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CONTEMPORARY ELEMENTS OF QUALITY MANAGEMENT SYSTEM IN THE METALLURGICAL ENTERPRISE

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In this paper authors submit a method of quality estimation for metallurgical products. The method include three aspects: product's fulfillment of appointed properties (essential sense of quality), product's fulfillment of requirements of environmental protection (liquidation quality, level of waste management, energetic quality), onerousness of production process for health of workers.

Key words: steelwork production, quality, environmental management

Suvremeni elementi sustava upravljanja kvalitetom u metalurškom poduzeću. U ovom radu autori prikazuju metodu procjene kvalitete za metalurške proizvode. Metoda uključuje tri aspekta: procjena ispunjenja bitnih svojstava proizvoda (bitni smisao kvalitete), procjena zadovoljavanja zahtjeva zaštite okoliša od strane proizvoda (kvaliteta postupka uništenja proizvoda, razine upravljanja otpadom, energetska kvaliteta), procjena opasnosti proizvodnog procesa za zdravlje radnika.

Ključne riječi: čeličana, kvaliteta, upravljanje okolišem

INTRODUCTION

The concept of quality – appearing for the first time in the thoughts of Plato, Cicero or Aristotle – has been used in numerous areas of human activity, from the quality of material goods and services, the processes related to processing, exchange, management, to those related to human living in general [1]. Definitions of quality are proposed currently in the literature on the subject (Joseph M. Juran, W. Edwards Deming, Armand V. Feigenbaum, Philip B. Crosby, Robert L. Flood), which, notwithstanding the great variety of formulations, have one underlying idea in common – that quality means the satisfaction of the customer's requirements [2]. Thus, quality has become one of the fundamental and essential elements for building or sustaining competitive advantage in the market.

In improving their management systems, business entities more and more often compete for various quality awards, thus striving to distinguish their market identity. Contemporary trends in environmental protection and the European Union's requirements make companies give more consideration to pro-ecological activities.

An increasing number of enterprises, wishing to create their image, will be interested in using not only quality standards, but also environmental management systems, or Health and Safety and Industrial Hygiene management systems [1]. The integration of these areas is not a new idea, as already Gemichi Taguchi believed that the quality of product is a loss transferred by the product to society, starting from the time of shipping that product. He assumed therefore that each product delivered to the user causes a loss, which is the lower, the higher the quality of that product is. These losses are commonly understood as the contamination of the natural environment and associated diseases resulting from the progress of civilization, occupational health and safety, but also the consumer's dissatisfaction or the manufacturer's losses caused by the disadvantageous image of the organization, which result in a loss of selling markets in the long term [3].

Understanding both the present and future needs of the customer, meeting the customer's requirements, the loss function – all these terms enable quality systems to encompass areas that have not been previously associated with the concept of quality.

CONTEMPORARY QUALITY MANAGEMENT SYSTEM ELEMENTS IN THE METALLURGICAL ENTERPRISE

In the majority of Polish and foreign enterprises, including metallurgical ones, already exist Integrated Management Systems that combine an environmental management system and a safety and industrial hygiene management system with general quality management systems (this integration may not only concern systems implemented in accordance with the requirements of ISO standards, but also can be completed in areas, such as a logistics system, the accreditation of laboratories, a

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financial system, etc.). The integration of those systems generally resulted from the wish for improving the management process, rather than from the need for looking at the issue of quality in a broader aspect. Individual areas still coexist side by side, while not interacting one with another, because quality continues to be perceived in the traditional way, which is targeted at meeting the requirements of the ISO 9000 standards.

In the metallurgical enterprise examined for the purposes of the present article there have been integrated management systems for years, which were created by combining separate systems for the management of individual aspects. For each of those areas (Quality, Environment, Health and Safety) several objectives have been set, as defined by values permissible for particular indices per annum. The selection of their type and limiting value is based on many years' experience, and allows for the specifics of a particular area. In the case of environmental protection, one of the key system's elements is the integrated permit, which has the character of a special permit (the Act on the Environmental Protection Law) for introducing substances or energy to any components of the environment, while complying with the environmental protection requirements, following the so called Best Available Techniques (BAT). Such an administrative decision constitutes actually some kind of license for conducting a particular activity, as the Act demands the functioning of installations operated without the required permit to be withheld. Such a specific kind of State intervention is also consistent with the idea of sustainable development, meaning a social and economic development or growth complying with the environmental requirements. This concept is generally viewed in a macroeconomic scale (e.g. a different approach to the problems under discussion is dependent on the level of economic development of a particular country): however, its implementation will require, above all, a pro-ecologic orientation in the management of the enterprise, which, in practice, refers to the ISO 14000 standards. So, the environmental management indices (e.g. sludge, dusts, slag, CO_2) reflect, on the one hand, the top-down imposed restrictions, and, on the other hand, the level of the Steel Mill's pro-ecological policy.

Also consistent with the idea of sustainable development is the Global Environmental Management (TQEM) initiative - its goal is to develop strategies and standards in cooperation related to environmental activity and work safety. Because of the variety of requirements and legal approaches in individual countries, Health and Safety related standards (PN-N-18000) are not international (ISO) standards yet. However, this does not prevent them from being associated with standards concerning quality or environmental protection. In this area, the basic indices [4] include the accident frequency rate (Ww – the number of accidents per 1000 working persons), the accident severity rate (Wc – the average number of days of incapacity for work per accident), and the accident absenteeism rate (the average number of days out of work due to accidents per 1000 worked hours). In the Steel Mill under examination, the Ww index in the years 2006 - 2008 was, respectively, 7,62; 7,76; 6,03; and did not exceed the limiting values set by the Plant. In the case of the Wc index, such exceeding did take place. For example, in 2008 its value was by 27 % higher than planned, which was caused primarily by accidents that did not result from performed work, but which nevertheless were so severe that resulted in a long-lasting disease of the worker concerned (complicated during treatment).

The 9000:2000 series ISO standards, which set the quality management standard, places the special emphasis on the needs for ensuring the safely working conditions, in terms of e.g. noise, contamination, etc., for the workers Š1Ć. Thus, all of the above-mentioned systems not only have some partial goals in common, but also are mutually complementary. It can therefore be said that the aspects related to environmental protection or health and safety constitute an important quality element. Such an approach, being consistent with Taguchi's idea, would require a different, broader view of quality-oriented issues in activities undertaken by enterprises. For a steel mill, a much more advantageous solution would be to create a production process monitoring system, which would allow particular indices to be assessed on an ongoing manner, e.g. per month (without being influenced by the annual scale). Having an appropriately developed database (referring to current technical and technological solutions), it will be possible to determine desired level of a specific index along with its tolerance range using SPC (Statistical Process Control) tools (e.g. Sheward cards). This would make it possible to assess the degree, in which the production process deviates from the optimal process being feasible under specific conditions in particular time periods. The selection of the types of indices should be representative of all significant aspects related to the specifics of a particular production and should be made while considering the issue of quality as a system concept, being also associated with environmental protection or work health and safety.

Figures 1 and 2 shows the percentage variations of example indices monitored in the Steelworks department being discussed, relative to the average values in the examined period. The analysis of the dynamics of non-conformity variations – as considered both in an annual and a biannual time-frame – indicates the occurrence of significant fluctuations reaching, in extreme cases, a level of above two hundred percent. Such large deviations did not result, however, in exceeding the permissible limiting values in a year time-scale.

This suggests the existence of considerable opportunities for improving the production processes in terms of enhancing the quality level. The dynamics of variations

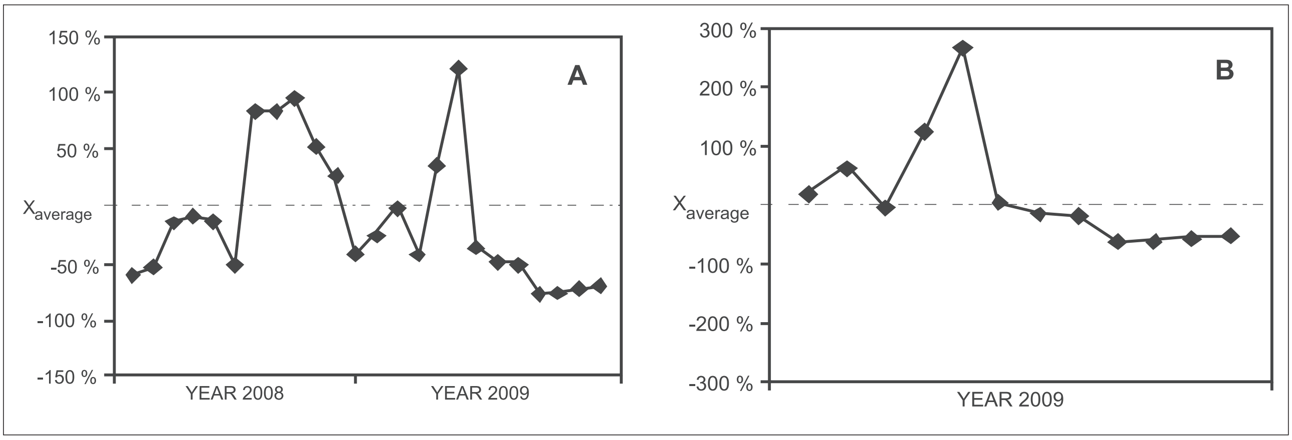

Figure 1 Percentage variation of a non-conformance with respect to its average value in the period examined: a) years 2008, 2009, b) year 2009

Note: The presented data do not apply to all of the detected non-conformances, but only to certain their group resulting from the classification adopted by the Steel Mill under examination.

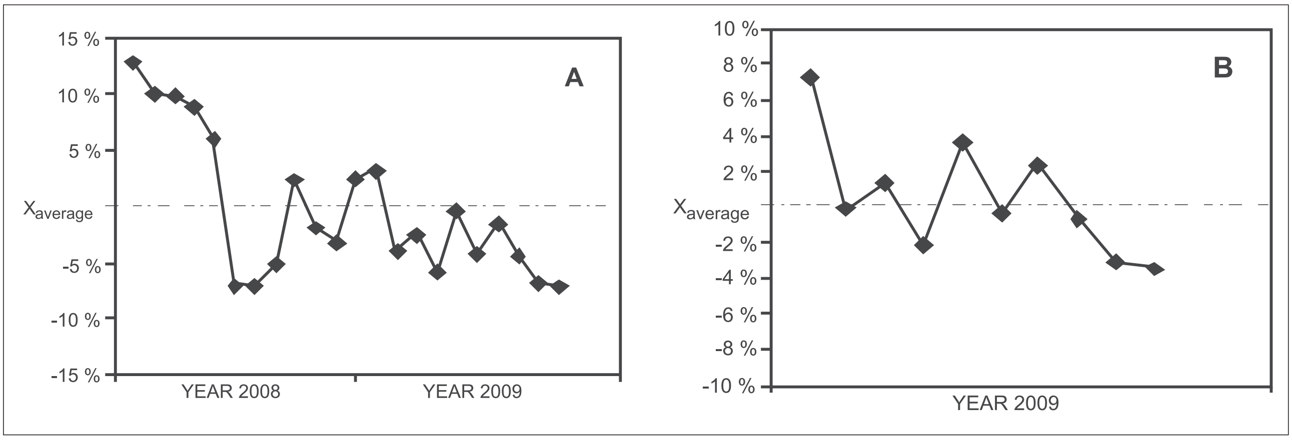

Figure 2 Percentage variation of steelmaking slag with respect to its average value in the period examined: a) years 2008, 2009, b) year 2009

Note: The presented data apply to all of the slag types obtained within the Steelworks under examination.

in the amount of steelmaking slag per ton of steel does not show such large fluctuations. The occurring variations of a dozen of so percent might result from the differences in the quality of charge and the grade of produced steel. The observed level of deviations is indicative of the production process running reasonably stable.

Obviously, it is necessary to develop broader analytical schemes, which will take into account a large group of indices allowing either the confirmation of the perceived trends or indication of totally different ones.

The identification of the type of indices, which would be subject to monitoring for the quality and environmental management systems, depends only on the experience and knowledge of the employees of the relevant organizational unit of the Plant. In the case of the health and safety management system this problem seems to be more complex. The Ww and Wc indices mentioned earlier appear to be insufficient for the assessment of the current state of safety in the area under being examined, as they indicate the existing problems through already occurred effects and reflect activities carried out in the past (e.g. the accident frequency rate, due to its nature, is subject to analysis only in a longer time-frame). Guided by the incident relationship triangle by Heinrich [4], it might also be necessary to record additionally so called no-injury (near-miss) incidents, which could be used both in prevention and in the ongoing assessment of the work health & safety management system. Another, more comprehensive solution is the integrated management index developed by the Health and Safety Executive [5] in the UK. It is calculated based on five partial indices: work health & safety management, accidents at work, sick leaves, health protection at work, and serious breakdowns and incidents that might cause them.

The previous, as well as the current [6] energy policy of the European Union attaches great importance to the efficient use of energy, which is also consistent with the adopted goals of Europe's economic strategy until 2020. The specifics of metallurgical production required undertaking an attempt to make the energy evaluation of the enterprise's basic products. A kind of "Energy Certificate" or any other energy consumption factors would provide other very important indices of the integrated management system. The energy aspect could have come into being within the environmental management system, but the energy intensity of this branch of industry and the weight of the entity under consideration indicate that it should function as another area of the integrated management system.

SUMMARY

The purpose of the article was to indicate the possibility of devising such a method of determining the quality of metallurgical products, which would take into account the degree to which, the production process:

- allows a product of specified properties (the quality, as understood in a basic sense – as per ISO 9000) to be manufactured
- meets the environmental protection requirements
- is noxious to the worker's health
- energy is intensive.

So understood quality would not make any quantity (of course, this is theoretically possible, e.g. by reference to BAT or comparison with other enterprises) being either absolute or competitive to existing standards. It would only provide guidance for a specific plant on how their manufacturing process (products) deviates at a particular moment from the optimal process, which is permanently feasible under given conditions.

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Note: The professional translator for English language is Czesław Grochowina, Studio – Tekst, Poland