POLICIES & PROCEDURES / WORK INSTRUCTIONS AND MANAGEMENT OF CHANGE IN PLANT MAINTENANCE - STRATEGY KEY FOR ENHANCING PROFITABILITY

Proper maintenance of plant equipment can significantly reduce the overall operating cost, while boosting the productivity of the plant. The key success is the implementation of management of change, the use of Engineering Standards and proper Work Instruction and procedures as set by the Equipment Manufacturers.

Although many management personnel often view plant maintenance as an expense, a more positive approach in looking at it is to view maintenance works as a profit center. The key to this approach lies in a new perspective of proactive maintenance approach. Reviewing the most likely ways that equipment will fail has been a major concern in reliability-centered maintenance (RCM) to ensure that proactive, predictive and preventive maintenance activities during turnaround could be planned and carried out. So often that maintenance department will adopt a more cautious approach of playing safe and relying on the conventional or usual method of equipment maintenance rather than trying a proven method which has been tested to be efficient just to avoid any complicated matter arising from the method.

Hence another perspective of looking at maintenance function is not only to maintain but also to enhance the process or the plant operation system as a result of turnaround planning. Thus rather than restoring or trying to restore the equipment to its original performance, planning a turnaround could better still aimed at enhancing the process and performance of a plant, equipment or any system.

North Oil Business has developed state of the art processes to enhance all available options to the enterprise so as to maximize the potential benefit of maintenance activities.

The definition of maintenance often stated maintenance as an activity carried out for any equipment to ensure its reliability to perform its functions. Maintenance to most people is any activity carried out on an asset in order to ensure that the asset continues to perform its intended functions, or to repair any equipment that has failed, or to keep the equipment running, or to restore to its favorable operating condition. Over the years, many new strategies has been implemented as a maintenance strategies which is intended to overcome the problems which is related to equipment breakdown. Some of the common maintenance strategies are as follows:-

1. Breakdown Maintenance

This is one of the earliest maintenance programs being implemented in the industry. The approach to maintenance is totally reactive and only act when the equipment needs to be fixed. This strategy has no routine maintenance task and also described as no scheduled maintenance strategy. To rectify the problem, corrective maintenance is performed onto the equipment. Thus, this activity may consist of repairing, restoration or replacement of components. The strategy is to apply the corrective maintenance activity only, which is required to correct a failure that has occurred or is in the process of occurring.

2. Preventive Maintenance

This is a time-based maintenance strategy where on a predetermined periodic basis, equipment is taken off-line, opened up and inspected. Based on visual inspection, repairs are made and the equipment is then put back on-line. Thus under this equipment maintenance strategy, replacing, overhauling or remanufacturing an items is done at a fixed intervals regardless of its condition at the time. Although this is a well intended strategy, the process can be very expensive as typically 95% of the time everything was alright. Nevertheless, some preventive maintenance is necessary as some regulation such as DOSH regulation require that annual/bi-annual boiler inspection to be conducted.

3. Predictive Maintenance

Predictive maintenance is a more condition-based approach to maintenance. The approach is based on measuring of the equipment condition in order to assess whether an equipment will fail during some future period, and then taking action to avoid the consequences of that failures. This is where predictive technologies (i.e. vibration analysis, infrared thermographs, ultrasonic detection, etc.) are utilized to determine the condition of equipment, and to decide on any necessary repairs. Apart from the predictive technologies, statistical process control techniques, equipment performance monitoring or human senses are also adapted to monitor the equipment condition. This approach is more economically feasible strategy as labors, materials and production schedules are used much more efficiently.

4. Proactive Maintenance

Unlike the three type of maintenance strategies which has been discussed earlier, proactive maintenance can be considered as an another new approach to maintenance strategy. Dissimilar to preventive maintenance that based on time intervals or predictive maintenance that based on condition monitoring, proactive maintenance concentrate on the monitoring and correction of root causes to equipment failures. The proactive maintenance strategy is also designed to extend the useful age of the equipment to reach the wear-out stage by adaptation a high mastery level of operating precision. Tables 1 below summarize the four different strategy of maintenance which being commonly practiced in the industry.

Apart from these maintenance strategies, another common maintenance issues are the maintenance processes. In the fast few years a growing interest has emerged in the field of Reliability Centered Maintenance (RCM). Being originally developed for the airline industry, RCM is a structured process to determine the equipment maintenance strategies required for any physical asset to ensure it continues to fulfill its intended functions in its present operating context. Therefore, the goal of RCM is to determine the critically equipment in any process, and based on this information, designed a customized preventive/predictive maintenance strategy for the organization. RCM initiatives however involve a tremendous amount of resources, time, and energy. Thus the process is an extremely time consuming and expensive too especially when done according to the textbook.

Another strategy worth mentioning is the Root Cause Failure Analysis (RCFA) which is based on failures that have occurred in the past. RCFA takes corrective action past the component stage and into the system deficiency or latent root stage. Most costs associated with conducting RCFA are in people's time and resources to verify findings. Thus, RCFA can be proactive when accepted chronic failures that comprise the maintenance budget are eliminated from recurring. Under RCFA, recommendations are generally non-capital expenditures that correct people's decision-making skills and the information they receive. The Changing Realm of Maintenance Over the past years, maintenance has become more important in the industry and the role of maintenance has grown into a much more prominent purpose in the plant operation. From a simple expectation of keeping equipment running or restoring it to the desired operating condition, management today saw a much more different role of maintenance.

Most management now saw maintenance efficiency as a factor that can affect the all business effectiveness and risk-safety, environmental integrity, energy efficiency, product quality and customer service and not contained only to plant availability and cost. Thus, as the climate of the doing business changed so does the need for better maintenance program. In general, the evolution of maintenance changes usually is categorized into 3 different generation, the period of 1930's-1940's which usually referred as the First Generation, between 1950's to 1970's often recognized as the second generation, and the 1980's till recent which commonly accepted as the third generation.

The evolution in the maintenance process also rooted from the changing complexity of the industry itself. The first generation is the earlier days of industrialization where mechanization is low. Most equipment in the factory is basic and repairing and restoration process is done in a very short time. Thus, the term downtime did not matter much and there was no need for managers to put maintenance as a high priority issue.

The second generation emerged as the results of growing complexity in equipment and plant design. This had led to increase mechanization and industry was beginning to depend on these complex machines. Repairing and restoration has become more difficult and special skill and more time is needed to mend the machinery. As this dependence grew, downtime became more apparent a problem and getting a sharper focus from the management. People are beginning to think that these failures should be prevented which led to the concept of preventive maintenance. As maintenance cost started to rise sharply relative to other operating cost, there is a rising interest in the field of maintenance planning and control systems. Beginning in the 80's, the growth of mechanization and automation has becoming more complex and some small breakdowns in equipment could effect the operation of the whole plant. This has meant that reliability and availability have become a key issues since any failure can have a serious consequences to the whole division.

The fundamental amongst the differences between the second and third generation's maintenance are; -

1. Focus is now not only concentrated on availability but also reliability
2. There is a push towards zero downtime or zero in-service breakdowns
3. Improved maintenance tools such as RCM, Total Productive

Maintenance (TPM), RCFA, Failure Modes and Effects Analysis (FMEA) and others are applied to achieve maintenance objectives. Under the third generation maintenance principles in many organizations have stated zero breakdowns/zero in-service failures as their maintenance goals. However, since no amount of maintenance can guarantee the total elimination of failures (there is always probability of failing-but may be very close to zero) is no longer a realistic objectives that is achievable, a more realistic approach is to avoid, reduce or eliminating the consequences of failures.

Fourth Generation Maintenance. Due to the rapid changes in the development of equipment and process, accelerated with the help of faster computers, it is only a matter of time when the maintenance scenario entered its fourth generation. As being discussed earlier, third generation maintenance has undergone a shift of focus in maintenance to highlight those areas where the inherent design of the assets yields probabilities of failures that are unacceptable, and provide some guidance and motivation for improving those assets. Hence, the basic principles of the fourth generation of maintenance although are expected to be based on the previous three generations will have some signified feature:

- Definite deliberation of risk, notably at higher levels of organizations, when dealing with equipment design and maintenance strategies
- Coherence between functional demand, equipment design and maintenance will be greater than the currently existing integration, and
- There will be swift development in information technology to detect, predict, diagnose and prevent equipment failures will. With these changes, maybe the focus of maintenance will change and perhaps the new mission of maintenance department is more towards providing an excellent support for their customers by reducing the need for maintenance.

Another factor, which might have a very influential factor in the fourth generation trend of maintenance, is the increasing usage of computer modeling in maintenance strategy. With the rapid development of computer technology especially in the area of artificial intelligent and expert systems, computer simulations and modeling may provide the predictive tools of the future. Not only that computers helps in collecting and storing data, it will also help us to better understand the focal source of an equipment failure.

Maintenance Cost

In recent years, there is a growing concern on the subject of higher maintenance cost and maintenance productivity. According to some company, maintenance is the largest single manageable expenditure in the plant: in many companies, surpass their annual net profit. Although many agrees that maintenance strategies such as preventative and predictive maintenance program has been shown to produce saving of up to 25%, study have shown that still 1/3 of these maintenance cost can be saved. Typically, maintenance cost can be divided into

two main groups. The first group referred as direct costs are easy to justify and to report. These direct costs consist of items such as labor, materials, services, and maintenance overhead cost are the cost tabulated and shown as maintenance costs. The other group of maintenance costs is hidden costs or indirect costs which are harder to measure.

These hidden costs of maintenance are classified as the six big losses:-

1. Breakdowns and unplanned plant shutdown losses
2. Excessive set-up, changeovers and adjustments losses
3. Idling and minor stoppages
4. Running at reduced speed
5. Startup losses and
6. Quality defects

Therefore, it is very important for companies to maximize their maintenance effectiveness and equipment uptime. According to a study on maintenance productivity, most maintenance department is only around 25% to 35% productive. This causes many companies to experience difficulties with quality control, production levels and schedule adherence, since the equipment they are using is not properly maintained. Table 2 shows some comparison between the effect of effective and non-effective maintenance process.

However, maintenance productivity can be drastically improved by planning and scheduling of maintenance activities. For the past 20 years, most manufacturers have only focusing on reducing costs in the manufacturing processes to stay competitive as the low cost producer. This effort although yielded some measurable productivity gain still retarded the opportunity for the additional maximum gain in the overall productivity since maintenance often was excluded from these improvement plans. Clearly, it is also important to integrate maintenance program into these improvement agenda. Another preference to increase the level of maintenance productivity is to outsourcing for maintenance partners. Associating with professional maintenance people give a company the advantage to address these issues with those experts who face and meet these challenges on a daily basis. In addition, outsourcing also enables a company to gain greater control over maintenance results. However, it is important to note that the following key elements have to be highlighted to achieve the optimum benefit from these outsourcing activities:

- Performance measurements are developed and clearly communicated
- Planned maintenance is established as the focus of the operation
- Maintenance becomes a competitive advantage
- Both manufacturer and maintenance contractor desire a mutually beneficial relationship
- Maintenance best practice are established and tracked In the maintenance partnership scenario, performance guarantees and continues improvement goals provide greater control over maintenance results and assure production goals are being achieved.