

Leading Digital Technologies and the Optimization of Processes in Occupational Safety

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Abstract Statutory regulation of processes managing safe working conditions includes the procedure of special assessment of working conditions. Implementation of this procedure involves processing considerable volume of input and output information by task performers and responsible parties. The volume of information depends on the level of management system structure, number of employees and kinds of working processes, equipment and materials involved in production. Introduction of digital technologies to regulation of special assessment process makes it possible to reduce labour input, optimize resources required for process implementation and lessen the costs of special assessment of working conditions.

Keywords: *leadership, digital technologies, optimization, occupational safety*

1 Introduction

Digitalization of economy has introduced its elaborated principles and approaches to the whole range of public and economic activities. Analysis of factors involved in this process allows one to get a clear insight into the broad scale it has attained.

A scope of activities within an organization is arranged into a uniform management system. That means the efficiency of an organization's activities in terms of management approach can be ensured by establishing an efficient management system, which involves connecting the elements of the system, or sub-systems within the particular hierarchal level, with interpenetrating channels, thus providing the exchange of various resources: information, material, human etc. This along with application of digital approaches makes it possible to bring all parts of the management system into a whole.

2 Literature review

Statutory regulation of special assessment of working conditions (Federal Law No. 426-FZ of 28 December 2013 "On Special Assessment of Working Conditions", Order of the Ministry of Labour and Social Protection of the Russian Federation No. 33n of January 24, 2014) elaborates on all processes and procedures involved in its implementation. Federal Law No. 426-FZ of 28 December 2013 on Special Assessment of Working Conditions", defines the following procedures: organization of special assessment of working conditions, preparation for special assessment of working conditions, identification of potentially harmful and hazardous factors, declaration of working conditions compliance with the statutory labour safety requirements, examination and measurement of harmful and hazardous factors in the working environment, presentation of the results of special assessment of working conditions. Order of the Ministry of Labour of Russia of January 24, 2014 No. 33n specifies procedures on examination of factors of the production environment and determination of classes of working conditions. All processes listed in these sources use information resources which specify the indicators necessary for special assessment of working conditions: workplace inventory, register of factors, working processes, equipment, materials etc. However, none of the regulatory documents contains any information on possible inter-crossing of data for procedures and their optimization in case of sequential and parallel implementation. Many researchers (Stolbyuk et al. 2017; Kosyrev 2013; Belyakov and Yulkin 2015; Tkachenko 2018; Popova and Taranushina 2019;

or Klovach et al. 2019), while regarding statutory regulation of special assessment procedure with the focus on individuals responsible, task performers and terms of implementation, set aside the issue of using databases in the process. International standards (ISO 45001:2018; IEC 31010:2019; IEC/FDIS 31010) regard carrying out certain procedures for occupational risks identification and risks management. In this context level of detail, quantity and volume of information, as well as resources for implementation of various risk management processes depend on the content of an organization (type of activity, number of employees, legal and other conditions). However, international standards still lack the information on databases to be used in risk assessment procedures.

3. Methods of assessment

The principle of discontinuity is observed in the performance of sub-systems as every sub-system has its own resourcing at disposal to address its aims and presents its own output, which can either be a finalized product or service or an intermediate product for other sub-systems' performance.

Designing a risk management system may present certain difficulties as different sub-processes tend to inter-cross in case when their functions and regulating actions coincide, when they address the same databases or when the outcome of a particular sub-process is used in other structures and actions. Thus, the preparation stage of certain activities should include conducting an audit in order to identify possible inter-crossing. This will facilitate an efficient use of resources as well as their minimization on the stage of implementation of various processes and sub-processes.

Information resources or databases used by task performers are the crucial elements or criteria of systems or sub-systems efficiency.

In this paper we study the implementation of digital approaches and their efficiency in the context of organizing and carrying out special assessment of working conditions as an element of occupational safety sub-system. In our research we will use the method of data analysis and classification (Davydov 2009; Scherbina 2013). This method involves compiling a divergent pool of analysis criteria, forming a hierarchical pyramid of semantic and content compression marking the proceeding to the next stage and forming the array of databases based on their using on various stages in other sub-systems. Database classification is considered as a compilation of a uniform resource field taking into account the maximum number of indicators, which may be requested by other elements of the system.

4. Analysis of the special assessment process

Special assessment of working conditions is regulated by the Federal Law №. 426-FZ of 28 December 2013 "On Special Assessment of Working Conditions". The whole process can be presented in the simplified form including the following range of sub-processes (Table 1, 2, 3).

Table 1. Special assessment process (organizational subprocesses)

Sub-process	Content	Task performer	Responsible party
Preliminary arrangements for special assessment of working conditions	- Establishment of the commission; - Selection of the certifying organization; - Inspection of workplaces and carrying out of legal requirements on occupational safety	Occupational safety division	Employer
Preparation for special assessment of working conditions	Development of the workplace inventory	- Commission for special assessment of working conditions; - Organization divisions (occupational safety division, legal division, HR etc.)	Commission chairperson
Identification of harmful and hazardous factors	- Identification of harmful and hazardous factors; - Development of the workplace inventory subject to special assessment	Experts of the certifying organization	Head of the certifying organization

Source: Federal Law No. 426-FZ of 28 December 2013 "On Special Assessment of Working Conditions"

We will divide the stages of implementation of a single process of special assessment of working conditions into subprocesses: organizational, experimental and final.

In the experimental subprocesses (Table 2) measurements are taken, measurement protocols are drawn up and a report on special assessment of working conditions is made. In terms of functionality, these subprocesses have additional actions and performers.

Table 2. Special assessment process (experimental subprocesses)

Sub-process	Content	Task performer	Responsible party
Measurement of factors	- Examination and measurement of factors identified at workplaces; - Development of primary documents of measurement results	Experts of the certifying organization	Head of the certifying organization
Processing and development of measurement results	- Development of documentation on measurement results (records, charts, workplace inventory etc.)	Experts of the certifying organization	Head of the certifying organization
Adjustment and revision of measurement results	Revision of workplace inventory (equipment, materials, factor exposure time, personal insurance policy number (SNILS), number of employees at a workplace etc.)	- Experts of the certifying organization; - Commission for special assessment of working conditions	- Head of the certifying organization; - Commission chairperson
Development of special assessment report	Development of all structural elements of the report	Experts of the certifying organization	Head of the certifying organization

Source: Federal Law No. 426-FZ of 28 December 2013 “On Special Assessment of Working Conditions”.

Table 3. Special assessment process (final subprocesses)

Sub-process	Content	Task performer	Responsible party
Review and approval of special assessment results by the commission	- Verification of special assessment report; - Approval of special assessment report by the commission	Commission for special assessment of working conditions	Commission chairperson
Submission of special assessment results to the state information system	Loading of special assessment results to the state information system	Experts of the certifying organization Commission chairperson	Head of the certifying organization
Publication of special assessment results on organization’s website	Publication of special assessment results on organization’s website if available	Commission chairperson	Employer
Communication of special assessment results to the employees	Communication of special assessment results to the employees in the form of special assessment charts signed by the employees	Chairperson and commission members	Employer
Declaration of working conditions compliance with the statutory labour safety requirements	Development and submission of declaration of working conditions compliance with the statutory labour safety requirements	Chairperson and commission members	Employer

Source: Federal Law No. 426-FZ of 28 December 2013 “On Special Assessment of Working Conditions”.

In the final subprocesses (Table 3) there is again a change of functions, content of actions, responsible persons and executors.

5. Analysis of the special assessment process based on input and output data mass

Now, let us conduct the analysis of input and output data mass for each sub-process in order to gain an impression of the database volume. The analysis of input and output databases will also be carried out for separate stages of the process of special assessment of working conditions: organizational, experimental and final (Table 4,5,6). The chosen databases will present the information regulated by statutory documents on each stage of special assessment of working conditions. The summary list of databases was created based on practical implementation of special assessment of working conditions in real economy sector organizations.

Table 4. Analysis of special assessment process based on databases used (organizational subprocesses)

Sub-process	Content	Databases and their sources used for process implementation
Preliminary arrangements for special assessment of working conditions	- Establishment of the commission; - Selection of the certifying organization; - Inspection of workplaces and carrying out of legal requirements on occupational safety	- Personnel database - Register of certifying organizations
Preparation for special assessment of working conditions	Development of the workplace inventory	- Personnel database - Equipment database - Materials database - Working operations database (performance time, movements, static loading, dynamic loading) - Work schedule database (shift work)
- Identification of harmful and hazardous factors	- Identification of harmful and hazardous factors; - Development of the workplace inventory subject to special assessment	- Harmful and hazardous factors classifier - Equipment database - Materials database - Working operations database (performance time, movements, static loading, dynamic loading)

Source: Federal Law No. 426-FZ of 28 December 2013 “On Special Assessment of Working Conditions”.

Table 5. Analysis of special assessment process based on databases used (experimental sub-processes)

Sub-process	Content	Databases and their sources used for process implementation
Measurement of factors	- Examination and measurement of factors identified at workplaces - Development of primary documents of measurement results	- Harmful and hazardous factors classifier - Personnel database - Equipment database - Materials database - Working operations database (performance time, movements, static loading, dynamic loading) - Work schedule database (shift work)
Processing and development of measurement results	Development of documentation on measurement results (records, charts, workplace inventory etc.)	- Normative regulatory documents - Primary documents of measurement results - Harmful and hazardous factors classifier - Personnel database - Equipment database - Materials database - Working operations database (performance time, movements, static loading, dynamic loading) - Work schedule database (shift work)
Adjustment and revision of measurement results	Revision of workplace inventory (equipment, materials, factor exposure time, personal insurance policy number (SNILS), number of employees at a workplace etc.)	- Normative regulatory documents - Primary documents of measurement results - Harmful and hazardous factors classifier - Personnel database - Equipment database - Materials database - Working operations database (performance time, movements, static loading, dynamic loading) - Work schedule database (shift work)
Development of special assessment report	Development of all structural elements of the report	- Normative regulatory documents; - Primary documents of measurement results; - Harmful and hazardous factors classifier; - Personnel database; - Equipment database; - Materials database; - Working operations database (performance time, movements, static loading, dynamic loading); - Work schedule database (shift work)

Source: Federal Law No. 426-FZ of 28 December 2013 “On Special Assessment of Working Conditions”.

Table 6. Results of the analysis of special assessment process based on databases used (final subprocesses)

Sub-process	Content	Databases and their sources used for process implementation
Review and approval of special assessment results by the commission	- Verification of special assessment report; - Approval of special assessment report by the commission	- Normative regulatory documents; - Harmful and hazardous factors classifier; - Personnel database; - Equipment database; - Materials database; - Working operations database (performance time, movements, static loading, dynamic loading); - Work schedule database (shift work)
Submission of special assessment results to the state information system	Loading of special assessment results to the state information system	
Publication of special assessment results on organization's website	Publication of special assessment results on organization's website if available	
Communication of special assessment results to the employees	Communication of special assessment results to the employees in the form of special assessment charts signed by the employees	
Declaration of working conditions compliance with the statutory labour safety requirements	Development and submission of declaration of working conditions compliance with the statutory labour safety requirements	- Special assessment charts database; - Special assessment records database

Source: Federal Law No. 426-FZ of 28 December 2013 "On Special Assessment of Working Conditions".

6. Results

All in all, according to the comparative analysis of database relevance for implementation of sub-processes of special assessment of working conditions the following conclusions can be made:

1. The array of the required database expands incrementally from the sub-process "Preparation for special assessment of working conditions" to the sub-process "Review and approval of special assessment results by the commission".
2. Certain databases used for particular sub-processes have inter-crossings: these include "Harmful and hazardous factors classifier", "Personnel database", "Equipment database", "Materials database", "Working operations database (performance time, movements, static loading, dynamic loading)". That is, all implementation stages of a single special assessment process use the same information resources pool.
3. The analysis of database users has revealed that the corresponding databases tend to be used by various performers in the context of various sub-processes implementation. This finding suggests switching to the development and application of a uniform information field with all necessary indicators added for discrete implementation of certain stages.

7. Conclusions

Overall, introduction of digital approaches to statutory and functional regulation of occupational safety and health management processes, including the process of special assessment of working conditions, provides a means of shortening the terms of certain sub-processes implementation by preparing information databases. Digitalization of databases for personnel, equipment, materials, working operations (performance time, movements, static loading, dynamic loading) and work schedule database (shift work) makes it possible to reduce the terms of implementation of the following sub-processes: "Identification of harmful and hazardous factors", "Measurement of factors", "Processing and development of measurement results", "Adjustment and revision of measurement results", "Development of special assessment report", "Review and approval of special assessment results by the commission".

In order to acquire a more precise assessment of labour input for sub-processes implementation and reduction of time, it is necessary to conduct comparative time studies. However, taking into consideration the practical experience of conducting special assessment of working conditions, it can be definitely stated that resourcing of the special assessment process, provided the corresponding databases are formed based on digital approach, can be reduced by two thirds of the whole volume of the resources expended.

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