Application of Predictive Maintenance in Kurdistan Region to Reduce Total Maintenance Costs of the Equipment

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Abstract: The School of Engineering at the University of Duhok is seeking the maintenance program of equipment in Kurdistan Region. One of the problems addressed is the planning maintenance issue which often entails unnecessary maintenance actions. There are significant efforts to improve maintenance process. One new method is to develop a predictive maintenance program using the latest technique of oil analysis to obtain information about equipment condition and use it as a management tool for effective maintenance. This system is built in order to solve the maintenance problems encountered in the managements of government service in Kurdistan. Predictive maintenance experience was implemented over a four-month period to field engineers. This system provides a mean to improve the interaction between School of Engineering and field engineers, and to avoid planned maintenance which often entails unnecessary maintenance actions. One new method used is to meet the maintenance needs of the equipment in a more interactive and effective way is predictive maintenance to reduce the total maintenance costs by saving as result of extended oil life, reduce downtime through failures, reduce downtime through unnecessary maintenance; also avoid the use of incorrect grade oils by checking bulk supplies and continuous analyzing of lubricant in use. The engineer responses were positive about the predictive maintenance techniques. Ninety (90%) percent reported very good results with the predictive maintenance techniques and evaluated it to be better than the planning maintenance. Results show that the experience was successful and solved a lot of problems as well as maintenance requirement.

*Index terms-**Planning maintenance, Predictive maintenance techniques, Managements of government service, Decrease total maintenance costs.***

I. INTRODUCTION

University of Duhok is valuable source of support and information to the managements of government service in Kurdistan to help them for achieving their professional goals. The School of Engineering at the University of Duhok is seeking the maintenance program of equipment in Kurdistan Region. One of the problems addressed is the planning maintenance issue which often entails unnecessary maintenance actions. We live in an economic era and age of technology explosion where the repair and down-time costs of mechanical systems have soared. These costs are further magnified by the shortage of trained mechanics and technicians, and also the time involved in obtaining replacement components. When precise information of mechanical condition is available neither time, money nor effort need be expended in unnecessary maintenance activity, these activities can be concentrated where the need exists. This is the fundamental purpose of this current research. The potential savings resulting from new predictive maintenance method are considerable. For example, with using oil analysis program, the average extension of useful lubricant life is generally sufficient in itself to make a complete program cost effective. The full benefit of a new maintenance method can only be realized when the information it generates is properly organized and applied. Unit condition reports, for example, provide with information which combines recommendations may be furnished where problems are detected, the equipment may then be classified as either critical (in need of immediate attention). Marginal (highlighted for closer scrutiny or minor corrective action). Or unit satisfactory. All analysis results may then be entered into the computer for future use.

II. RELATED STUDIES

One of the primary goals of the current study's research was to provide saving to the managements of government service in Kurdistan to help them for achieving their professional goals, through good maintenance and optimum unit operating conditions. Meeting this goal is an enormous task in itself; Technology affords mechanisms to achieve this goal, especially in the area of maintenance. Without a doubt, lubricants reduce friction, thereby reducing the rate of wear on the two surfaces that are moving relative to each other (Roger, 1980). Liquid lubricants effect cooling of the heat generated between two moving parts as well as carry away dirt, moisture, and foreign materials between the sliding surfaces. Hence, in automobile engines, lubricants reduce wear and carry away any wear articles when such occur (Kelly and Harris, 1978).Odi-Owei (1987) viewed component part wear as the major cause of machinery failure, most especial in automobile engines and other machineries, due to the contamination of the lubricant by the wear particles and debris. Also, the deterioration of lubricant quality that results from additive depletion has significant effect on the life and performance of automotive engine parts. Therefore,

there is need for a proper monitoring technique. Bar well (1978), Okah-Avae (1982), and Waggoner (1971) observed that lubricant monitoring addressed to contaminant level assessment should be in place to monitoring the level and type of such contaminant wear elements - copper, boron, chromium, aluminum, lead, tin, molybdenum, silicon, nickel, magnesium and tungsten; air–borne dirt and sooth; un-combusted fuel; water; inorganic acids; oxidation; and salts. According to Henry (1979) lubricant monitoring and analysis can be carried out in either on load or off load condition.

III. OBJECTIVE OF THE WORK

The object of this work is to avoid planned maintenance which often entails unnecessary maintenance actions. One new method used is to meet the maintenance needs of the equipment in a more interactive and effective way is predictive maintenance to reduce the total maintenance costs by saving as result of extended oil life, reduce downtime through failures, reduce downtime through unnecessary maintenance; also avoid the use of incorrect grade oils by checking bulk supplies and continuous analyzing of lubricant in use.

IV. PREDICTIVE AND PREVENTIVE MAINTENANCE

Predictive maintenance techniques are designed to help determine the condition of in-service equipment in order to predict when maintenance should be performed. This approach promises cost savings over routine or time-based preventive maintenance, because tasks are performed only when warranted. The main promise of predicted maintenance is to allow convenient scheduling of corrective maintenance, and to prevent unexpected equipment failures. The key is "the right information in the right time". By knowing which equipment needs maintenance, maintenance work can be better planned (spare parts, people, etc.) and what would have been "unplanned stops" are transformed to shorter and fewer "planned stops", thus increasing plant availability. Other potential advantages include increases equipment lifetime, increases plant safety, fewer accidents with negative impact on environment, and optimizes spare parts handling.

V. FIELD ENGINEER EVALUATION

Evaluations about the predictive maintenance techniques were carried out by the managements of government service in Kurdistan during Semester 2 of academic year 2012-2013. A total of 28engineers (out of 37engineers) responded to the predictive maintenance techniques than using the Planning Maintenance-specific questionnaire, shown in Table (1), representing a return rate of 76% for the survey. The first and most apparent observation is that a significant percentage of engineers, about 90% of the sample, do seem to prefer to work with Predictive maintenance techniques than using the planning Maintenance. The engineer's response for the questionnaire is shown in figure (1)

VI. RESULTS

The engineer responses were positive about the predictive maintenance techniques. Ninety (90%) percent reported very good results with the predictive maintenance technique sand evaluated it to be better than the planning maintenance, and ten (10%) percent chose not to answer all questions.

VII. CONCLUSION

In this work a predictive maintenance program is introduced. The objective of this current research study is to conduct the predictive maintenance process in the School of Engineering at the University of Duhok. This system is built in order to solve the maintenance problems encountered in the managements of government service in Kurdistan, also to provide saving and help to them for achieving their professional goals, through good maintenance and optimum unit operating conditions. Predictive maintenance experience was implemented over a four-month period to field engineers. This system provides a mean to improve the interaction between School of Engineering and field engineers, and to avoid planned maintenance which often entails unnecessary maintenance actions. One new method used is to meet the maintenance needs of the equipment in a more interactive and effective way is predictive maintenance to reduce the total maintenance costs by saving as result of extended oil life, reduce downtime through failures, reduce downtime through unnecessary maintenance; also avoid the use of incorrect grade oils by checking bulk supplies and continuous analyzing of lubricant in use. The engineer responses were positive about the predictive maintenance techniques. Ninety (90%) percent reported very good results with the predictive maintenance techniques and evaluated it to be better than the planning maintenance Results show that the experience was successful and solved a lot of problems as well as maintenance requirement.

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AUTHOR'S PROFILE

Dr. Farhad Bilal was born in Erbil, IRAQ, 1950. Received master (M Sc) of condition monitoring program, from University of Swansea, U.K., 1984. and received Ph.D. from U.S.M. Work as Lecturer in faculty of Engineering, university of Duhok, Kurdistan Region, IRAQ.
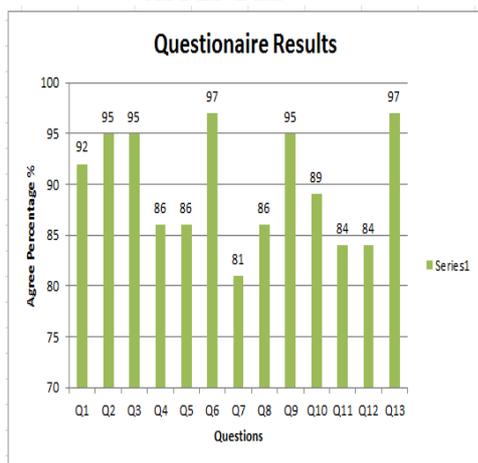
APPENDIX

Fig (1) Questionnaire results

Table (1) Predictive maintenance techniques Questionnaire Results

	Questions	Agree	Disagree
Q1	I prefer using Predictive maintenance techniques than using the Planning Maintenance.	34	3
Q2	Predictive maintenance techniques are designed to help determine the condition of in-service equipment in order to predict when maintenance should be performed.	35	2
Q3	More effective way is predictive maintenance techniques than the planning maintenance.	35	2
Q4	The main promise of predicted maintenance is to allow convenient scheduling of corrective maintenance	32	5
Q5	A lot of problems can be solved in more interactive through predicted maintenance than the planning maintenance..	32	5
Q6	Predictive maintenance is to prevent unexpected equipment failures.	36	1
Q7	The predictive maintenance is a key for "the right information in the right time".	30	7
Q8	By the predictive maintenance we can know which equipment needs maintenance.	32	5
Q9	Predictive maintenance program is becoming a valuable source of support and information to the management...	35	2
Q10	Maintenance work can be better planned (spare parts, people, etc.) By the predicted maintenance	33	4
Q11	Other potential advantages include increase equipment lifetime, increase plant safety, fewer accidents with negative impact on environment, and optimize spare parts handling.	31	6
Q12	"Unplanned stops" are transformed to shorter and fewer "planned stops", thus increasing plant availability…	31	6
Q13	Overall, I would enjoy using Predictive Maintenance than the planning maintenance.... again.	36	1