

A UNICCO Whitepaper:



Life Cycle Management

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INTRODUCTION

Innovative practices are needed more than ever to cost effectively maximize the use of current production processes and the facilities that house them, commercial facilities and institutional facilities. Global competition is driving facility and production process owners to increase quality while reducing operating and maintenance expenses. At the same time, regulatory and social factors are making it more difficult to obtain environmental permits for new sites. The long-term use of current assets means management of age-related degradation (corrosion, wear, fatigue, etc.) will become even more important. The prudence of management decisions affecting expenses and capital costs are being challenged more and more by shareholders and regulatory agencies. A discipline is needed that can help management and engineers cope with these issues and reliably forecast future expenditures.

A Life Cycle Management (LCM) Program is the discipline for efficiently supervising the ongoing performance and aging of a facility and/or production process. A clear relationship is established between economic, performance and quality goals and the ways to effectively manage them. Unforeseen capital expenditures (“surprises”) are minimized and long-term strategic planning is made more effective. The earlier such a program is started, the greater the return on investment if LCM proves to be a business consideration.

UNICCO[®] Service Company is experienced in the development and implementation of LCM programs, tools, and techniques. UNICCO has developed and applied the associated methods, procedures, computerized techniques, and technical resources in numerous facilities. UNICCO can quickly assess the current condition of a facility or production process, and customize a practical, cost-effective LCM program. The program can be designed to use MAXIMO[®], a fully integrated and computerized work management system incorporating modules, such as on-line maintenance (proactive and reactive), supply support/provisioning, and accounting functions such as purchasing and inventory control. In addition, UNICCO provides complete facility and process management services for those organizations choosing outsourcing as a strategic and economical approach.

This paper was prepared to address some of the questions you may have about life cycle management. We believe that once you are informed, you will see the large potential value of an LCM Program and want to know what UNICCO can do to assist you with the development of a program for your facility and/or production process. Throughout the remainder of this paper, the terms, “asset”, “facility”, and “production process” are used interchangeably.

WHAT IS LIFE CYCLE MANAGEMENT?

Achieving the maximum economic benefit and utilization of an asset is accomplished by thoughtful planning and design. Good management practice assures this by mandating that a strategic approach be developed and implemented. The Life Cycle Management (LCM) Program is the discipline that will address the manager's strategic concerns and provide critical information to support decisions in a timely fashion. It promotes long-range organization and operating philosophies. LCM is a continuous process that begins with an integrated assessment of all the factors affecting the operation, maintenance, service life, and ongoing resource requirements for a facility. LCM produces a realistic long-term forecast of investments and activities that will be needed to maintain and operate the asset.

Other attributes and products of a LCM Program are that it:

- ❑ Emphasizes forward thinking problem recognition and resolution.
- ❑ Prioritizes resources and activities on the aspects of the facility that allow economic, performance, and utilization goals to be achieved or exceeded.
- ❑ Produces an integrated examination of the major structures and equipment, what can degrade or fail and why, and effective ways to prevent it or minimize the risk of failure.
- ❑ Uses accepted business process re-engineering methods to recognize opportunities to rethink operating approaches and reduce adverse challenges to key structures, and equipment.
- ❑ Looks at and beyond the current formal and informal maintenance and inspection programs to verify that the procedures and resources are being applied effectively and efficiently.
- ❑ Provides the basis for extended operation, changes in utilization, capital improvements, and investments in quality by excellence.
- ❑ Formalizes opportunities to improve or optimize maintenance activities and reliability characteristics.
- ❑ Highlights the impact of equipment obsolescence, spare parts unavailability, demographic changes, compliance with new and emergent regulations (i.e., OSHA, EPA, etc.) competitive influences, and other non-technical or peripheral issues.

- Retrieves and preserves the institutional knowledge of key personnel and minimizes the “reinvention of the wheel” syndrome when personnel changes occur.
- Reduces corporate risk and liability exposure, and enhances work safety and compliance with OSHA and EPA requirements.

Establishing a LCM Program does require an initial investment. The size of the investment depends on the complexity and current conditions of the facility or process, scope of the program, quality and completeness of commensurate measures currently in place, and other considerations. UNICCO customizes the LCM Program to make sense for each facility. Opportunities to realize both near-term and long-term benefits are built into the program from the beginning. Implementation of the program maintains an ongoing and clear working relationship between quality, performance, service life, and economic goals. Unanticipated failures (or surprises) are minimized, and strategic planning is made more effective.

WHERE DOES LIFE CYCLE MANAGEMENT APPLY?

The principles of life cycle management can be successfully applied to any capital or labor intensive asset. The program can be set up for an entire complex (multiple facilities), a facility and all its production processes, or for selected processes, systems, or equipment assemblies. The asset can be any medium to large industrial or manufacturing facility as well as any large commercial facility or institution. The greatest benefit from developing and implementing a LCM Program occurs in any of the following situations:

- Assets requiring a large capital outlay, relatively long lead time for replacement, and/or scheduled outages, changeovers or downtimes for maintenance that are infrequent and short in duration.
- Assets whose operation and maintenance costs dominate the strategic planning decisions concerning new capital expenditures and economic service life.
- Where the prudence of management decisions regarding operating and capital expenditures for the facility are subject to shareholder, government agency, or third party examinations.
- Where there is a need to effectively optimize and/or integrate several ongoing maintenance activities or programs (such as preventive maintenance, reliability-centered maintenance, predictive maintenance, corrective maintenance, surveillance activities, etc.) that have evolved during the service life of the facility.

- Facilities in regulated industries.
- Facilities requiring special siting considerations such as the need for an environmental impact assessment.
- Facilities that may adversely affect employees and public health and safety, and/or need to comply with federal OSHA regulations (including 29CFR1910, “Process Safety Management of Highly Hazardous Chemicals”), EPA regulations, or similar state and local regulations.
- Federal, state, and local infrastructures, requiring assurance that long-term integrity can be maintained and long term funding requirements for the modifications, repairs, inspections, and testing are realistic.

Of course, if the current process for operating and maintaining the facility is not yielding the desired results, then life cycle management may be the solution.

WHEN SHOULD A LIFE CYCLE MANAGEMENT PROGRAM BE APPLIED?

The decision of when to start a Life Cycle Management Program is driven by the need to effectively apply resources and assets in a changing world, to have a reliable vision of the future, and to avoid crisis management situations. Most would argue that you cannot start soon enough. The insights provided by LCM are needed from “day one”. It is just a matter of tailoring the scope of the program throughout the service life of the facility as the performance goals and strategic objectives are redefined.

Historically, LCM Programs get started when it becomes apparent that a choice will have to be made whether to continue operating the current facility or to replace it. Another issue which initiates interest in LCM is when it is uncertain that the cost of a new capital addition can be recovered during the remaining service life of the facility. In this case, the primary focus is on realistic forecasts of operating and maintenance costs, and/or the viability of assuring asset health and extending the service life. The need for more effective methods to control operating and maintenance costs also causes LCM efforts to be considered. An effectual LCM program incorporates many Predictive Maintenance (PDM) elements with an emphasis on precision maintenance techniques. PDM in manufacturing environments provide greater insight in conditions of equipment, enhanced planning and scheduling, and up-time optimization.

WHAT ACTIONS ARE NECESSARY FOR PROGRAM REALIZATION?

Step #1: Perform Facility and Equipment Assessment

Before the decision is made to consider LCM as a maintenance solution, a thorough examination and analysis is conducted. This will determine the current operating conditions and life expectancies, compare costs replacement and the return on investment, and overall asset health. Cost of execution will be impacted if LCM implementation is not methodically researched.

A thorough review of existing PM and PDM programs and efforts are also examined as part of condition assessment. Features and conditions that would impose significant replacement or refurbishment costs, and regulatory or public relations costs, are specifically noted. The collected information is compared to UNICCO's library and database of facilities, processes, equipment, and components in service having similar functions and subject to similar environments. This allows UNICCO to characterize the relative nature, scope, and cost of the activities that will be needed in the near-term and long-term.

The initial appraisal tests the economic viability of the facility goals versus other perceived alternatives. Information from the condition assessment and studies performed by UNICCO for other relevant facilities are used in an economic analysis. The results of the analysis allow management to prudently evaluate the goals, see the potential merit of a LCM Program, shape the scope of the program, and identify the resource requirements.

Step #2: Shape the Scope of the Program and Prepare the Program Plan

It would not be prudent to develop a Life Cycle Management Program that applies an equal investment of resources to all the elements (structures, equipment, and/or components) of a facility. The elements having the greatest influence on costs, safety, and reliability merit the most attention to preserve and maintain their performance. These are the elements that could directly impact the continued use of the facility and force its eventual shutdown or retirement. These are the "critical elements".

UNICCO uses a qualitative approach to identify, categorize, and model the critical elements. The approach is derived from accepted business process re-engineering methods and tailored to the area of asset management. It considers replacement feasibility, service history, performance impact, regulatory consideration, and the potential benefit of preventive maintenance activities. The results produce a ranking of the facility elements in each category. The highly ranked elements are the "critical elements" and they become the focus of the program. The lower ranked elements receive a proportionally reduced level of attention.

UNICCO's LCM Program is designed for the long term and typically involves the organizations that manage, operate, and maintain the facility. Therefore, the program plan is an effective tool to ensure that these organizations are cognizant of the goals and objectives, and are pulling in the same direction.

The plan defines the scoping considerations, evaluation approaches, and implementation priorities. The responsibilities of the affected organizations, schedules, and resource requirements are also defined in the plan.

Step #3: Establish Effective Maintenance Requirements and Methods

Most facilities are subject to some type of preventive maintenance activities. The activities may include periodic replacements, refurbishment, inspections, overhauls and/or testing. They are conducted using formal and informal procedures. Formal procedures are documented and approved by cognizant personnel in responsible charge.

The effectiveness of current procedures is examined in Step No. 3 of the Life Cycle Management Program. The process ensures that the elements of the facility are subject to measures or controls at intervals commensurate with their influence on costs, safety, and reliability and/or the manifestation of the conditions leading to degraded performance or failure. A more thorough examination is performed for the critical elements.

The examination focuses on developing an understanding of the mechanisms contributing to degraded conditions. Damage through misuse and age-related degradation are the prominent, contributing mechanisms. Misuse may be a result of poor quality, improper repairs, and over use. Aging affects all facilities to some degree. Aging mechanisms include corrosion, fatigue, wear, etc. The rate, magnitude, or character of age-related degradation can change over time as a result of environmental conditions, service duty, or specific material performance.

The examination process considers the design features, design requirements, materials and operating and maintenance history. The contributing mechanisms are identified and their influence on ongoing performance is characterized. Next, the capability of the current procedures to effectively detect and mitigate these mechanisms is evaluated. Operational experience and manufacturer's information are investigated as appropriate. Production/utilization schedules are examined to identify opportunities to perform maintenance activities.

The examination process is expected to identify the need for enhancements or corrective action. Typically, these enhancements involve refocusing maintenance activities to emphasize the critical elements; formalizing current

practices and schedules; and adjusting the scope and/or frequency of inspections, surveillance, and testing activities to ensure that they will detect and mitigate the contributing mechanisms. Sometimes the enhancement may involve changes in operation, production, or utilization.

The modularized features of the MAXIMO computerized work management system can be used throughout the examination process to capture, analyze, and report on the facility features, history, contributing degradation mechanisms, and associated maintenance activities. This would allow the examination results to be more effectively and efficiently applied during the ongoing implementation steps of the program. For example, the MAXIMO asset management module would be applied to define all the facility equipment and structures included in the LCM Program. The module would retain the type, size, manufacturer, vendor, model, serial number, associated system designation(s), etc. As work is completed, the module would also retain the repair history for use in trend analysis and preventive maintenance planning.

Step #4: Recognize the Peripheral Issues

The LCM Program needs to examine more than just the hardware issues to develop a complete picture of all the factors affecting the operation, maintenance, and service life of the facility. The non-hardware considerations are referred to as peripheral issues. Governmental, environmental, personnel, training, public relations, financial, and social issues are included and may affect the strategic decision regarding the continued use of the facility. Some of the more influential peripheral issues are:

- Transfer of Institutional Memory – Key personnel on the current staff develop a valuable knowledge base about the design, operation, and maintenance of a facility. These personnel typically solve problems without creating new ones in the process. Establishing methods for capturing and transferring this institutional memory to new personnel is an important LCM consideration.
- Prudency Issues – Management of regulated and publicly held companies often wrestle with the difficult decision of justifying the prudency of expenditures. Making provisions in the LCM Program for monitoring, feedback, and periodic cost/benefit evaluations is the key to developing the information management needs and keeping the LCM Program on track.
- Technical Obsolescence – The longer-term availability of replacement parts and competent suppliers needs to be recognized in the LCM Program for some facilities. This is particularly important when there is a significant dependency on specialized machinery or the performance of electronic components.

- Changes in Regulatory Requirements and Industry Standards – This change may require the facility to be back-fitted to remain in compliance. Employee safety and handling hazardous materials are typical examples.

Step #5: Prepare a Life Cycle Management Diagram

Optimizing capital and labor costs for a facility, process, or piece of equipment requires a reliable forecast of the replacement, refurbishment, and maintenance activities. A convenient illustration for this purpose is the life cycle management diagram. The diagram is a time line of all the activities showing the recurrence intervals, cost, man-hours, etc. Other pertinent information, such as the description of the activity, performance schedule, implementation prerequisites, etc., is maintained in a supporting database. Peak activity periods can be easily recognized on the diagram and effectively planned or alternative methods examined that would level resource requirements. Critical and routine spare parts can be better stocked to meet operational needs without the cost of excess inventory. Inventories may even be shared by facilities within comfortable geographic proximity.

Step #6: Implementation and Ongoing Monitoring

Life Cycle Management does not stop when the evaluations are completed. Nor is there just a single set of implementation activities. LCM is an ongoing process that requires a thoughtful implementation plan and continuous feedback to ensure facility goals are achieved and benefits are maximized.

Step 6 shifts UNICCO's LCM effort from evaluation to implementation. The factors to be addressed are:

- Use the evaluation results and cycle management diagram to formulate appropriate implementation strategies. For example, some of the long-term or larger scope activities may only be implemented if certain revenue goals are achieved, regulatory changes are made, or industry research is completed. In these cases, the implementation activities are staged accordingly.
- Identify the affected organizations, their responsibilities, and resource requirements.
- Establish an implementation schedule and annual budgets.
- Provide for training of personnel involved in maintenance, inspection, and other LCM activities.

- Perform the implementation activities. MAXIMO, the computerized work management system, can be used to generate work orders for all processes in accordance with the planned LCM schedule. It can also interface with other facility business systems to form an integrated enterprise-wide capability.
- Establish methods for ongoing monitoring and feedback based on observed trends. UNICCO typically uses MAXIMO for this task. MAXIMO can be easily set up to include the necessary procedures, graphs, criteria, etc. to allow tracking of performance relative to goals and thresholds.
- Conduct routine appraisals and reassessments, and institute the required course corrections.
- Prepare administrative control documents and measures that ensure changes to the facility and to the maintenance programs properly consider the LCM evaluations and requirements.

The implementation plan is a convenient tool to describe and provide for many of the above factors. The plan can be presented to management to receive the required authorizations and to set the wheels in motion.

Step #7: Cost/Benefit Analysis

Corrective and preventive maintenance activities and ongoing monitoring may add to the overall cost of operating a facility, process, or piece of equipment. A periodic cost/benefit appraisal is needed to consider the merits of other options such as replacement, adding new inspection techniques, increasing (or decreasing) maintenance activities/frequencies, etc. MAXIMO can be conveniently used to take information from the life cycle management chart, examine the routine operating practices and costs, and determine the most cost-effective time to perform the required maintenance activities. UNICCO has significant experience in economic modeling and cost/benefit analyses and maintains, without MAXIMO, a database of capital and labor costs for maintenance, refurbishment, and replacement activities.

WHAT ARE THE BENEFITS OF A LIFE CYCLE MANAGEMENT PROGRAM?

Establishing a Life Cycle Management (LCM) Program requires a modest investment. The investment is made over the course of the service life of the facility. For this investment, management is expecting a payback in a reasonable time period. Reduced operating and maintenance costs are expected. The benefits of a LCM Program are realized in the near term and long term. These are intangible benefits as well.

Since many LCM Program activities address the detection and mitigation of degradation, it is not surprising that near-term benefits are realized. These activities provide benefits by avoiding corrective maintenance expense and unplanned operational failures (repair and replacement expense). Maintenance is anticipatory instead of reactive. Resources are effectively optimized and prudently focused on the aspects of the facility that have the greatest influence on productivity and operating costs. Spare parts inventories are brought in line with real needs and can be more cost effectively purchased because the “guessing and surprises” are removed from the equation. The payback after the first several years can be more than enough to pay for the development of the program, the engineering evaluations, and the near-term implementation costs. Facilities with preventive maintenance programs will also derive near-term benefits, because these programs will be improved and more efficient.

The long-term benefits are both “economic” and “strategic” in nature. The disciplined process of the LCM Program quantifies the service life margins of the various elements and processes of the facility in terms that facility operators can understand. For most facilities, this heightened awareness results in increases in production, capacity or availability, and constitutes a major benefit of the LCM Program. Changing regulation and environmental requirements are making the siting of new industrial facilities a very expensive proposition. Prudent investing in current assets to maximize their service life, thereby deferring the costs of replacement, will typically result in substantial benefits. Environmental requirements will, in many cases, necessitate restoring the site to a “green earth” condition when the facility is no longer required. Deferral of these expenses through a LCM Program will provide significant benefits. The need to make capital improvements will have many causes. The LCM Program will minimize the costs for refurbishing or replacing major structures, systems, and equipment. However, as the years of service continues, justifying investment in the facility becomes increasingly more difficult. The LCM Program takes the guesswork out of making these investments. The routine and fixed costs are well known, and any capital costs are likely to have been anticipated and well evaluated in advance. Such knowledge will lead to economic benefits, because long-term financial and strategic plans can be confidently executed.

Intangible benefits are difficult to quantify in an economic sense. Nevertheless, they can be important factors for justifying a LCM Program. For example, LCM activities promote and contribute to the overall operational excellence of a facility. Motivational factors are realized that produce improved employee morale teamwork, and quality awareness. An efficient and smooth running facility also promotes reduction in corporate risk and liability.

SUMMATION

At UNICCO, we believe that life cycle management is an important discipline required for world class competitors. The consequence of inaction is the possibility of escalating baseline costs worsened by unanticipated maintenance, refurbishment, or replacement costs. The net result is erosion of competitive positions and the confidence to achieve the needed return on investments. For most facilities, implementation of the LCM Program will pay for itself in a very short time period. A practical, common sense approach is applied so that the program can be easily managed over the long term. The program works for you; you don't work it. UNICCO currently supports the management of over 600 million square feet within more than 2,500 facilities and has been refining the concepts of facility management for the past fifty years. We know your improvement opportunities and have developed the solutions.



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