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THE ROLE AND FUNCTION OF SAFETY AUDITING IN COAL MINING MANAGEMENT

ROLE A FUNKCE BEZPEČNOSTNÍHO AUDITU V ŘÍZENÍ KAMENOUHELNÉHO DOLU

Abstract

In present paper the importance of „auditing” for dealing with health and safety problems in underground coal mines is discussed. Various kinds of audit are shown and possibilities of its application for workplaces are indicated. Within frame of the paper a mathematical model of audit and its solution are presented.

Abstrakt

Tento článek pojednává o významu auditu pro řešení problematiky bezpečnosti a ochrany zdraví na hlubinných uhelných dolech. Jsou předvedeny různé typy auditu a možnosti uplatnění auditu na pracovištích. V rámci přednášky je uveden matematický model auditu a jeho řešení.

Key words: audit, total loss control, management evaluation, regarding itemized tendencies.

Introduction

Management is understood as a business activity in which we establish and realize aims in organizations being under manager control, based on own or on having at disposal production resources. Within the confines of management we can distinguish so-called *management functions* (planning, organizing, motivating, executing, co-ordinating, controlling, husbanding of staff) as being stages of so-called *organized cycle*. An opinion evolution in range of management perception made Frank Bird and Jack Fletcher (on the break of sixties and seventies) by forming a Complex Control System of Losses (***Total Loss Control***). The aim of the System was to expand one of the managements' functions (controlling) in a way to take control of *all* phenomena unfavorable to enterprise. The most important principle in this System was saying that: ***incidents and damages result from human mistakes or from unsuitable processes of managing and controlling in enterprise.*** Preventive activity consists in controlling all events breaking or disturbing a productive process and which in this way cause losses. System of ***Total Loss Control*** was modified and developed during nineties in connection with introduction of ***Total Safety Management Programme***, being a part of Total Quality Management Programme. According to assumptions of Total Safety Management Programme ***”safety of work is an integral part of productive process on each level of management with direct involvement of employees and managers of institution”.***

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Audit as a method of control and quality management evaluation

In the management system of enterprise we can distinguish procedures of complex evaluation and of quality control management, it means *controlling* where *audits* are tools and forms of realization [1], [9]. *The main aim of audit is to identify problems in management area, to investigate these problems and to evaluate them, to get information about methods, techniques and organizational actions undertaken in enterprise.* In this meaning ***occupational safety audit is to be understood as a method of control and quality evaluation in area of safety management, it is applied for getting information about methods, techniques and organizational actions undertaken in enterprise to prevent injuries, destructions, undesirable losses and to protect important goods.***

Similarly as it is in planning also with reference to occupational safety audits we can talk about definite systematics - it is different on each level of organization [5]. Occupational safety audits should be carried out on every level of management of institution, i.e. on tactical level (managers of institution) - *tactical audit of occupational safety*, on operational-sectional level - *audit of occupational safety in department or section*, and on executive level - *audit of safety in a workplace*.

Realization procedures of occupational safety audit

Occupational safety audit - independent on organizational level which is concerned it equally applies the following formalized realization procedures [5]:

1. Identification of objects to be evaluated.
2. Determination of expert team.
3. Giving evaluation criterion and defining a list of problematic areas.
4. Doing an audit of evaluated objects.
5. Preparing a ranking of such objects.
6. Formulating corrective recommendations as conclusions.
7. Specifying a deadline and a way of opinion modernization.

Tactical audit of occupational safety with complex procedures of control and evaluation in mine as a whole. Supervising of realization procedures of tactical audit of occupational safety as well as of how it takes place in case of operational-sectional audit and in case of audit of safety in a workplace. This supervision is a job of internal auditor appointed by a coordinator of occupational safety system of mine or by a consultative council of safety management and losses control [6].

Quality evaluation of occupational safety management in mine as a tactical audit descends from American programme **MERIT** (*i.e. Management Evaluation Regarding Itemized Tendencies*), which was adapted to Polish mines by Polish - American Association for Occupational Safety in Mining sited in Katowice [2]. Programming procedures **MERIT** (*evaluation of management by defining directions of changes*) are a part of organizational techniques elaborated in USA to analyze dangerous conditions of work and to eliminate dangerous events (including accidents). The applied methods are connected with theoretical and practical activity of American enterprises using philosophy and system methodology being until now the last stage of evolution which theory and practice of occupational safety and health has passed during previous decades period. ***Occupational safety is treated here as an integral part of management system***, in which all component elements as well as connections between such elements have to be taken into consideration by preventive activities so as to avoid accidents at work, breakdowns and other kinds of unfavorable events [4], [8].

In case of tactical audit of occupational safety the evaluation is made in nine problem areas, while in case of operational-sectional audit or in case of audit of safety in workplace it is made in twelve problem areas [5]. For example, problem areas defined by a tactical audit of occupational safety are the following:

- A. Planning of actions in area of occupational safety management of mine.
- B. Accidents investigation.
- C. Control and inspection of Occupational Safety and Health.
- D. Observation and analysis of how the work is executed.
- E. Personal protection.
- F. Regulations of Occupational Safety and Health in mine.
- G. Informing about state of Occupational Safety and Health.
- H. Promotion of Occupational Safety and Health.
- I. Personal opinion about conditions of Occupational Safety and Health in mine.

For audit investigations in area of work safety management a simple random dependent selection method was used - "test mother sample" was defined as being 6-10 % of general population. Receiving level of a test sample is assured both by investigations of workers representatives from each essential organizational level of mine (*tactical audit*) and by investigations of representatives of individual professional groups in departments (*operational-sectional audit*), or in workplace (*audit of safety in workplace*). As we can see the safety audit is assured for a great part of mining staff not only by undertaking particular audit activities, but also by permanent activity, i. e. repeated within closely defined time outlooks (for a safety audit realized on tactical level such period is 12 months).

By establishing a final opinion WZBi for an object (mine, organization separated from enterprise's structure, workplace), and also by determining partial opinions WO_{Pi} (it means opinions for individual problem areas) it is enabled the following:

- to compare objects between themselves;
- to follow a tendency or trend of changes;
- to show strong sides or weak sides in area of occupational safety management.

Mathematical model of evaluation

For process of evaluation of quality of occupational safety management we used a questionnaire poll. Based on results of such research a matrix was developed, the horizontal lines were coordinate axes treated as points P_i in identification space and columns are the next problem areas within frame of occupational safety management [5]:

$$\begin{bmatrix} x_{11} & x_{12} & \dots & x_{1r} \\ x_{21} & x_{22} & \dots & x_{2r} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mr} \end{bmatrix},$$

m - object which was examined (mine, organization separated from structure of enterprise, workplace in a department or section),

r - problem area of occupational safety management.

Example

Research audits were made in twelve workplaces of mining department in underground mine "Budryk" S.A. [5]:

- service of cutter-loader in a longwall face of department G1;
- service of cutter-loader In a longwall face of department G2;
- service of cutter-loader in a longwall face of department G3;
- service of face conveyor in longwall face of department G1;
- service of face conveyor in longwall face of department G2;
- service of face conveyor in a longwall face of department G3;
- operator of powered support in a longwall face of G1;
- operator of powered support in a longwall face of G2;
- operator of powered support in a longwall face of G3;
- securing of cutter-loader stable hole in longwall face by crew of G1;
- securing of cutter-loader stable hole in longwall face by crew of G2;
- securing of cutter-loader stable hole in longwall face by crew of G3

Questions concerning the domain of occupational safety management are grouped in 12 problem areas (from A to L). The obtained answers enable building-up of an evaluation matrix:

1,000	0,875	0,813	0,750	0,750	0,750	0,750	0,917	0,750	0,750	0,750	0,750
0,563	0,375	0,500	0,750	0,583	0,750	0,500	0,75	0,625	0,75	0,625	0,5
0,750	1,000	0,938	0,750	0,833	0,250	1	0,9167	1,000	0,875	0,750	0,750
0,563	0,250	0,438	0,500	0,167	0,000	0,250	0,500	0,375	0,375	0,375	0,500
0,75	0,75	0,9375	0,75	0,8333	0	0,75	0,8333	0	0,875	0,75	0,5
0,5625	0,625	0,6875	0,75	0,4167	0,25	0,5	0,5833	0,75	0,375	0,25	0,25
0,9375	0,875	1	0	0,5833	0	0,75	0,9167	1	1	1	1
0,5	0,625	0,6875	0,75	0,75	0,75	0,5	0,75	0,625	0,25	0,625	0,75
0,9375	1	1	1	1	1	1	1	1	1	1	1
0,8125	0,5	0,5625	1	0,8333	1	0,75	0,8333	0,875	0,875	1	0,75
0,5	0,5	0,6875	0,5	0,5833	0	0,5	0,625	0,375	0,75	0,75	0
0	0,75	0,4375	0,75	0,75	0,5	0,5	0,6667	0,125	0,5	0,625	0,25

The following evaluation criteria were accepted [5]:

- positive opinion was admitted when final evaluation coefficient was within range $<0,8 - 1,0>$;
- sufficient opinion was admitted when final evaluation's coefficient was within range $<0,6 - 0,8>$;
- negative opinion was admitted when final evaluation's coefficient was within range $<0,0 - 0,6>$.

Based on results it is obvious that the following four workplaces:

- service of cutter-loader in a longwall face of department G3;
- operator of powered support in a longwall face of G1;
- service of face conveyor in longwall face of department G3;
- service of cutter-loader in longwall face of department G1

got a positive opinion,

the next four:

- service of cutter-loader in longwall face of department G2;
- operator of a powered support in longwall face of G2;
- appointment of a cutter-loader niche in wall of squad G2;
- service of a longwall conveyor in department's longwall G1

got a sufficient opinion,

and finally the last four:

- appointment of a cutter-loader niche in wall of squad G3;
- service of a longwall conveyor in department's longwall G2;
- operator of a powered support in a longwall G3;
- securing of a cutter-loader stable hole in longwall face by crew of G1

got a negative opinion.

Analysis of results shows that:

1. For all twelve problem areas of the workplace "Securing of a cutter-loader stable hole in wall face by crew G1" negative opinions were obtained.
2. For the workplace "Operator of powered support in longwall face of G3" in seven cases, in areas: A, B, D, F, G, L the value of final evaluation coefficient was negative.
3. In case of the workplace "Service of face conveyor in longwall face of department G2" we obtained eight problem areas for which the final opinion was negative. They were: A, E, F, G, H, J, K and L areas.

Conclusion

By introducing modern procedures of integrated management system of work's safety and equally of standardized system of quality evaluation of organizational results to Polish enterprises and mining plants the protection of life and health of miners is improved, generally without necessity of considerable increase of production costs. The necessary condition of putting into practice the rules of integrated work safety management system can be gained, if the program is accepted and supported by the director, by the enterprise management and also by all mine workers [3], [7]. The herewith introduced proposal of assessing and evaluating of quality in the domain of work safety management enables to examine the condition of current safety and health management of work on each level of management and equally to show the strongest and the weakest elements of the problem area of occupational safety.

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Resumé

Zavedení integrovaného systému řízení bezpečnosti práce a sjednoceného systému hodnocení kvality organizačních aktivit vyplývajících z přijatých realizačních principů systému umožňuje do značné míry chránit život a zdraví pracovníků bez nutnosti zvyšování nákladovosti produkce. Nezbytnou podmínkou efektivního zavádění principu integrovaného systému řízení bezpečnosti práce je akceptování jeho programu nejen ředitelstvem, osobami vedení a inženýrskými kádry, ale také celým osazenstvem dolu [3], [7]. Uvedený návrh posuzování a kvalitativního hodnocení činností v oblasti řízení bezpečnosti práce umožní zkoumat aktuální stav bezpečnosti a hygieny práce na všech úrovních řízení, mimo jiné určováním nejsilnějších a nejslabších aspektů projevujících se v problematice bezpečnosti práce.

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