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Computerized Maintenance Management System and Equipment Reliability Program Integration Issues and Opportunities

1010273



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Technical Update, December 2005

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CITATIONS

This document was prepared by

EPRI Solutions, Inc.
942 Corridor Park Blvd.
Knoxville, Tennessee 37932

Principal Investigator
J. Thibault

This document describes research sponsored by the Electric Power Research Institute (EPRI).

This publication is a corporate document that should be cited in the literature in the following manner:

Computerized Maintenance Management System and Equipment Reliability Program Integration Issues and Opportunities. EPRI, Palo Alto, CA: 2005. 1010273.

ABSTRACT

EPRI has performed a number of projects aiding in the selection of Computerized Maintenance Management Systems (CMMS). Since these projects have been performed, these technologies have progressed as more and more systems are installed. This report is not intended to act as a guide to CMMS selection or implementation; but to present reliability opportunities for current and future CMMS users. As more organizations implement CMMS, the challenge is to look beyond mere implementation or "going live"; but to improve equipment reliability. A CMMS alone cannot improve equipment reliability or increase plant availability. Instead, a CMMS is a useful tool to tracking equipment health and maintenance resource management for a well-disciplined organization.

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1
CMMS SELECTION AND IMPLEMENTATION

EPRI has performed a number of projects aiding in the selection of Computerized Maintenance Management Systems (CMMS). Since these projects have been performed, these technologies have progressed as more and more systems are installed. This report is not intended to act as a guide to CMMS selection or implementation; but to present reliability opportunities for current and future CMMS users.

Major Definitions

Computerized Maintenance Management System (CMMS)

Computerized Maintenance Management Systems (CMMS) schedule, track and monitor maintenance activities and provide cost, component item, tooling, personnel and other reporting data and history. These systems have increasingly been used in power generation facilities over the past decade to help track and improve maintenance organization.

Enterprise Asset Management (EAM)

An Enterprise Asset Management (EAM) system is the next generation of CMMS technology. An EAM integrates the features of a CMMS into other plant systems like accounting, operations, and security; and utilities common databases and user interfaces. EAMs have grown in popularity over the past decade because of increased computing and networking capability. These systems have an appeal to large organizations because of the potential cost savings from systems standardization.

CMMS vs. EAM in Reliability Maintenance

The difference between a CMMS and an EAM is not well-defined; because the scope of each overlap. As more organizations consolidate, the potential savings from EAM installations increase. Power generation facilities will increasingly be utilizing EAM installations. However, in terms of reliability maintenance, an EAM and CMMS are largely synonymous. The advantages gained in reliability come less from the type of system implemented and more from the disciple of the organization.

Basic Principles for Selection

The following is a quick overview of CMMS selection processes. For more information on CMMS Selection, please refer to Section 3.

Establish Objectives

The first step in selecting a CMMS is to establishing which issues the installation will address. Modern CMMS systems have myriad features and some organizations may be motivated to use as many of the features as possible. However, the purpose of the software is to aid in the efficient operation of the plant. Management should identify and prioritize where value will be gained by the operation of the CMMS. The following are a few examples of possible objectives for CMMS installations.

Work Execution-Related Objectives

A well-functioning CMMS should streamline how work is done. A few target objectives could be the following:

- Reduction of overtime
- Backlog reduced
- Task time reduced for routine tasks

Inventory-Related Objectives

A modern CMMS contains features which associate work orders with not just equipment; but tools and parts. The following are a few target objectives:

- Accounting for parts based on task performed
- Reduction in spares
- Decrease of the variety of replacement parts.

Reliability-Related Objectives

These objectives will be covered in greater detail in Section 3. A CMMS can help a plant achieve greater equipment reliability by bringing increased accountability and efficiency to a maintenance organization.

- Increase in percentage of Preventative Maintenance tasks not skipped or deferred.
- Increase in key equipment availability
- Decrease in amount of unplanned repair work

Evaluate Current Maintenance Practices

After establishing some initial objectives, it is important to evaluate current maintenance practices. The process should inform some of the objectives and may help in adding additional objectives or reprioritizing. A thorough and objective evaluation of current maintenance practices is the vital step to obtaining value from a CMMS. The intent of a CMMS installation is to improve maintenance efficiency. Computerization of an inefficient maintenance program may not improve plant reliability. Here are some key questions which should be asked:

- How are tasks being scheduled?
- How are tasks being tracked?

- Can all costs associated with a task be accounted for?
- How is backlog managed?

Define Needs

Following the establishment of objectives and the evaluation of maintenance practices, the identification of some general program functional needs should be established. The following are examples of the questions to ask when establishing functional needs:

- To what level does this CMMS need to be integrated with other plant systems such as accounting, plant historians, and other operations data?
- What systems will be included in the CMMS?
- What level of detail is necessary with equipment? Is only key equipment to be tracked? How are subcomponents to be handled?

Select Vendor

Each organization has different procurement methods and procedures for constructing requests for quotations. During vendor selection, a few key factors should be considered.

- Information Technology (IT) Policies – The CMMS will need to conform to security and operations policies established in the plant. Also, asking questions about data transfer early will help keep operations costs down in the future.
- Size of the Organization – The CMMS for a small, independent user tracking key systems will be different than that of a large utility maintaining all equipment through the plant.
- Vendor History – Within each CMMS-development organization is a unique set of skills and experiences. The key factor in determining a vendor's capabilities is to review what work the vendor has done in the past.
- Matching Vendor Capabilities with Plant Capabilities – Management may determine that evaluating maintenance practices would be within the capability of plant staff or that a third-party is best to evaluate those methods and practices. Determining what tasks need to be performed is important in evaluating what the CMMS vendor's capabilities.

Basic Principles for Implementation

Development and Installation Planning

This is the process for bring the CMMS from conceptual stage to "going live". Getting a system on-line and operational is just one part of implementation. When planning, it is critical not to ignore other issues like personnel training, improvement of maintenance practices, and continued improvement. Poor planning is a major reason for failure in CMMS implementations. Having key members of the staff who are responsible for maintaining and adjusting the development and installation planning will help keep the vendor accountable and insure that the project will meet its objectives.

Training

All too often, training is the last priority of a CMMS project. By the time that personnel are actually training on the system, the project is facing increasing budgetary and scheduling pressures. If all of the people who are supposed to use a CMMS do not know how to use it and do not have quick access to operational information, the CMMS cannot be effective. Starting training as soon as possible and involving as much of the plant staff in testing and evaluation helps to insure that the CMMS will be used correctly when the development is finished. Training should be relegated to as the last task to be completed.

Metrics Review

Before the vendor was hired, the plant should have determined what the CMMS implementation should help the plant achieve in measurable terms. Establishing, measuring, and evaluating these metrics is important to determining if the project is successful, and is key to prioritizing mitigation plans during initial implementation. A CMMS project never has unlimited resources, putting the resources to addressing important areas is vital for success; but it should be agreed upon early what the criteria for success is and those metrics should be evaluated periodically.

Vendor Support

Since post-development support following initial implementation, one step which is overlooked is establishing scope for vendor support following installation. As was the case with development, it is important to establish needs and have key plant personnel accountable for how vendor technical and operation support will be executed.

New Developments

From the time that a plant decides to implement or upgrade a CMMS to implementation, the system can be considered out-of-date by some. While it is often valuable to take advantage of the value offered by new features, it is important to consider first what the agreed upon objectives were for CMMS implementation. The following are the major areas of advancements in CMMS technology.

Web Delivery

A growing number of CMMS programs are delivered via the Internet or an Intranet; and the user interface is handled using web browsers. These systems have a number of advantages:

- Centralized data storage.
- Standard interfaces.
- Reduced maintenance costs.
- Licensing simplification
- Enhanced communication between remote sites

While web-delivery makes sense for a number of organizations and is increasingly preferred among new CMMS customers, this method presents a number of challenges for power

producers. For instance, web delivery often requires that the computer being used is connected to a network when work orders are being entered and evaluated. Also, customization of screens can be difficult.

Integration with Other Plant Systems

The evolution of CMMS to Enterprise Asset Management (EAM) systems has been aided mainly by the development of database integration technologies like Open Database Connectivity (ODBC). Modern systems can now be integrated to a number of systems like plant historians, accounting systems, and even security systems. While the increase capability can appear to be useful, this area can be dangerous in terms of scope creep. It is important to measure possible features against established project objectives.

Integration with New Plant Technologies

As is the case with integration with plant systems, modern CMMS program allow quick data transfer to items like RFID readers for inventory and an increasing number of equipment condition assessment technologies like vibration measurement systems. While these capabilities are touted by vendors, each case of integration should be thoroughly evaluated in terms of meeting project objectives.

2
EQUIPMENT RELIABILITY

Simply installing and using a CMMS does not guarantee to increase equipment reliability or availability. A CMMS can be a powerful tool in a well-disciplined maintenance organization to applying resources to valuable maintenance tasks. EPRI has written dozens of reports on Reliability-Centered Maintenance and Plant Maintenance and Reliability Optimization; and hundreds of reports on condition-based and predictive maintenance technologies. This section does not deal specifically with the integration of any one technology; but instead covers some general practices in improving equipment reliability utilizing CMMS data.

Preventative Maintenance (PM) Compliance

In many plants, Preventative Maintenance (PM) tasks are ignored because of emerging needs caused by equipment failures, aging equipment, and limited maintenance resources. In many cases, PM tasks are overlooked, cancelled, marked as done without being properly completed or delayed indefinitely. Deferring necessary maintenance is detrimental to equipment reliability. In many organizations, addressing critical repair needs while performing necessary maintenance is increasingly difficult. Looking at what percentage of PM tasks actually get performed is only one metric. Prioritizing, scheduling, and adjusting PM frequencies based on plant experience and quantitative data can greatly enhance key equipment reliability. Proper utilization of a CMMS during PM planning and scheduled; and subsequent review of the data can make the CMMS a powerful tool in enhancing equipment reliability.

Emergent vs. Proactive Action Ratio

A key measure of how well a maintenance organization is operating is what percentage of resources is being spent handling emergent issues. Emergent issues can be defined as issues which are brought on by equipment degradation and/or major failure which are often unscheduled. Ideally, a maintenance organization would never deal with emergent issues. While this result is purely theoretical, a maintenance organization can lower the amount of emergent work performed by improving maintenance practices and assigning resources to effective preventative tasks. Using the CMMS to track this ratio is a powerful first step to improving this key metric of a maintenance organization's effectiveness.

Post-Action Information

Getting information as to what tasks were performed during a repair or PM task is the first step to optimizing that task. The CMMS at some plants have a rigid set of field entries for plant personnel to fill out following a maintenance action. The following list is an example of possible post-action items that can be tracked by the CMMS.

- Checklists
- Measurements
- Readings
- Actions Taken
- Additional Tools Needed
- Parts Used
- Additional Parts Needed w/Numbers
- Additional Materials Needed
- Equipment Identification Numbers
- Number of Manhours
- Additional Steps Taken

Failure History

At many facilities, the complete failure history of a component is tracked only in the memories of certain plant personnel. The judgments made from this are largely subjective and sometimes emotional. Tracking failure histories from CMMS data allows plant management to objectively analyze equipment performance and assign resources accordingly.

Maintenance History

Equipment getting exactly the amount of maintenance it needs is rare. For some maintenance organizations, trying to achieve the manufacturer's recommended maintenance intervals for each piece of equipment is the definition of PM compliance. However, performing unnecessary maintenance endangers plant availability and takes resources away from necessary maintenance tasks. Utilizing CMMS data along with condition-based and predictive maintenance technologies can better inform PM frequencies, tasks, and even help management make more objective decisions for equipment replacement.

3
SOME CMMS RESOURCES

EPRI Reports

CMMS Selection, Implementation, and Guidelines

Table 3-1: CMMS Reports

Number	Product Title	Date
TR-108938	CMMS Selection at Wisconsin P.S.: Computerized Maintenance Management System	10/97
TR-109728	CMMS Selection at Cinergy (Computerized Maintenance Management System)	12/97
TR-111464	Computerized Maintenance Management System Best Practices	12/98
TR-111151	CMMS Implementation at Cinergy Computerized Maintenance Management System	2/99

Maintenance Process Improvement

Table 3-2: Maintenance Process Improvement Reports

Number	Product Title	Date
TR-109795	Streamlined Reliability-Centered Maintenance (SRCM) Program	12/97
TR-109795-V2	Streamlined Reliability Centered Maintenance (SRCM) Implementation Guidelines	10/98
TR-109795-V3	Streamlined Reliability Centered Maintenance (SRCM) Implementation Guide	10/99
TR-107902	Cost Benefit Analysis for Maintenance Optimization	12/99
TP-114094	Equipment Maintenance Optimization Manuals (2)	12/99
1004018	Boiler Reliability Optimization Guideline	9/01
1004016	Streamlined Reliability Centered Maintenance Analysis Application Update	10/01
1006537	EPRI Boiler Reliability Optimization Program: Case Studies from 1998-2001	12/01
1004376	Streamlined Reliability Centered Maintenance at Reliant Energy	11/02
1004705	Maintenance Excellence Matrix: Assessment Guideline for Fossil Power Plants	11/02
1007442	Reliability Assessment of the Coronado Generating Station	3/03
1004377	Consolidated Plant Maintenance Optimization Guideline: For Fossil Power Plants	12/03

Recent Industry Articles

In 2005, *Maintenance Technology* magazine published by Applied Technology featured a three-part series on "Managing an EAM/CMMS Project".

- May 2005: "Phase One: An unbiased team approach to system selection", C. Scott MacMillan and Lance Morris, Cohesive Information Solutions, Inc.

- June 2005: "Phase Two: Best practice methodologies for system implementation", C. Scott MacMillan and Lance Morris, Cohesive Information Solutions, Inc.

- July 2005: "Phase Three: Instilling a mindset of continuous improvement for system optimization", C. Scott MacMillan and Lance Morris, Cohesive Information Solutions, Inc. *Note: This issue contained a Directory of EAM/CMMS providers.*

Books on CMMS Selection, Implementation, and Improvement

As more organizations have implemented CMMS, a number of books have been released covering methods and the lessons learned from implementation.

- Terry Wireman. *Computerized Maintenance Management Systems*. Industrial Press, Inc. New York. 1994.

  This book covers the basics including maintenance management and organization, work order management, site implementation team guidelines, and integration with other plant systems.

- Daryl Mather. *CMMS: A Timesaving Implementation Process.* CRC Press, Ottawa, IL. 2002.

  This book covers many of the same areas as *Computerized Maintenance Management Systems*, but also includes sections on cause code development, development of key performance indicators, and a description of the differences between CMMS, EAM, and Enterprise Resource Planning (ERP) systems.

- Richard D. Palmer. *Maintenance Planning and Schedule Handbook.* McGraw-Hill, New York. 1999.

  While this book covers Maintenance Planning and Scheduling concepts, it does so while explaining how to integrate each into a CMMS. This book could serve as a reference for those who wish to improve their maintenance process utilizing a CMMS.

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