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Original Research Article

DMAIC METHOD APPLYING IN COAL HANDLING PLANT TO REDUCE COAL WASTAGE

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ABSTRACT

DMAIC is a methodology that relies on a collaborative team effort to improve performance by systematically removing waste. In India at present maximum power production done by the coal based thermal power plant. Power plant has Coal Handling Plant for conveying coal receiving point to boiler. There are so many wastage and extra power consumption for this purpose. In coal handling plant of coal based thermal power plant, coal handling process involves a number of activities from loading and unloading to stockpile. This procedure can be carried out by coal the conveying system which includes a large number of mechanical equipment and drives. The important activities under coal handling include bunkering loading/unloading, dumping, transporting stacking, reclaiming etc. which are done with the help of various mechanical equipment and electrical drives. Every organization wants to profit as much as possible and increases their production rate by using maximum effort for care and maintain. It is possible if the equipment is running in good condition with zero breakdowns, zero accident, minimum coal spillage and zero wastage. This research work presents a practical analysis for monitoring the operational performance of equipment drives, which shows the objectives is implementation of a suitable and appropriate methodology for improvement of the coal handling systems, which handling the coal from track hopper to stockyard, stockyard to bunker and direct bunkering from track hopper. So that reduces coal wastage or spillage. Overall we can improve the efficiency of the plant. Overall we can improve the efficiency of the plant. This research work deals with the quantitative measurement of equipment performance in coal handling plant, which defines losses for

many reasons. As a result, valuable information is provided concerning the performance monitoring of production equipment and implementing a suitable methodology for improvement of the coal handling machinery operations like TTR, crusher, reversible belt feeder, belt conveyor, bucket wheel stacker and reclaimer.

KEYORDS: DIMAIC Method, Coal wastage, reduction.

1. INTRODUCTION

Lean Six Sigma is a methodology that relies on a collaborative team effort to improve performance by systematically removing waste; combining lean manufacturing/lean enterprise and Six Sigma to eliminate the eight kinds of waste: Time, Inventory, Motion, Waiting, Over production, Over processing, Defects, and Skills (abbreviated as 'TIMWOODS').For a productive enterprise, the main difficulties and inefficiencies lie in the choice of maintenance actions and operation process especially when the machine plays a vital role in the production process. Thus, given the importance of maintaining process and its impact on the performance of production facilities, optimization methods have been developed

This DMAIC method can apply in different-different manufacturing industry. We can apply this in coal based thermal power plant also to increases the efficiency of coal handling plant so that the overall efficiency of thermal power plant will be improve. In other hand we have to minimize the wastages of energy during idle running of electrical drive and minimize the spillage of coal also.

Motivations:

- It analyzes and evaluates the results of plant production rate. It is also adopted to eliminate the major causes of poor performances.
- The primary focus is to design a method for finding out the root causes of the coal handling system.

2. LITERATURE REVIEW

Jayaswal, P. et al. (2012) proposed to implement Jishu Hozen and Kobastu Kaizen application for enhancing the overall equipment effectiveness. [1]

Król, R. et al. (2009**)** proposed to improve the reliability of conveyor belt system by analyzing their failures, root causes and some minimal parameter for condition monitoring techniques. [2]

Lodhi, G. (2013) proposed an operation and maintenance of crusher house to keep equipment running in good working condition, extend equipment life, improve the quality of operation and reduce operating costs for plant efficiency improvement. [3]

Velmurugan, G. et al. (2014) presents the troubleshooting of belt conveyor systemwhile handling the bulk material. Due to sticking of material, many problems are occurring, for example, damages in belt conveyor system due to chemical reaction and also causes failures due to carry back of the product. [4]

Sokovic, M. et al. (2009) proposed basic quality tools for continuous improvement of an organization. In view of this, it is evident that continuous improvement can be possible with the help of quality tools, techniques and methods which are helpful the quality engineers for doing their own job in site.[5]

3. PROBLEM IDENTIFICATION:

In coal handling plant a large number of rotating equipment are there and they are rotated by the help of drive motor which consume electrical power. Following problems are observed at the time of operation in coal handling plant:

- Spillage of material is also increase the production cost, wastage of time, money and manpower.
- Lack of knowledge of workman or engineer regarding that system is more dangerous and non-beneficial for the organization.
- Many time mentainance team takes more time to rectify the problem.

Problems during rainy season:

- In rainy season coal mud formed by coal spillage and coal dust.

Problems during summer and winter season:

In summer and winter season coal dust are formed and pollute environment. This is suppress by water spray

4. METHODS

DMAIC is an abbreviation of the five improvement steps it comprises: Define Measure, Analyze, Improve and Control. All of the DMAIC process steps are required and always proceed in the given order.

The five steps of DMAIC

DEFINE

The purpose of this step is to clearly articulate the business problem, goal, potential resources, project scope and high-level project timeline. This information is typically

captured within project charter document. Write down what you currently know. Seek to clarify facts, set objectives and form the project team. Define the following:

•A problem

•The customer(s)

•Voice of the customer (VOC) and Critical to Quality (CTQs) — what are the critical process outputs?

•The target process subject to DMAIC and other related business processes

•Project targets or goal

•Project boundaries or scope

•A project charter is often created and agreed upon during the Define step.

MEASURE

The purpose of this step is to objectively establish current baselines as the basis for improvement. This is a data collection step, the purpose of which is to establish process performance baselines. The performance metric baseline(s) from the Measure phase will be compared to the performance metric at the conclusion of the project to determine objectively whether significant improvement has been made. The team decides on what should be measured and how to measure it. It is usual for teams to invest a lot of effort into assessing the suitability of the proposed measurement systems. Good data is at the heart of the DMAIC process:

•Identify the gap between current and required performance.

•Collect data to create a process performance capability baseline for the project metric, that is, the process Y(s) (there may be more than one output).

•Assess the measurement system (for example, a gauge study) for adequate accuracy and precision.

•Establish a high level process flow baseline. Additional detail can be filled in later.

ANALYZE

The purpose of this step is to identify, validate and select root cause for elimination. A large number of potential root causes (process inputs, X) of the project problem are identified via root cause analysis (for example a fishbone diagram). The top 3-4 potential root causes are selected using multi-voting or other consensus tool for further validation. A data collection plan is created and data are collected to establish the relative contribution of each root causes to the project metric, Y. This process is repeated until "valid" root causes can be identified. Within Six Sigma, often complex analysis tools are used. However, it is acceptable to use basic tools if these are appropriate. Of the "validated" root causes, all or some can be

•List and prioritize potential causes of the problem

•Prioritize the root causes (key process inputs) to pursue in the Improve step

•Identify how the process inputs (Xs) affect the process outputs (Ys). Data is analyzed to understand the magnitude of contribution of each root cause, X, to the project metric, Y. Statistical tests using p-values accompanied by Histograms, Pareto charts, and line plots are often used to do this.

•Detailed process maps can be created to help pin-point where in the process the root causes reside, and what might be contributing to the occurrence.

IMPROVE

The purpose of this step is to identify, test and implement a solution to the problem; in part or in whole. This depends on the situation. Identify creative solutions to eliminate the key root causes in order to fix and prevent process problems. Use brainstorming or techniques like Six Thinking Hats and Random Word. Some projects can utilize complex analysis tools like DOE (Design of Experiments), but try to focus on obvious solutions if these are apparent. However, the purpose of this step can also be to find solutions without implementing them.

•Focus on the simplest and easiest solutions

•Test solutions using Plan-Do-Check-Act (PDCA) cycle

•Based on PDCA results, attempt to anticipate any avoidable risks associated with the "improvement" using FMEA

•Create a detailed implementation plan

•Deploy improvements

CONTROL

The purpose of this step is to sustain the gains. Monitor the improvements to ensure continued and sustainable success. Create a control plan. Update documents, business process and training records as required.

A Control chart can be useful during the Control stage to assess the stability of the improvements over time by serving as

- A guide to continue monitoring the process and
- Provide a response plan for each of the measures being monitored in case the process becomes unstable

MODIFICATION:- For minimise the spillage of coal one modification is done by the maintenance team. In this modification the pads of the hood is replace by the log and thick rubber strip (old pieces of conveyor).after this modification the spillage of coal is reduces.

Before modification

Fig. 1 Rubber pad before modification

After modification

Fig 2. Rubber pad after modification

5. RESULT DISCUSION

Lean Six Sigma is a methodology that relies on a collaborative team effort to improve performance by systematically removing waste; combining lean manufacturing/lean enterprise and Six Sigma to eliminate the eight kinds of waste: Time, Inventory, Motion, Waiting, Over production, Over processing, Defects, and Skills (abbreviated as 'TIMWOODS').we can use this method and implements in the process and work culture of the field and make favourable and maximum output from resources in safe manner. By help of DMAIC methods we want to reduce spillage.

improvement of the coal handling systems, which handling the coal from track hopper to stockyard, stockyard to bunker and direct bunkering from track hopper. So that reduces coal wastage or spillage.

6. CONCLUSION

The proposed work is to make study of system of the coal handling and associated equipment explicitly and make suggestive measures for improvement of coal handling system of machinery like TTR,, belt conveyor system, reversible belt feeder, stacker, reclaimer etc. under the backdrop of the aforementioned scenario the objectives of the present research work consists of the following.

- A brief review of equipment and its system of cyclic operation such as bunkering conveying, stacking, and reclaiming.
- Development and recommendation of appropriate methodology for monitoring the candidate machinery and suggestive measures for improvement of their availability and performance.
- In India at present maximum power production done by the coal based thermal power plant. Power plant has Coal Handling Plant for conveying coal receiving point to boiler. There are so many wastage and extra power consumption for this purpose.
- The method is based on five main steps summarized in the acronym (DMAIC): Define Measure, Analyze, Improve and Control. Application of the method on the maintenance& operation processes with using maintenance methods during the five phases of the method will help to reduce costs and losses in order to strive for optimum results in terms of profit and quality.
- For minimize the spillage of coal one modification is done by the maintenance team. In this modification the hood pads of the hood is replace by the log and thick rubber strip (old pieces of conveyor).after this modification the spillage of coal is reduces

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