

Risk of the processes in the aspect of quality, natural environment and occupational safety

T. Karkoszka*, D. Szewieczek

Division of Materials Processing Technology, Management and Computer Techniques in Materials Science, Institute of Engineering Materials and Biomaterials, Silesian University of Technology, ul. Konarskiego 18a, 44-100 Gliwice, Poland

* Corresponding author: E-mail address: tatiana.karkoszka@polsl.pl

Received 23.10.2006; accepted in revised form 15.11.2006

Industrial management and organisation

ABSTRACT

Purpose: Purpose of the presented paper aimed at motivating the necessity of the simultaneous implementation of Quality Management System, Environmental Management System, as well as Occupational Health and Safety Management System and showing the possibility of usage the simultaneous estimation of incompatibilities, environmental impacts and results of threats to occupational health and safety; in this case in the process of thermal treatment.

Design/methodology/approach: Methodology used for the research has covered the integrated method of technological processes' analyzes and opinion taking advantage of general algorithm of estimating the risk connected with the presence of incompatibilities, environmental impacts and effects of threats to occupational health and safety.

Findings: Findings of the carried out researches are as follows: the realization of quality, environmental and occupational health and safety policy using the proposed model of processes' estimation leads to the improvement of the analyzed productive processes by the preventive and corrective actions, and in consequence - to their optimization from the point of view of products' quality and in the aspect of quality of environmental influence and occupational health and safety.

Practical implications: Practical implication can refer to the replacement of different methods of estimation the incompatibilities in Quality Management System, environmental impacts in Environmental Management System and the after-effects of threats to occupational health and safety in Occupational Health and Safety Management System by applying of the integrated estimation of the risk; what has been verified in the in the processes of thermal treatment of the steel wire.

Originality/value: Originality of the presented paper belongs to the methodology comprising the usage of integrated estimation of technological processes.

Keywords: Quality management; Environmental management; Safety and health management; Technological process analysis

1. Introduction

The more modern and based on the quality criterion solutions in the field of management appear as the result of constantly growing requirements and expectations from the client. However, the Quality Management System, which embodies only the quality activities, and not taking into

account the environmental aspects, as well as the occupational health and safety, does not fully reflect all the efforts made by the company.

The only one possibility of coming into agreement of those contradictory businesses of the company and its employees, together with taking into consideration problems connected with environment protection, is the simultaneous implementation of the Quality Management System,

Environmental Management System, as well as Occupational Health and Safety Management System.

The norm PN-EN ISO 9001:2000, coherent with the norms PN-EN ISO series 14000, is of the highest importance, mainly because of "process approach", which has a specific way of specifying the elements of the organization and its partial activities, which are influential on each other and create the management system.

According to the norm, the process can be regarded as set of interrelated or interacting activities which transforms inputs into outputs". The Integrated Management System embodying at the outputs of the processes both products and fixed services offered to clients as well as the ones occurring during the production process, which are unintended and at the same time perilous for the environment, and using in this manufacturing process the human resources, so, it is nothing else but system of connected with each other, and mutually influential processes.

That is why the identification of the particular processes is so crucial and defining their sequence as well as mutual dependence. This full characteristic of the processes in the Integrated Quality, Environmental, Occupational Health and Safety Management System should enable making such an analyzing of these processes, which will take into account the quality of the product manufactured and the services delivered, influence of the processes and the products on the natural environment as well as danger which might be put on the workers by this processes and products.

According to the above mentioned the research on standardizing of the estimating methods and planning the integrated method of estimating the processes, from the point of view of quality, environment, occupational health and safety, is so important.

2. Methods of estimating the processes in the quality, environmental and occupational health and safety system management

So far measurable and proved aims of the quality, environmental and occupational health and safety policy have been realized mostly in independently functioning management systems.

Implementation of the Quality Management System, based on the requirements stated by the PN-EN ISO 9001 standard, apart from the assurance of trust that the requirements concerning the quality of the products and services will be fulfilled, mainly the result should cover the follows [1-4]:

- improvement of the processes accordingly to the described procedures of the interior structural system together with clearly stated aims of the company as well as with the range of responsibilities and the entitlements,
- decrease of the costs of the defective products, which means costs of repairs, warranty, customer service and the financial fines,
- increase of the turnover and the shares on the market due to the increase of the customer's satisfaction,
- increase of the productivity due to the work-force motivation.

Implementation of the Environmental Management System, based on the requirements of the ISO norm 14000 series, was the answer to the increasing interest of the problems concerning degradation of the environment, and the obtained ISO 14000 certificate was meant to confirm [1-3]:

- improvement of the work effectiveness, due to combining of the economics business together with the natural environment protection ones,
- better position in the competition on the market due to the improvement of the company image,
- less frequent controls and easier acquiring of the outside permissions.

Implementing of the Occupational Health and Safety Management System, based on the domestic PN-N-18001 standard, and had to be the confirmation of the increasing importance of the human resource in organizing, and in practice it had to lead to [5,6]:

- decrease of the costs coming from the accidents occurred or the work-related illnesses,
- creation of the comfortable conditions for the whole workers in the field of the physical and psychical safety.

The core of the system quality, environmental as well as occupational health and safety management, is the fact that these systems are the part of the general management system - the one based on the conception of the constant improvement. Soon, it was discovered that only the simultaneous management of these branches of company is the one of the basic conditions of its efficient functioning [1-3,5].

As the most efficient and profitable during the simultaneous implementation, the usage of the up-dated PN-EN ISO 9001:2000 norm was pointed out, as the norm which structure lets for the direct integration, and the proposed "process approach" enables the identification and the management of numerous and commonly connected and influential processes [1-3,7,8].

Company, while realizing the requirements of the PN-EN ISO 9001:2000 standard, and at the same time managing the production system based on the quality criterion, is obliged to constant fulfilling of the external requirements, proving the conformity of the management system and constant improvement of the effectiveness of the process management system by the proper quality policy, environmental policy, and the health and safety-at-work legislation. Due to that fact managing the processes in practice requires applying the proper methods of estimation of processes being realized, both in the aspect of environment protection as well as in occupational health and safety [7-10].

In the field of quality management one of the most popular method of examination and estimation is the expert method Failure Mode and Effect Analyzes allowing for elimination of the potential nonconformities occurring in the process by elimination of the sources of their origin [1,7,9,11-13].

Accordingly to the ISO norms series 9000 these nonconformities are called "non-fulfillment of a requirement", and the defect means "non-fulfillment of a requirement related to an intended or specified use [14]".

In the range of the environmental management system PN-EN ISO 14004 norm proposes the environmental aspects identification aiming at estimating the previous, current and the

further, both positive and negative, influence of the company acting on the environment [1,7-9,13,15].

Environmental aspect it is "element of an organization's activities or products or services that can interact with the environment [16]".

Occupational Safety and Health Management System based on the guidelines of the PN-N-18002 norm, suggests the occupational risk assessment. Its aim is to identify the threats occurring at the work places as well as to defining the occupational risk involved [5,6,17].

Threat it is "the condition of the environment which might cause the accident or the illness [18]".

It can be stated that although all of the analyzes led aim at estimating the probability of the incompatibility occurrence (nonconformity, environmental impact, threat result) and pointing the risk connected with it, the procedure of the estimating these factors is different in each case [1,7-9,13].

3. Own research

Conducted investigations included technological process of heat treatment of wire which has been realized in the company being the national manufacturer of wires and steel ropes.

The thermal processing (patenting) has been realized as basic interoperation processing assuring the steel structure permitting on further plastic deformation of the drawing wire.

Heating and soaking of the wire has been led in through - open stove to austenitization in temperatures corresponding with temperatures holding in next chambers of the stove (960°C - 940°C - 920°C) for 25 seconds.

Cooling has been led in the bathtub with the lead solution about temperature 500°C for 15 seconds.

The range of investigations has included: the quality of the wire, influence of the productive process on natural environment as well as safety and hygiene of work on the patenting position.

For the need of the research for Integrated Quality, Environmental and Occupational Health and Safety Management System the constant dependence between causes of nonconformities and nonconformities (for Quality Management System), environmental aspects and their impacts (for Environmental Management System) as well as between threats to occupational health and safety and their results (for Occupational Health and Safety Management System) has been accepted.

In the investigative methodology the identification of the processes with utilization the of the "process approach" has been proposed.

One has accepted the general algorithm of estimating the risk connected with presence of incompatibilities, environmental impacts and results of threats to occupational health and safety as well as the undertaking the preventive and corrective actions.

Risk has been defined as a function of probability of specified dangerous events occurrence and resulting from it consequences;

- risk connected with the incompatibility occurrence as a function of probability of occurrence of cause of the incompatibility and the meaning of the incompatibility,

- risk connected with the environmental impact occurrence as a function of probability of occurrence of environmental aspect and the meaning of the environmental impact,
- risk connected with the results of threats to occupational health and safety occurrence as a function of probability of occurrence of threats and the meaning of their results.

Both in the opinion of the probability of appearance of cause of incompatibility, environmental aspect, threat to occupational health and safety and in the opinion of the meaning of incompatibility, environmental impact, result of threat to occupational health and safety the five-stage scale has been used.

The pointed independent risk indicator connected with the occurrence of incompatibilities, environmental impacts as well as the results of threats to occupational health and safety has shown the risk of realization of the analyzed process in the frames of Quality Management System, Environmental Management System as well as Occupational Health and Safety Management System.

The pointed total risk has shown the risk of realization of the analyzed process in the frames of Integrated Management System.

The proposed methodology has been used in opinion of technological process of thermal processing of steel wire. For the analyzed process one has qualified the risk connected with occurrence of the incompatibilities, risk connected with occurrence of the environmental impacts as well as the risk connected with occurrence of the results of threats to occupational health and safety.

For the analyzed process the risk connected with the occurrence of incompatibilities has been 40, the risk connected with the occurrence of environmental impacts - 25, the risk connected with the occurrence of the results of threats to occupational health and safety - 13. The risk of realization of the analyzed process in the frames of integrated management system has been 78.

4. Conclusions

Today, the principle aspects of activity of every enterprise are the quality of the produced articles and rendered services, protection of natural environment as well as the occupational health and safety. Management systems of these aspects based on the requirements of standards PN-EN ISO of 9000 series, PN-EN ISO of 14000 series as well as PN-N of 18000 series are the basic condition of correct functioning and development of every organization.

However the fundamental meaning, especially from the point of view of processes improvement in the aspect of quality, environmental protection as well as occupational health and safety, belongs to the application of the adequate methods of processes opinion.

In the own research the test of analyzes of technological process of thermal processing of steel wire has been undertaken. In the analyzes the procedure of simultaneous opinion of risk connected with the occurrence of incompatibilities, risk of environmental impacts as well as risk of effects of threats to occupational health and safety has been used. One had qualified risk connected with the occurrence of incompatibilities, environmental impacts as well as results of threat to occupational health and safety, and then the integrated coefficient of risk for realized process has been calculated.

The analyzes of technological processes led in such a way permits for opinion of realized processes both in reference to effectiveness of individual management systems, and in the complex conception of the Integrated Management System.

The risk, which has been estimated on the acceptable level, is the management subject. Risk management is the organizational process steered on maintenance of the risk in the controlled state, which has been defined, accepted and left in institution. In the activities connected with the risk one can decide about avoidance of the risk by the renouncement or not taking risky undertakings, or about reduction of the risk as a result of usage of proper preventive actions.

In the studied technological process the integrated risk has been qualified as moderated. One has marked the risk connected with the occurrence of occupational health and safety threats and their results as low, and the risk connected with the occurrence of environmental aspects and their impacts as moderated.

However the risk connected with the occurrence of incompatibilities and their causes has been estimated as comparatively high.

In reference to the management of technology as well as risk connected with realization of processes, the studied process has been qualified as requiring the usage of preventive and corrective actions; first of all in the range of produced articles quality management.

References

- [1] D. Szewieczek, T. Karkoszka, The analysis of a technological process based on quality and environmental criterion, The Scientific Conference on Materials, Mechanical and Manufacturing Engineering and Technology MMME'2005, Worldwide Congress on Materials and Manufacturing Engineering and Technology COMMENT'2005, 16th-19th of May, 2005, Gliwice - Wisła, 285-288.
- [2] S. Tkaczyk, T. Karkoszka, Integration of the management systems based on the quality criterion in technological processes, International Conference on: Integrated Management Systems - quality, environment, safety, technology, Szczyrk 2001, 373-379 (in Polish).
- [3] J. Bagiński, Integrated management systems, Economy Academy Publ., Katowice, 1999 (in Polish).
- [4] J. Michalska, Quality costs in the production process, Proceedings of the 14th International Scientific Conference on Achievements in Mechanical and Materials Engineering AMME'2006, 4th-8th of June, 2006, Gliwice - Wisła, 425-428.
- [5] D. Podgórski, Occupational health and safety management in polish enterprises implementing TQM conceptions, Quality Problems 4, 2000 (in Polish).
- [6] D. Podgórski, Z. Pawłowska, Fundamentals of occupational health and safety system management, CIOP, Warszawa, 2004 (in Polish).
- [7] T. Karkoszka, M. Roszak, Quality and environmental aspects in the technological process management, Polish Conference on: Projecting & Managing of the realisation of the production. Chosen subjects, 5th-7th of May, 2005, Zielona Góra, 63-68 (in Polish).
- [8] T. Karkoszka, D. Szewieczek, Operating steering in the processes of the steel wire production, Proceedings of the 11th Scientific Conference on Contemporary Achievements in Mechanics, Manufacturing and Materials Science CAMMS'2005, 6th-9th of December, Gliwice - Zakopane, 450-456.
- [9] T. Karkoszka, D. Szewieczek, Analysis of the wire rod superficial processing based on the quality criterion, Proceedings of the 14th International Scientific Conference on Achievements in Mechanical and Materials Engineering AMME'2006, 4th-8th of June, 2006, Gliwice - Wisła, 443-446.
- [10] PN-EN ISO 9001. Quality management systems. Requirements, PKN, Warszawa, 2001.
- [11] M. Dudek, D. Szewieczek, Usage of quality methods: Failure Mode and Effect Analysis (FMEA) and Statistical Process Control (SPC) as a element of production process, Proceedings of the 11th Scientific Conference on Contemporary Achievements in Mechanics, Manufacturing and Materials Science CAMMS'2005, 6th-9th of December, Gliwice - Zakopane, 317-321.
- [12] K.M. Tay, Ch.P. Lim, Fuzzy FMEA with a guided rules reduction system for prioritization of failures, International Journal of Quality & Reliability Management 23 (2003) 1047-1066.
- [13] D. Szewieczek, S. Tkaczyk, T. Karkoszka, QFD analysis as a manner of quality assurance in the technological process, The 12th International Scientific Conference on Achievements in Mechanical and Materials Engineering AMME'2003, Gliwice - Wisła, 919-922.
- [14] PN-EN ISO 9000. Quality management systems. Fundamentals and vocabulary, PKN, Warszawa, 2001.
- [15] PN-EN ISO 14004. Environmental management systems. General guidelines on principles, systems and supporting techniques, PKN, Warszawa, 1998.
- [16] PN-EN ISO 14001. Environmental management systems. Requirements with guidance for use, PKN, Warszawa, 2005.
- [17] PN-N ISO 18002. Occupational health and safety management systems. General guidelines for occupational risk assessment, PKN, Warszawa, 2000.
- [18] PN-N ISO 18004. Occupational health and safety management systems. Guidelines, PKN, Warszawa, 2001.