J. FURMAN

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TRAINING WITHIN INDUSTRY (TWI-JS) PROGRAM AS A TOOL TO IMPROVE WORK SAFETY IN THE STEEL INDUSTRY IN POLAND

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Accidents at work related to the operation of technological machinery are recorded in the steel industry in Poland. A reduction of accidents is possible through the implementation of technical and organizational measures. As regards the elimination of hazards at workplaces, it is possible to apply the Training Within Industry (TWI) program. One of its modules, i.e., Safety (JS), is aimed at creating a safe workplace by the acquisition of the skills of identification and elimination of the causes of hazards leading to accidents. This article aims to present the possibilities of the use of the TWI-JS method to prevent accidents at work in the steel industry.

Key words: steel industry, accident, work safety, TWI program, Poland

INTRODUCTION

Training Within Industry is a program supporting the development of managerial skills among experienced operational staff and low and mid-level supervisors. TWI was developed during WWII in the USA to support the defence industry. The program was intended to provide employment and quick and effective training for many workers with no previous experience of work in the production area. The TWI program was mainly dedicated to supervisors who were responsible for the work of employees directly involved in production [1,2]. It aimed at the acquisition of skills of instructing employees, improving work methods and maintaining good relations with employees to achieve an increase in productivity, quality and work safety [3]. The structure of the TWI program is based on three basic modules: Job Instruction (JB), Job Methods (JM), Job Relation (JR) and the Job Safety (JS) module, which is a supplement of the original program [1,2].

TWI-JS aims at maintaining safety in the workplace, which is the main role of a supervisor. It provides an opportunity to involve operators in identifying potential threats and eliminating them in combination with training and an understanding of the provisions of occupational safety and health. TWI-JS teaches superiors to analyse the chain of events leading to accidents and dangerous situations. This makes it possible to identify and remove the root causes to "break the chain", Figure 1 [1,4].

TWI-JS is based on four stages [1]:

- identifications of the causes of hazards;
- determination of preventive measures;
- application of preventive measures;
- monitoring of results.

J. Furman: joanna.furman@polsl.pl – Silesian University of Technology, Katowice, Poland

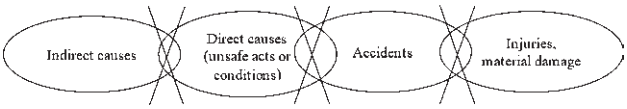

Figure 1 The broken chain of events [1]

Following the 4-stage TWI-JS method makes it possible to maintain safety in the workplace because it teaches employees to identify potential hazards, i.e., what type of (material, immaterial) factors may cause accidents, how to identify them and what actions must be taken to eliminate them. The Job Safety module is based on an instructional model of the TWI program [1,4], which can be used during trainings and while solving problems in the area of occupational safety and health (OSH).

ACCIDENTS AT WORK IN THE STEEL INDUSTRY IN POLAND

Minor accidents, i.e., accidents resulting in short-term absences from work, were the most frequently recorded events in the steel industry in Poland in a period between 2014-2021, Figure 2. Machinery operation was one of the causes of those accidents. It involved starting and stopping a machine, supervising its operation, feeding and receiving materials and semi-finished products [5,6]. Apart from the tasks related to carrying out the production process, machine operators frequently perform additional maintenance activities on a machine as part of Autonomous Maintenance (e.g., adjustments, cleaning, lubrication, simple repairs). Those activities may also be a potential source of hazard for operators [7].

According to the data released by Statistics Poland, accidents during machinery operation in the steel industry in Poland occur, among others, as a result of an employee's improper behaviour, which is related to, among

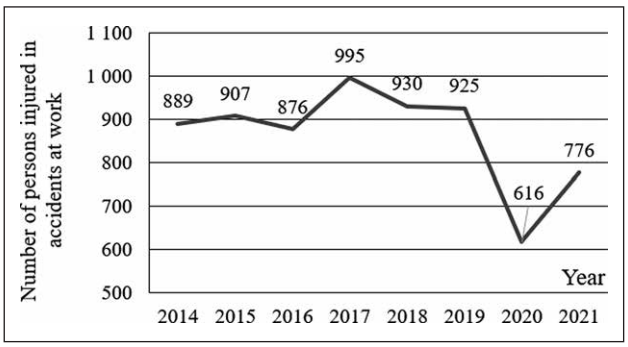

Figure 2 Number of persons injured in accidents at work in the steel sector in Poland in 2014-2021 [own research based on Statistic Poland]

others, the ignorance of hazards and health and safety regulations, disregard of hazards in a workstation or a lack of experience [5]. This aspect concerns the safety culture, which affects employees' attitudes and behaviour related to increasing or decreasing the risk of accidents – which consequently translates into the current state of safety in the workplace [8,9].

It is therefore necessary to take measures to reduce the causes of accidents at work in the form of a combination of technical and organizational solutions and involve machine operators in those activities so that they can identify and react to hazards fast. The use of the TWI-JS method by superiors in combination with an instructional TWI model may support the activities aimed at improving the safety of machine operators.

APPROACH TO PREVENTING ACCIDENTS AT WORK ACCORDING TO TWI-JS

Safety at a machine operator's workstation must take into account three critical factors, which may be direct and indirect causes leading to an accident, Figure 1. These are [10]:

- physical factors that cover, among others, machines and equipment in operation, tools and protective measures used, the marking of dangerous zones of a machine/the area;
- human factors that relate to, among others, an operator's knowledge, skills, physical and mental state, his attitudes and behaviour in the area of OSH and a superior/operator relationship;
- cultural factors that include, among others, adopted procedures, safety instructions, superiors' attitudes and behaviour in the area of OSH.

An understanding of these factors increases the awareness of the existence of potential hazards during the performance of work. Under the TWI-JS method, the ability to identify potential hazards is a key element in the area of the improvement of work safety.

The four-stage approach to the process of identification and elimination of hazards may be used by superiors in the steel industry in Poland as a supporting tool in activities aimed at improving occupational safety. The adoption of the TWI-JS method requires that the actions outlined in Figure 3 are carried out.

The first stage focuses on the identification of the causes of hazards at a workstation. It includes:

- an analysis of the area to acquire the ability to identify direct and indirect causes;
- an analysis of the register of accidents at a workstation to obtain a detailed knowledge of the conditions at an operator's workstation;
- a review of applicable work standards and safety instructions (a verification of the documents jointly with the operators);
- an analysis of hazards related to an operator's work and machine work (thermal, mechanical and electrical hazards) using a checklist, which is an auxiliary tool in the area of monitoring hazards at the workplace;
- observation of the workplace (including employees' behaviour) to eliminate irregularities leading to an accident (as an action in the area of the anticipation of accidental events).

The second stage of the TWI-JS method is connected with a selection of (technical and organizational) solutions to identify hazards so that they are eliminated or reduced to a minimum (e.g., guards on machines, LOTO system, emergency stop switches, marking of control elements, pictograms, light and sound signs, personal protective equipment, trainings). It is recommended that employees are engaged in that stage due to their knowledge of the work performed.

In the third stage, the actions taken focus on implementing selected remedial measures and identifying the persons involved in the process. An important element in this respect is the active involvement of machine operators to increase their awareness in the area of safety (adherence to the changes made, a change in behaviour). It is necessary to develop new standards and safety instructions (e.g., in line with an instructional TWI model), which take into account the introduced remedial measures. They can be a training tool for a supervisor.

The last stage of the TWI-JS method is the monitoring of the obtained results. The actions undertaken are evaluated, among others, by observations, audits, a response by supervisors to deviations from the health and safety regulations and the inclusion of employees in safety inspections at the workplace. The actions undertaken under that stage aim at obtaining information about the effectiveness of the remedial measures put in place, as well as identifying other OSH irregularities.

Each TWI-JS stage should be discussed at team meetings (supervisor, machine operators). That approach aims to increase employees' awareness in the area of OSH, which should translate into safer behaviour during machinery operation. According to TWI-JS, the maintenance of safety at a machine operator's workplace is possible by a constant monitoring of human labour, the safety of the machines and tools used, and the safety standards.

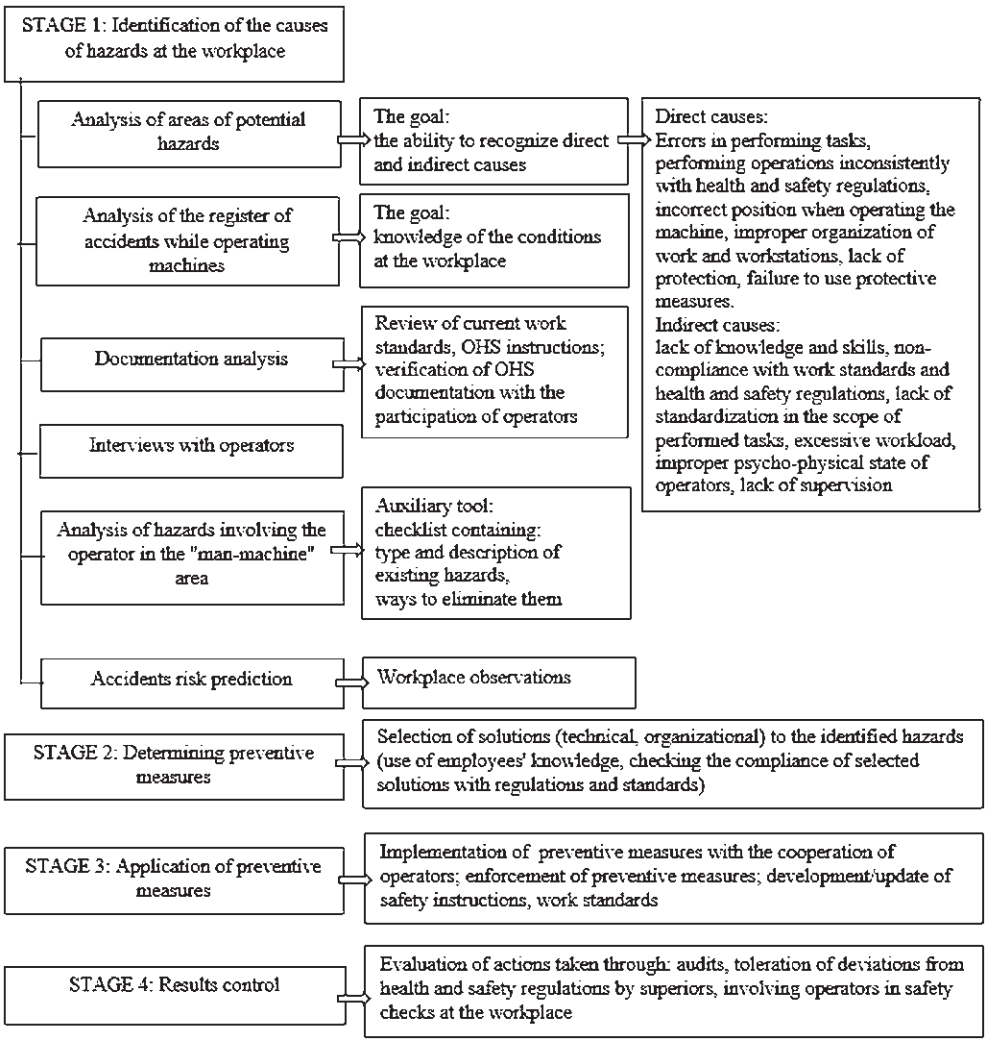

Figure 3 The four-stage approach to improving occupational safety according to TWI-JS [own research based on [1]]

CONCLUSIONS

Machinery operation is one of the causes of accidents at work registered in the steel industry in Poland. Employees' improper behaviour during the performance of work is a significant problem in this area, which further increases the risk of accidents. It is therefore necessary to implement solutions that will reduce the number of accidents and, at the same time, will shape machine operators' behaviour in the area of OSH.

The presented approach to occupational safety according to TWI-JS makes it possible to prevent accidents at work, teaching employees to identify and eliminate hazards during machinery operation. TWI-JS may be used in the steel industry in Poland, as well as in other sectors, as a supporting tool for reducing occupational accidents at work. It requires cooperation between and involvement of machine operators and a supervisor who will consistently put in place the various actions.

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Note: M. Gorgol is responsible for English language, Katowice, Poland