

INTRODUCTION OF TOTAL PRODUCTIVE MAINTENANCE IN STEELWORKS PLANTS

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The paper presents the concept of TPM - Total Productive Maintenance and its basic method 5S (sort, systematize, sweep, sanitize, self-discipline). The new management concept is realized in Japanese and USA companies. On the Polish market the methods was adopted in the first years of 21st century by car manufacturers and household equipment producers. Nowadays the concept is tested by steelworks in Polish steel industry. The process of introduction of these methods is long, difficult and requires organizational and technical changes. The companies which realize Awareness Management Project of workers in Health and Safety System use other methods whose primary goal is to ensure objectivity and comparability of results and skill assessment of particular employees (the Current and Periodic Assessment System for worker and supervision positions).

Key words: TPM – Total Productive Maintenance, 5S method, Current and Periodic Assessment System for Worker and Supervisors Position, Workers' Awareness Management Project in Health and Safety System

Uvođenje potpunog proizvodnog održavanja u industriju čelika. Članak predstavlja koncept Potpunog proizvodnog održavanja, TPM, i metode 5S u osnovi koncepta (organizirati, sistematizirati, očistiti, standardizirati, disciplinirati). Nova metoda upravljanja primijenjena je u japanskim i SAD kompanijama. U Poljskoj metoda je prihvaćena u prvom godinama XXI. stoljeća od strane proizvođača automobila i kućnih aparata. Danas, koncept se testira u Poljskoj industriji čelika. Proces uvođenja metoda je dug, težak i zahtijeva organizacijske i tehničke promjene. Kompanije koje primjenjuju Projekt upravljanja svjesnog ponašanja zaposlenika unutar Sustava zdravstvene sigurnosti i sigurnosti na radu koriste druge metode čiji je primarni cilj osigurati objektivnost i usporedivost rezultata i procjenu vještina posebnih zaposlenika (Sustav kontinuiranih i periodičnih procjena za radnike i rukovoditelje).

Ključne riječi: TPM - Potpuno proizvodno održavanje, metoda 5S, Sustav kontinuiranih i periodičnih procjena za radnike i rukovoditelje, Projekt upravljanja svjesnog ponašanja zaposlenika unutar Sustava zdravstvene sigurnosti i sigurnosti na radu

INTRODUCTION

The main goal of industrial companies nowadays is to gain a competitive advantage. A competitive advantage is a consequence of low costs and high work efficiency, and customer-oriented operations. The changing circumstances and the growing demands on the part of the customers necessitate the implementation of new production management methods. Companies have decided to take another step to harmonize operations and increase the efficiency of production. They create systems of organizational development. Methods such as TPM, i.e. Total Productive Maintenance, have gained popularity in the steel industry in the last few years. The method aims at eliminating machinery breakdowns, zero defects and the improvement of work safety. The TPM concept is based on the 5S method. The method makes it possible to improve work organization, in-

creasing effectiveness and decreasing accident rate (zero accidents at work). In the Polish steel sector use other methods to harmonize work operations that are called: Current and Periodic Assessment System for worker and supervision positions, Awareness Management Project for workers in Health and Safety System etc. All the methods are involved in the process of developing organization and increasing productivity.

TOTAL PRODUCTIVE MAINTENANCE -TPM

The history of TPM is inseparably linked with Japan although the first system actions aimed at the improvement of equipment operation were taken in USA at the beginning of 21st century. The name of TPM was first defined and used by Japan Institute of Plant Engineers in 1971. The history of TPM development can be outlined as follows: 1. Before 1950 – Breakdown Maintenance. 2. The 50s – Preventive Maintenance and Productive Maintenance. 3. The 60s – Corrective Maintenance. 4. 1971 - Total Productive Maintenance 5. The 80s –

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Predictive Maintenance. The first two concepts were among the methods called Time Based Maintenance whereas the last two, Condition Based Maintenance. Time Based Maintenance refers to actions defined in time. Condition Based Maintenance, on the other hand, is based on performing actions according to the determined needs [1, 2].

TPM teaches machine operators and workers how to look after the company's equipment. The essence of the concept is zero stoppages and zero breakdowns. Thanks to the TPM system each piece of equipment in the production line is always ready to perform its task and therefore no disruptions in the production process take place [1]. The main purpose of introducing TPM is to enhance the effectiveness of the whole machinery [2].

TPM is a tool that helps to detect and reduce waste by means of three zeroes: zero breakdowns, zero defects, zero accidents at work. TPM program include actions in these five main areas: 1/ educating all employees starting from top management positions to production line workers, with a view to changing their awareness concerning everything that constitutes an effective manufacturing system, 2/creating a system whose all implementation actions would be based on teamwork, 3/starting from the introduction of 5S i.e. introducing order through the removal of unnecessary things, thorough cleaning and visualizing the process of management, 4/ creating a system of impartial assessment and comparison of results for the individual workplaces, 5/developing and implementing the continuous workers' awareness management in the health and safety systems [1, 2, 3].

THE 5S METHOD AS THE BASIS OF TPM

The 5S principle is a method of creating and maintaining a well-organized, clean, highly efficient and high quality workplace. The method name is an abbreviation of Japanese words: seiri, seiton, seiso, seiketsu, shitsuke, that in English have been translated into – sort, systematize, sweep, sanitize, self-discipline. The 5S method is consistent with the principles of the Japanese Kaizen philosophy which focuses not only on products but also on work quality, machine operation methods, process characteristics and approach to processes and procedures. Kaizen applies to all aspects of worker's behavior and it requires changes to it leading to participation and cooperation. Drawing on Kaizen principles, employees of the steel sector introduce worker's awareness management programs aimed at continuous improvement and productivity growth [4, 5].

CASE STUDY - 5S IN A STEELWORKS PLANT

For the case study the biggest company on the Polish steel market, ArcelorMittal Poland, has been chosen. In 2006 it commenced the introduction of the TPM concept

and the 5S method. The basis for the TPM implementation was the so-called Single Minute Exchange of Die (SMED). SMED makes it possible to shorten the production line changeover time. At ArcelorMittal Poland SMED was carried out together with the Kaizen Institute coordinators. The whole process of machinery changeover was filmed, and the duration of each activity timed. Next, together with the workers, the material was analyzed and finally new standards for particular production lines changeovers were established. The pilot 5S program was introduced in the Sosnowiec branch of ArcelorMittal Poland (at cold-rolled strip mill). The 5S principle was applied to all devices of the mill. In February last year it was introduced to precision winders and glow furnace, and in May to preliminary drawing machines and grindery in the welding wire unit. In September works on the introduction of Kaizen to other steelworks departments started – the upgraded quality steel wire rod mill. As part of the program workers tidy their work area and improve work organization at their workplaces. The purpose behind both TPM and the 5S method is to increase efficiency through the expansion of knowledge and skills of the workers, and their responsibility. Workers become more committed to their work, they are able to properly understand a given situation and make the right decisions. The company runs a special incentive program called the "Idea of the Month". A special team composed of the management of a given department and the CEO, award a financial prize to the authors of best work organization improvement solutions. The "Idea of the Month" program at ArcelorMittal Poland has contributed to:

- the installation of a drainpipe to prevent oil from dripping on the floor in the assembly room,
- the use of a special pallet for a narrow production line so that it stays fixed and does not wobble,
- improvement in guidance of scrap case on cutter n° 2.

Let us have a closer look at the specific elements of the 5S method. In the Sosnowiec branch of ArcelorMittal (cold rolling mill) a crane for lifting and installing rings on the spooling machine was disassembled, the floor in the assembly room was renovated (any bumps or signs of unevenness were removed) and the packaging line was equipped with oil mist ventilation to protect the worker's health. The cold rolling mill branch has already managed to dispose of around 80 percent of all items marked with red cards. More over team leaders are responsible for checking workplaces both before and after work to ensure that workers maintain order. The control checks also take place during work. In 5S standardization and compliance with procedures is needed. Standards may concern the item marking methods, the use of colors, codes, marking models of the floor around the workplace, marking models of tools access zones, etc. The whole system is subject to periodic and running

controls. In addition, a cross control by workers holding the same posts at different departments or branches of the company takes place [6].

SAFETY OF WORK IN STEELWORKS

The Value statement of the ArcelorMittal concern is: "We are committed to the health and safety of all employees, both on and off the job in order to become the most admired steel company". The marketing slogan of the company is: "We build a safe organization. We are not as strong as our products and therefore health and safety issues are "our priority" whereas its strategic goal is "Zero accidents". In 2003 there were 184 accidents in four steelworks plants of the company. In 2005 there were 99 accidents. In 2006 there were 119 accidents and in 2007 there were 74 accidents. Approximately 64,7% of all accidents are caused by human errors and routine, whereas 35,3 % of accidents are due to bad work organization, the majority of which means lack of compliance with safety regulations concerning work organization and the remaining part a consequence of inattention, forgetfulness or lack of knowledge. Accidents are most frequent at toolmaker, smelter and electrician workstations. The company organizes periodical health and safety trainings, courses and drills on e.g. first aid to improve work. Besides all accidents are discussed with workers and analyzed. The company wants to reduce the accident rate to 3,0 in 2008 (currently the accident rate is 3,6). The accident rate = number of accidents x 1 000 000 / worked man-hours [7].

THE ASSESSMENT SYSTEM FOR WORKER AND SUPERVISOR POSITION – CASE STUDY

Due to organizational development of ArcelorMittal Company on the Polish steel market, the company has decided to implement the Assessment System. The primary goal for the implementation of the Current and Periodic Assessment system for worker and supervisor positions is to ensure objectivity and comparability of results and skill assessment for particular employees. The key components of the system are: an assessment interview with a superior (it will provide an opportunity to present mutual expectations, exchange comments on results and quality of work as well as set the path of professional development for each employee); appointment of a steering committee and a review of workplaces and results achieved at individual workplaces, the review will be based on the analysis of organizational documents and information gathered by consultants during their visits at particular workplaces; identification of criteria used for current and periodical assessment of employees; preparation of assessment rules and tools to which employees holding a supervision position will be

introduced during trainings; assessment of employees and their work.

WORKERS' AWARENESS

There are various types of awareness. There is ecological awareness, marketing awareness, market awareness, productivity, work efficiency or work safety awareness, etc. What is work safety awareness then? It is all the information and beliefs on how to work not to cause an accident and the ability to see the link between efficiency and working conditions and a worker's health and life. Work safety awareness is combination of the health and safety system and the TPM concept. Worker's awareness in the TPM system consists of their expertise, views and opinions on safe work methods, work organization improvement, care for the machines, etc. It is also the assessment of workers' results and attitude at individual workplaces. It is also the adopted approach to work and safe behavior models. The particular elements overlap and blend creating a whole. The higher the level of worker's TPM awareness, the higher quality of organizational culture and the more efficient and safer the work is. Lack of awareness invariably has a negative impact.

CASE STUDY – WORKERS' AWARENESS MANAGEMENT PROJECT

In 2008 ArcelorMittal Poland commenced work on the development and introduction of a project called 'management of workers' awareness on health and safety at work'. The project can be divided into the following stages:

1. Development of a planning document i.e. the so-called "Corporate Health and Safety at Work Strategy". The document is based on the "photography" of the actual state of health and safety and the identified workers' awareness on safe work methods (interviews, observations, surveys).

2. Dividing the strategy into action programs. Currently workshops for team leaders are being organized at the company. Team leaders will be members of the so-called project support teams. Team leaders participate in workshops during which they learn about methods and courses of action that influence workers' awareness and, as a result, the change of their attitude to safety. The support teams also include representatives of trade unions, supervision employees and public labor inspectors. These teams play, first of all, an advisory role in the company. Team members hold regular meetings with workers and explain them what awareness management is about. The first workshops are also attended by management staff which is to set a good example. The next workshops are attended by the remaining company workers.

3. Continuous improvement of the safety management system and implementation of new methods for raising workers' awareness on TPM and work safety [8, 9].

BENEFITS OF TPM

In the companies that have implemented TPM the following can be seen: growth of employees' involvement, new skills learned and creativity released, for many people participation in the TPM program provides the first opportunity to actively engage in corporate life and feel ownership at a workplace; increase in work efficiency (by as much as 150 %, experts say); breakdown reduction (drop by 90 % or even 99 %); drop in the number of accidents at work (62888 persons injured in accidents at work in industry in 1995, 42871 persons in 2006, drop by 20017 persons); reduction of internal waste (by 90 %); improvement of work quality and reduction of complaints (by cca. 75 %); reduction of production costs by 30 %; reduction of materials kept on-stock by 50 %; drop or lack of environment-related breakdowns; increase in the number of proposals for new organizational solutions, development of workers' initiative in search of innovation [10].

CONCLUSION

The adjustment of a steelwork company activity to the new rules of global economy requires the application of modern work organization solutions. The aim of TPM and 5S is to increase worker's efficiency through the improvement of their skill and knowledge as well as the extension of their responsibilities. Workers become more committed to their work, they are able to understand and interpret a given situation correctly and make the right decisions, which altogether contributes to, among others, higher productivity and improvement of working conditions. In the paper attention was paid to

the modern methods – TPM - Total Productive Maintenance and "5 S". These methods are customer oriented and help to obtain permanent competitive advantage. The process of introduction of these methods is long and requires organizational and other changes.

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