward the use of a specific system, i.e. software and instrumentation, rather than comprehensive use of the technology. As a reference, I have used all of the predictive maintenance technologies for more than 30 years and still learn something new every day. There are a number of vendors that offer technical training that can support your predictive maintenance program. However, you should carefully evaluate the merit of their courses before electing to use them as training support. In general, independent training companies, with no association with equipment manufacturers, can provide high quality training with an unbiased approach.

4. Get management support
Lack of a total commitment from plant or corporate management to provide the resources required to implement and maintain a program is the single largest reason for failure of predictive maintenance programs. There are a number of reasons for lack of long-term commitment. However, in most cases, it stems from the lack of planning and justification in the pre-program effort. Management must know the true cost and potential benefits of the program before it begins. After implementation, they must be continually informed of the progress and actualbenefits that the program provides. Therefore, it is imperative that a viable means of quantifying the actual results of the program be developed and the ongoing status of the program communicated to all key management staff.

Management support should include implementation of a formal maintenance planning function, a viable information management program and craftsman skill training in order to gain maximum benefits from predictive maintenance. The predictive program will provide the trigger for maintenance activities, but without proper planning and repair skills, full benefits cannot be obtained. The information management program has two functions: (1) maintain equipment histories and (2) track program benefits.

5. Develop a program plan
A definite program plan that includes all activities required by a total plant predictive maintenance program must be developed before implementing your program. The program plan should include:
- Specific scope of program;
- Goals and objectives; and
- Methods that will be used to implement, maintain and evaluate the program.

The plan should also include specific return-on-investment (ROI) milestones that can be used to measure the success of the program.

6. Dedicated personnel
A key part of a successful program is a full-time, dedicated staff. The program cannot be implemented or maintained with part-time personnel. Regardless of the predictive maintenance techniques used for the program, regular, periodic monitoring of critical plant parameters is an absolute necessity. Most programs implemented with part-time staff have failed because activities required to maintain the program have been delayed or ignored because of other pressing demands on staff time.

7. Establish accountability
The predictive maintenance team must unde stand the reason for implementing the program and be accountable for its success or failure.

Staff commitment is an absolute requirement for a successful program. Without this total commitment, the program will probably fail. Division or area managers must also accept responsibility for program success. In most plants, these managers control the resources, both financial and personnel, within their departments. Without their full support and commitment to the program, little can be accomplished.

8. **Develop a viable database**
The actual benefits derived from a program will depend on the accuracy and completeness of the database developed for the program. All predictive maintenance technologies depend on a clear, detailed definition of the critical equipment that is included in the program.

Database development requires a tremendous effort in both manpower and time. A typical microprocessor-based predictive maintenance program may require as much as 10 man-years to develop in a large, integrated process plant. Even small plants must invest an average of 1 to 3 man-years in this startup effort. However, the time is well spent. The initial investment will greatly reduce the manpower and time required to maintain your program and will greatly improve the benefits derived from the program.

Many program failures result from shortcutting the database development step. In part, this is driven by the absence of accurate machine data and by the restrictions of many predictive maintenance systems. To achieve maximum benefits from your program, invest the time and manpower required to establish a complete database.

9. **Maintain the program**
Do not quit after the implementation phase is complete. Many programs fail because the plant staff did not follow through after the development stage. Follow the program plan. Meet each of the schedules and milestones developed in the program plan. Constantly evaluate the program's progress and correct any errors or problems that may exist. A successful predictive maintenance program must be dynamic. Follow through.

10. **Communicate**
Communication is absolutely necessary for long-term success. All successful programs have a well-defined communications plan that includes transmittal of corrective actions identified by the program; feedback from manufacturing; and a regular program status report that is circulated throughout the plant and corporate management team.

Program justification is a never-ending process. Management and other plant team members must be continually informed of the program's status and the benefits derived from it. Failure to communicate will severely reduce the potential for a successful program.

The Payoff

Although the effort required to implement and to maintain a total plant predictive maintenance program is great, so are the benefits that can be derived. Properly implemented and maintained, predictive maintenance, as part of a total plant performance management program, can reduce the negative impact of maintenance on availability, product quality and operating profit.

Predictive maintenance can transform the maintenance operation from an expensive support function to a full member of the profit generating team in your plant. Do not expect an easy quick fix. Like all things of value, a certain amount of effort is required to gain positive results. If you follow these steps, you can establish a total plant predictive maintenance program that will provide maximum benefits for your plant.

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