Achieve World-Class Production Through Reliability

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The vision of general management was that the new smelter located on the Mt. Holly Plantation near Charleston, SC, would begin operations with a planned maintenance system that could be developed into a total proactive system. At the time in 1978-79, there were no maintenance computer systems available on the market with the capability to support and accomplish the desired objectives. Thus TSW of Atlanta, Georgia was brought on site to take not only the Alumax of S.C. maintenance concepts and develop a computer system, but they were to integrate all the plant business functions into one on-line common data base system available to all employees in their normal performance of duties.

Since the development and initial operation of the Alumax of SC maintenance management system, it has matured and rendered impressive results. These results have received extensive recognition on a national and international level. The first major recognition came in 1984 when Plant Engineering magazine published a feature article about the system. Then in 1987 A.T. Kearney, an international management consultant headquartered in Chicago, performed a study to find the best maintenance operations in North America. Alumax of S.C. was selected as one of the seven "Best of the Best". And in 1989, Maintenance Technology magazine recognized Alumax of SC as the best maintenance operation in the U.S. within its category and also as the best overall maintenance operation in any category.

MAINTENANCE APPROACHES

From a basic point of view there are two maintenance approaches. One approach is reactive and the other is proactive. In practice there are many combinations of the basic approaches.

The reactive system responds to a work request or identified need, usually production identified, and depends on rapid response measures if effective. The goals of this approach are to reduce response time to a minimum (the computer helps) and to reduce equipment down time to an acceptable level. This is the approach used by most operations today. It may well incorporate what is termed as a preventative maintenance program and may use proactive technologies.

The proactive approach responds primarily to equipment assessment and predictive procedures. The overwhelming majority of corrective, preventative, and modification work is generated internally in the maintenance function as a result of inspections and predictive procedures. The goals of this method are continuous equipment performance to established specifications, maintenance of productive capacity, and continuous improvement. Alumax of SC practices the proactive method. The comments which follow are based upon the experience and results of pursuing this vision of maintenance.

MAINTENANCE MANAGEMENT PHILOSOPHY

Alumax of SC began development of the maintenance management concept with the idea that maintenance would be planned and managed in a way that provides an efficient continuous operating facility at all times. Add to this that maintenance would also be treated as an investment rather than a cost, and you have the comprehensive philosophy on which the maintenance management system was built. An investment is expected to show a positive return, and so should maintenance be expected to improve the profitability of an operation. The management philosophy for maintenance is just as important as the philosophy established for any business operation. For most industry, maintenance is a supervised function at best, with little real cost control. But it must be a managed function employing the best methods and systems available to produce profitable results that have a positive effect on profitability.

The development of a philosophy to support the concept of proactive planned maintenance is important. It is believed that many maintenance management deficiencies or failures have resulted from having poorly constructed philosophies or the reliance upon procedures, systems, or popular programs that have no real philosophical basis.

THE FUNCTION AND CONTROL SYSTEM

Today there is little disagreement that the function and control system of a good maintenance management program must be computer based.

Using the philosophy that maintenance management is to be considered in the same way that all other business functions are considered, it is difficult to justify any other approach other than complete integration of maintenance management functions with total organizational management functions. The computer is the tool to use to accomplish this difficult and complex task.

The computer, in an integrated operation, must be available for use by every member of the maintenance organization as well as all other plant employees who have a need. it is an essential part of the maintenance employee's resources for accomplishing his work. It is just as important to a mechanic or electrician as the tools in his toolbox or the analysis and measurement instruments that he uses daily.

The computer must supply meaningful and useful information to the user as opposed to normal computer data.

A successful integration of data systems will tie together maintenance, warehouse, purchasing, accounting, engineering, and production in such a way that all parties must work together and have the use of each other's information. This is part of the answer to the question being asked almost universally, how do you break down the barriers between departments and get them to work as part of the whole or as a team. The computer system must be on line, available, and time responsive. A batch system or semi-batch system will not provide the support needed for a dynamic, integrated, maintenance management system.

In the integrated system with a common data base, data is entered only once and immediately updates all other files so that its use is immediately available to all functional areas. This means that anyone in any functional area can use or look at data in any other area, unless it is restricted. Some have referred to this effect as the "fish bowl effect" since everything is visible to all. This stimulates cooperation, in fact, it dictates cooperation.

WHAT IS MAINTENANCE?

Everyone knows what maintenance is; or at least they have their own customized definition of maintenance. If the question is asked, words like fix, restore, replace, recondition, patch, rebuild, and rejuvenate will be repeated. And to some extent there is a place for these words or functions in defining maintenance. However, to key the definition of maintenance to these words or functions is to miss the mark in understanding maintenance, especially if you wish to explore the philosophical nature of the subject. Maintenance is the act of maintaining. The basis for maintaining is to keep, preserve, and protect. That is to keep in an existing state or preserve from failure or decline. There is a lot of difference between the thoughts contained in this definition and the words and functions normally recalled by most people who are "knowledgeable" of the maintenance function; i.e., fix restore, replace, recondition, etc.

SPECIFICATION

If we shift our defining thoughts to maintenance in the pure sense, we force ourselves to deal with keeping, preserving, and protecting. But what are we to keep, protect, or preserve? You may think that it is the machine, equipment, or plant, and that is true. But how are you to define the level to which the machine, equipment, or plant is to be kept. One way would be to say - "keep it like new". At face value the concept sounds good, but it is more subjective than objective. The answer to maintenance levels must be defined by a specification.

A specification is a detailed precise presentation of that which is required. We must have a specification for the maintenance of equipment and plant. In actual usage today the specification, if it exists, is not detailed or precise. A specification usually does exist informally in the mind of the mechanic or management member even though they may be unable to recite it. This means that at best, it is a variable, general -type specification. This kind of specification is defined in terms of and is dependent upon time available, personnel training level, pressure to produce a current order now, money allocated or available, or management opinion. Obviously, a specification like this will not qualify as a true specification, nor will it qualify as a supporting component of the act of maintaining. The true maintenance specification may be a vendor specification, a design specification, or an internally developed specification. The specification must be precise and objective in its requirements. The maintenance system and organization must be designed to support a concept based on rational specifications. Detailed work plans and schedules may be constructed to provide the specification requirement at the maintenance level. In the maintaining context, the specification is not a goal. It is a requirement that must be met. The maintenance system must be designed to meet this requirement. The specification must be accepted as the "floor" or minimum acceptable maintenance level. Variation that does occur should be above the specification level or floor. The specifications will probably be stated in terms of attributes and capacity.

In reference to maintenance specifications, included are individual equipment specifications, process specifications, and plant performance specifications.

THE MAINTENANCE FUNCTION

The maintenance department is *responsible* and *accountable* for maintenance. It is responsible for the way equipment runs and looks and for the costs to achieve the required level of performance. This is not to say that the operator has no responsibility for the use of equipment when in his hands - he does. The point is that *responsibility* and *accountability* must be assigned to a single function or person whether it be a mechanic or operator. To split responsibility between maintenance or any other department where overlapping responsibility occurs is to establish an operation where no one is accountable. Alumax of SC considers this a fundamental principle for effective operation of maintenance.

The maintenance function is responsible for the frequency and level of maintenance. They are responsible for the costs to maintain, which requires development of detailed budgets and control of costs to these budgets.

Just as the quality function in an organization should report to the top manager, so does the maintenance function for the same obvious reasons. This allows maintenance problems to be dealt with in the best interest of the plant or company as a whole. Maintenance efforts and costs must not be manipulated as a means for another department to achieve its desired costs results.

Where the maintenance department or group is held responsible and accountable for maintenance, the relationship with other departments takes on new meaning. The maintenance department can't afford to have adversary relationships with others. They must have credibility and trust as the basis of interdepartmental relationships. This is an essential element for the successful operation of a maintenance management system.

THE MAINTENANCE ORGANIZATION

The organization is constructed on the basis that the central functional element for core maintenance is the Technical team.

Technical Teams - Core Maintenance - These teams perform core maintenance for the plant. They are composed of qualified electricians, mechanics, and technicians. The teams are assigned based on a functional requirement plant wide or on the basis of a geographic area of responsibility. The focus, direction of the team, and individual team member needs are provided by an assigned member of the facilitator and directional control team.

Facilitator and Directional Control Team - Members of this team have been trained and qualified to provide team organizational dynamics and traditional supervisory functions as required. With the facilitator, the team must address work performance by categories, administrating, training/safety/housekeeping, budgeting and cost control and information reporting as well as the technical requirements of the team. These members perform the necessary traditional supervisory functions, especially related to personnel functions, for the technical teams.

Work Distribution and Project Coordination Team - This team works with the Facilitator, Planning and Engineering teams to staff technical teams to meet work load requests, inventory requirements, contractor support, and field superintendence of engineering projects.

Job Planning Team - This team works closely with the Technical teams and the Facilitator team to plan and schedule maintenance, overhaul, and contractor work. Where operators are doing maintenance functions, the same applies.

In addition, information and reports are prepared by this team for all other teams as required or requested. Quality control of the data input is a responsibility of this team. Coordination of production requirements must also be performed.

Technical Assistance Team - This team is a resource to the Technical teams and Facilitator team for continuous improvements, modifications, trouble shooting, and corrective action.

Materials Support Team - This team works with the Planning team, Facilitator team, and the Technical teams to meet planned job requirements and emergency material requirements.

Maintenance Management Team - **This team provides overall coordination of maintenance and material functions to meet the plant capacity requirement. Overview of budget and cost control is also provided.**

User/Operator Maintenance Team - **This is a team of designated operators who perform assigned and scheduled maintenance work. They must be selected, trained and qualified prior to being assigned to this team.**

Plant Engineering Team - **This team provides projected management for the Plant capital budget program. They provide consulting and troubleshooting to the Technical Teams on an as requested basis.**

Other teams must be specifically defined.

For each of the above teams, a detailed performance requirement document must be developed. Individual team members are guided by a specific job performance document. These documents detail the vision, mission, processes used, and strategies employed.

SERVICE vs. PRODUCT

Does the maintenance function provide a service or produce a product? Again, definition is important in the development of this part of the philosophy. Service is defined as a useful labor that does not produce a tangible commodity. A product is something that is produced, usually tangible, but definitely measurable.

In the case of the maintenance function and the development of this philosophy, both a service and a product are considered as an output of maintenance. The current thinking which is related to traditional maintenance (reactive maintenance) suggests that the maintenance function is for the most part a service function. But the philosophy being developed here considers the maintenance function as the provider of a product with a small but limited service component.

Consider the product produced by maintenance to be capacity (Production/Plant capacity). Writers on the subject of maintenance have suggested this concept in the past, but little has been made of developing the idea to date. A predominate service approach to maintenance, as is currently practiced, is a reactive mode of operation, and is typical of most t maintenance operations today. React means response to stimulus. Most maintenance operations today are designed to respond to the stimulus of breakdown and the work order request, except for small efforts related to preventative maintenance and predictive maintenance, usually less than 25% of man-hours worked. This simply means that the maintenance function must be notified (stimulated) of a problem or service requirement by some means , usually by someone outside of the maintenance organization, then maintenance reacts. Rapid response is the "score card" of this system.

It is being suggested by this proactive philosophy that the maintenance function be addressed as the producer of the product- capacity. Capacity is measured in units of production or output (or up time). A total proactive system must specifically be designed to produce capacity (product). If the maintenance function is to be classified as proactive, it cannot stand by and wait for someone to call or make a request. In a total proactive approach, maintenance must be responsible and accountable for the capacity and capability of all equipment and facilities.

The function must provide a facility and equipment that performs to specification and produces the product (capacity). Stated again, the maintenance function is a process that produces capacity which is the product.

THE CUSTOMER

Since the comparison of service vs.. product (capacity) has been introduced, it is now time to look at the customer relationship, a current "buzz word" program in industry, but a valid consideration. In either the case of service or capacity the maintenance function has customers. Customer satisfaction will be very different depending upon the selection of the one concept vs. the other; that is, service vs. product or, stated another way, reactive vs. proactive.

The service relationship by necessity is a highly reactive customer interface. The customer demands a maintenance function that rapidly responds to their request and provides near zero down-time in order to achieve customer satisfaction. Just a superficial analysis of this relationship is enough to see that it is potentially explosive in the terms of plant intra-relationships. In the reactive/service case, the maintenance function must develop a rapid response, "SWAT TEAM" mentality, to cope with this requirement. It is highly unlikely that many maintenance operations will or can achieve the customer's expected degree of performance even if cost is of no concern.

In the case where maintenance provides a product (capacity) to the customer, a totally proactive approach must be specifically designed. It is essential that the customer not be burdened with routine problems of quality or up-time related to the performance of the equipment and facility.

The customer must have the specified capacity at all times unless otherwise agreed. This means the maintenance function must be held responsible and accountable for the capacity capability of the equipment and plant. Systems must be designed and developed to utilize trained personnel and use work plans and specifications that will result in assessment and evaluation so that a course of action for maintaining the current and future capacity of the plant is assured.

The actions necessary to assure capacity must be taken by the maintenance function without stimulus from the customer. Customer satisfaction is much easier to determine and achieve with the proactive mode of operation because the parties are dealing with a product (capacity) which is objectively specified and agreed to in advance.

HUMAN FACTORS

In the final analysis of maintenance management at Alumax of SC, it must be concluded that the absolute key factor in the success achieved is the individual.

The culture that has been created at Alumax allows for individual and collective success. It also allows recognition and reward for these successes.

A culture which produces above normal results must be built on good, qualified people. The people must have the training and capability of doing an above average job. They must be given information about the work they are to do and the company they are a part of. They must be trusted with information, any and all information that is not of a highly confidential nature. They must be allowed to evaluate, select, and use information they deem best for doing their job or providing the answers to their questions and concerns.

In a proactive environment, the employee must have or be given a reason to feel good about himself and his accomplishments. A planned environment takes away the one thing that most mechanics and electricians have or have been taught to use to express their self worth -THE BREAKDOWN-! If this is taken away, what is left? At Alumax the maintenance employees have learned to take pride in clean, well operating equipment - not the heroics of recovering from a breakdown. They have learned that in a planned environment they can organize

their lives. They know when they will come to work, when they will leave, and they know that their personal time will not be violated by overtime except in unusual circumstances. They can plan their own time with little fear of interruption.

Trust is placed in Alumax employees. They are allowed and encouraged to solve problems, not just fix things. Their ideas and efforts are valued and they are allowed to make equipment modifications within established guidelines without the delays and tedious help of engineering. The trust of the hourly employee is demonstrated by allowing participation in meetings and seminars at other plants, schools, and by making formal presentations at Alumax or other plants.

MAINTENANCE MANAGEMENT

Certainly the fundamentals of team activity and traditional TPM (The Program Approach) are used throughout our organization where positive results can be obtained, but keep in mind that total proactive maintenance is not a program - it is a philosophy - an industrial way of life reflected by its culture. Total proactive maintenance requires a new mindset and a management approach that is compatible with the philosophy.

RESULTS

Some of the results achieved by the Alumax of SC maintenance management system are a proactive approach to maintenance, where 90% planned work is achieved, impacts many areas of the business other than pure maintenance functions. The functions related to warehousing, purchasing, expediting, shipping and capital equipment replacement, are all improved by the achievement of a high level of proactive maintenance.

CONCLUSION

1. Maintenance is a process.

2. The maintenance process produces capacity.

3. The maintenance process is information driven.

4. Maintenance is not a services organization.

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