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QUALITY RISK MANAGEMENT – AN INTEGRATED APPROACH IN THE MINING INDUSTRY

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ABSTRACT: The continued development of management system standards into areas such as environment, health and safety, and information security has reinforced the calls for an integrated approach. In the mining field, characterized by a high level of specificity, an integrated approach to underground activities should not omit the influence of the risk factors. In this context QRM can be not just a solution, but also a necessity.

1. INTEGRATED MANAGEMENT SYSTEMS (IMS)

The IMS contributes to company sustainability by driving progress in achieving environment, health and labor safety precaution, social responsibility and quality objectives and targets aligned with the organization's business objectives. Implementing an IMS is a multi-phased process which involves designing a management system that suits the business model; performing pilot tests within the operation to test the proposed IMS; refining the system based on the testing; and finally, integrating it into the fabric of an organization's operations.

The IMS contributes to company sustainability by offering a system that not only provides a means to focus business energy, but also monitors its progress in attaining the organization's business objectives and targets. IMS improvement goals are monitored monthly, quarterly, and annually to determine its efficacy in creating cost savings and reducing non-conforming products and delivery. Key to success is having clear, simple targets that provide measurable outcomes and milestones along the way.

Finally, an IMS contributes to sustainability by driving design for environment processes and fulfilling end-of-life requirements that are arising.[4]

2. RISK FACTORS IN THE UNDERGROUND WORKING SYSTEM IN THE IMS CONTEXT

An important achievement in the mining field, concerning IMS, at international level was obtained by Mining, Minerals and Sustainable Development (MMSD) Project. The objective was to understand how to maximize the contribution of the mining and minerals sector to sustainable development at the global, national, regional and local levels. Through this process, MMSD has proposed a clear agenda for global change in the minerals sector, that is based on careful analysis, that is understood and supported by many key stakeholders, and that identifies mechanisms for moving forward.

The Final Report attempts to present a broad panorama of the issues which confront the mining and minerals sector in the transition to a society consistent with the model of sustainable development. [6]

In Romania the situation of the mining sector is well known. This industry comprise some large companies declared as being of national interest, yet stirring up

controversy on the subject of their viability in a free market economy during the economic transition period.

In the paper context we try to underline the importance of the identification of the specific risk factors, considered as a premise for IMS approach in the underground working system.

The underground working system is characterized by a high level of specificity due to the particularities of the four elements which exist and interact: operators, working tasks, production means and working environment [1].

The existence of the risk factors is known in the underground working system. It is important to identify them in order to start a casual chain determined by characteristics, status, processes, phenomena, behaviors.

In order to demonstrate their existence, it is necessary to perform a systematic analysis of the characteristics of accidents and possible deviations and errors at the level of each system component.

- Risk factors particular to the operators

When the operators deviate from the standard procedure needed to accomplish the working task, an erroneous action has occurred at one or more of the basic links of working activity, respectively: errors regarding reception, processing and interpretation of information, decision errors, execution errors, self-adjustment errors. This error materialized as a non-adequate behavior from the point of view of working safety and takes the form of a wrong action or omission.

- Risk factors particular to the working task

Two categories of potential accidents or occupational disease cause may occur: improper content or structure of the working task compared to the labor system objective or to the requirements imposed by the risk situations (wrong operations, procedures, rules, absence of certain operations, non-adequate methods) and under/over-dimensioning of requirements imposed to the operators, i.e. requirements that are not adequate for their capabilities.

- Risk factors particular to the production means

- Mechanical risk factors- their action consists of unexpected, uncontrolled and non appropriate release of kinetic energy incorporated in the production means or in certain parts of them;
- Thermal risk factors – the potential danger is given by the action of the thermal energy that is incorporated in the production means, at the contact or during their manipulation performed by operators;
- Electric risk factors – the danger consists of the possibility of a direct or indirect contact between the operators and the electrical energy used by production means;
- Biological risk factors – their action has a potential for biological accidents, depending on the characteristics of macro or micro-organisms used within the working process.

- Risk factors particular to the working environment

The physical environment can induce either deviations under the form of exceeding the functional level or intensity of the specific parameter (microclimate, noise, vibrations, chemical toxicity, radiation, lighting).

The psychosocial environment is characterized by risk factors of psychical nature, whose result consists of overachievement by the workers.

The studies and analyses regarding accidents and occupational diseases emphasized the major incidence of the risk factors particular to the operators.

In Romania, as well as all over the world, the malfunctions of the working system occur in the mining industry in a large number than in any other field of activity.

In the context of this paper, working accidents and the occupational diseases are considered malfunctions of the working system. These dysfunctions of the working system that may lead to labor accidents or occupational diseases are produced only under the condition that the risk factors for accidents and/or occupational diseases exist and are active [2].

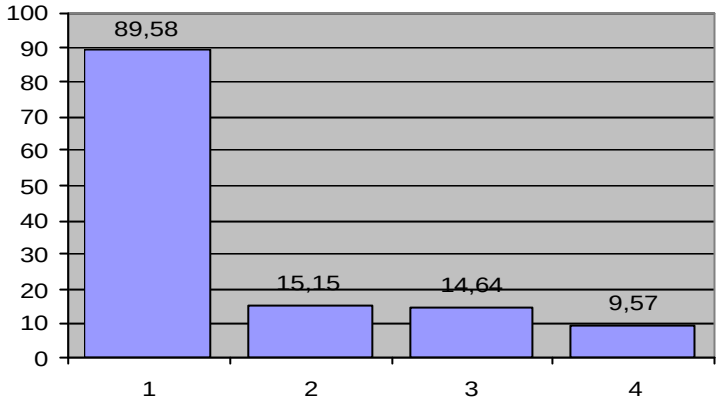

Figure 1.Classification of work accidents by causes [source: National Hard Coal Company Petrosani, Romania

Legend:

1. The person who carries out the work
2. The production means
3. Work duty
4. The working environment

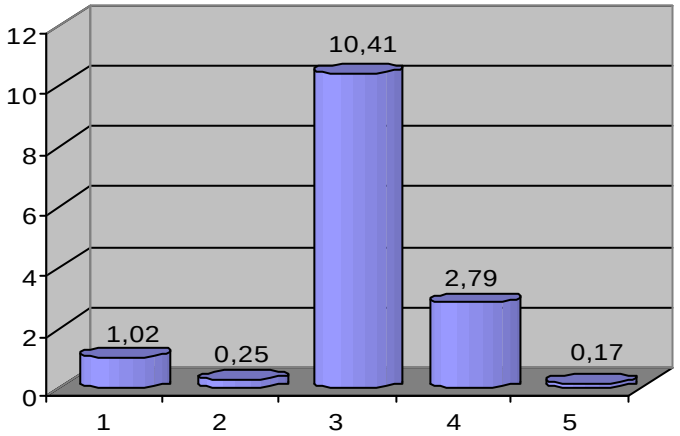

Figure 2.Classification of work accidents by causes depending on work duty [source: National Hard Coal Company Petrosani, Romania]

Legend:

1. Omission/errors in presetting working tasks
2. Unsuitable distribution of the employees on the working place;
3. Shortcoming in guidance, surveillance and control;
4. Lacks in providing suitable works condition;
5. Other causes

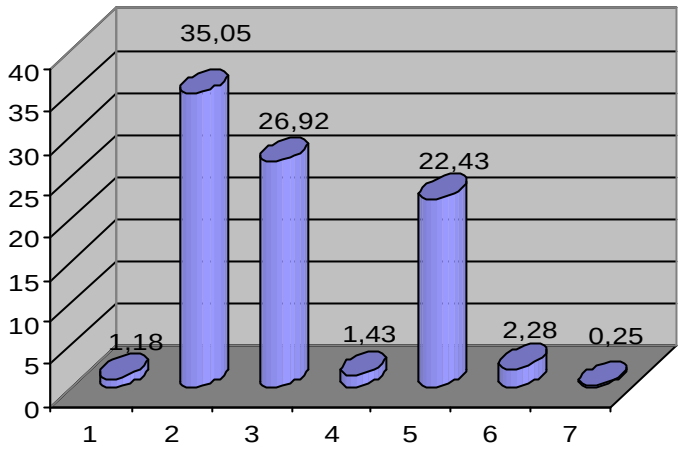

Figure 3 Classification of work accidents by causes depending on the person who carries out the work duty [source: National Hard Coal Company Petrosani, Romania]

Legend:

1. Unsuitable utilization of the protection means;
2. Failure to perform operations that are indispensable to working safety in due time;
3. Shortcoming in carrying out working tasks;
4. Exposure to hazardous factors outside the work site;
5. Falls on the same level;
6. Falls from heights;
7. Other causes.

3. QUALITY RISK INTEGRATED MANAGEMENT SYSTEM IN THE UNDERGROUND WORKING SYSTEM

Analyzing the risk factors, we can say that the most suitable IMS for underground must take into account the risk associated to the factors already presented.

The response can be Quality Risk Integrated Management System that will generate new developments with regards to the safety, health, environment, risk and quality solutions within the division, which will bring together a total business solutions approach, which allows organizations to comply with the necessary health and safety regulations as stated in governance guidelines.

The approach is based on risk management principles utilized actually in many areas of business and government including finance, insurance, occupational safety, public health, and by agencies regulating these industries. There are also examples of the use of quality risk management in the pharmaceutical industry today. The importance of quality systems has been recognized and proved by the great number of the firms from different domains which implemented the quality management system. In the specifically case of the underground working system, quality risk management can be a valuable component of an effective integrated management system. QRM includes systematic processes designed to coordinate, facilitate and improve science-based decisions making with respect to risk.

The steps used to initiate and plan a QRM process might be:

- ✓ Define the problem and/or risk questions, including pertinent assumptions identifying the potential risk;

- ✓ Assemble background information and data on the potential hazard, harm or human health impact relevant to the risk assessment;
- ✓ Define how decision makers will use the information, assessment and conclusions;
- ✓ Identify a leader and necessary resources;
- ✓ Specify a timeline and deliverables for the risk management process.

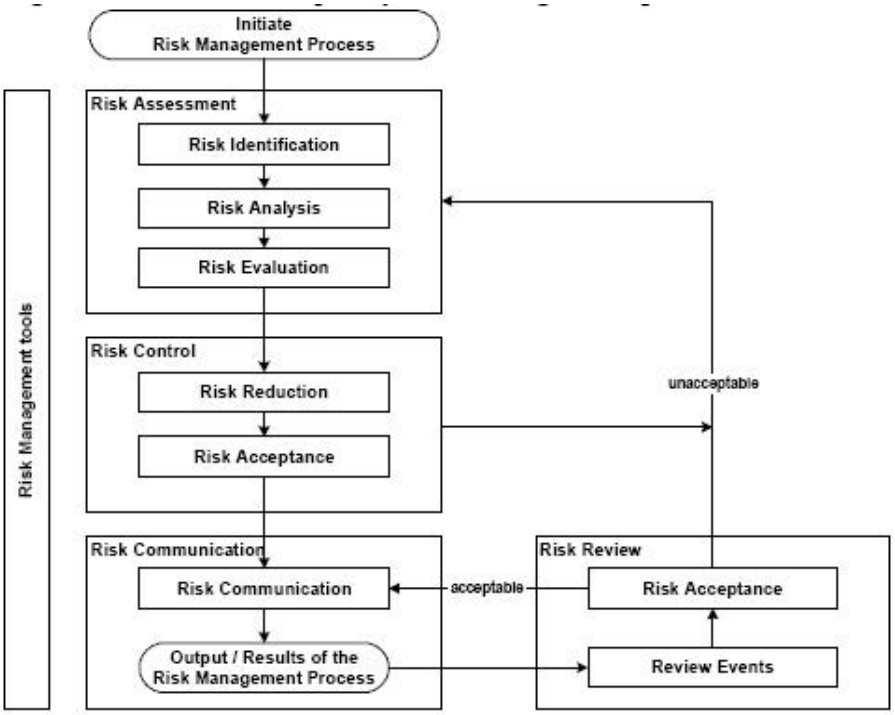

Figure 4 Quality Risk Management Process [7]

The particularities of the mining industry and the peculiarity of hard coal mining in Jiu Valley support the importance of QRM approach in this sector of activity.

In the underground working system we deal with imprecise information regarding the evolution in time of the following components: tools, equipment, mining machines, environment, geo-mining conditions and human factor, component that generate the risk factors presented above.

What it is important, is the possibilities of operating through combination of the variable types, probabilistic and fuzzy, existing exact information given by the value of some set indicators, probabilistic information given for example by the functioning of the equipments that are contained into the face coal system and imprecise information are the ones related to the environment (geo-mining conditions) or to the human factor [3].

In this context we propose a model based on the fuzzy logic. The variables (s,m,t,e) are the expression of the risk factors identified. For each variable is defined the linguistic terms.

s – the correlation of the geometrical parameters of a face coal with the function limits of the equipments in order to obtain an optimal level of the functioning probability of the system for diminishing the risk of appearing the defect state;

m – the quantity of materials means and also of measures of working safe necessary for diminishing the risk of appearing the defect state;

t – cognitive means – quantity and quality of the knowledge and habits used for diminishing the risk of appearing the defect state;

e - the value of the prejudices followed the risk manifestation

This is the actual phase of the researches regarding the possibility of making a model for evaluating the risk associated to the human factor. It is wanted that, in the end, after having applied the specific steps of the fuzzy logic, by obtaining the defuzzyfication result, it should be appreciated the action of human factor by framing into an action typology.

The action typologies will be introduced in the aggregate risk matrix. The matrix indicates, an aggregate rating is a combination of two already assess ratings – one for the quantity of risk and the other for the quality of risk management.

4. CONCLUSIONS AND FURTHER RESEARCH

The paper presented some considerations about the QRM implementation in the mining field. The first step of the QRM approach is to define the problem and/or risk questions, including pertinent assumptions identifying the potential risk.

The risk factors in the underground system were identified and also the dysfunctions of the working system that may lead to labor accidents or occupational diseases produced only under the conditions that the risk factors are active.

The future actions will have to concentrate on evaluating the risk grade associated to the human action for linked to a group of risk factors already presented in order to determine the risk assessment using a fuzzy model. The aggregate risk matrix shall establish the relation between the action typologies of a human action, the risk associated to a human action and quality management risk in an integrated management system.

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