

# Comparative Analysis and Optimization of Digital Control for Providing Occupational Safety in the Organization

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## ABSTRACT

Operation of management systems in organizations involves the following functions: planning, application, assessment, actions for improvement, monitoring. The design and implementation of management systems demand organizing processes, which involve input and output resources (information, material, and human), responsible employees and executives, and deadlines for task completion. When designing the processes for implementing control procedures in the occupational safety system, managers of organizations and divisions face the problem of optimizing the types of control in such aspects as content, objects of control, deadlines for task completion and executives. Since all structural divisions of the organization are interconnected by all types of occupational safety control through participation and execution, the issue of streamlining control procedures gains urgency. It is urgent in all the aspects: resources, deadlines and executives. Comparative analysis of different types of control in the area of providing industrial safety, in aspects of content, control objects and implementation of results to pursue employer's policies in the area of occupational safety, permanent improvement and increasing efficiency can provide optimization of the control procedures applied to an organization and follow the mandatory requirements of the Russian Federation legislation in the area of occupational safety and industrial safety.

**Keywords:** *Risk, safety, control, factors, procedures, labour, analysis, ranking, hazardous production facility.*

## 1. INTRODUCTION

Occupational safety in the organization is one of the elements of the management system. Its integration with the overall management system of the organization gives an opportunity to administer industrial safety in a systemic way. In other words, it makes it possible to assess all types of resources necessary to achieve the goals and fulfil the tasks set out in the safety policy: temporary, material, human, informational, etc. The output of any subsystem, in this case, the subsystem of occupational safety, to the other level in the management system implies the emergence of additional links and the exchange of resources. To provide a systematic approach as the basis of managing an organization, it is necessary to ensure smooth operation of any subsystem.

Further in the text, the term "smooth" will mean co-ordinated work, which starts from setting the intended targets and finishes with their achievement. Intermediary variables are such areas of work as planning, provision, assessment, and improvement [1]. In general, providing occupational safety in view of an effective management system includes the following aspects:

1. Setting the goals and objectives for the area of occupational safety aligned to the head management policy.

2. Discrete management, exercised via the distribution of responsibilities and functions among structural divisions and employees.

3. Competence and training of the organization personnel.

4. Process procedures (providing resources and means of protection: personal and group protective equipment, medical examinations, document management, monitoring, insurance, etc.) [2].

The achievement of intended targets in any area of providing occupational safety must be monitored and adopted for the effective operation of the occupational safety management system.

The types of control to provide occupational safety, currently, may include:

- Establishment of the employer's control over the state of workplace protection in the organization [3];
- Production control over compliance with industrial safety requirements at a hazardous production facility [4], [5];
- Assessment of the compliance of working conditions with the requirements of regulatory documents [6].

On the basis of analysing regulatory documents [2-7], which included determining the volume and content

of control procedures, locating linear dependence of their sequence, identifying overlapping areas by functionality and executives, the following consistent patterns were revealed:

1. The types of control planned by the organization are based on the type of the operated facilities [8- 10].

2. Form and frequency of control procedures depends on the type of operated facilities, the materials used in production, the requirements of regulatory legal documents, and the structural organization of the management system.

3. There is overlapping of control areas, in in the aspects of the factors under study and the frequency of execution.

4. Each type of control has a local regulatory document setting the organization and execution of control procedures [11- 13].

5. Each type of control is reflected in the corresponding reporting document, the form and content of which is conditioned by regulatory documents, facilities under control, and the management system structure of the organization.

6. In accordance with the functional purpose, control procedures are related to occupational safety divisions. Depending on the operated facilities and the structural organization of the management system, these divisions are presented as directorates, departments, and sectors [14], [15].

7. The procedure for the identification and assessment of occupational risks can be, currently, distinguished as a separate type of control.

## 2. COMPARATIVE ANALYSIS

Data on the results of the comparative analysis of the types and content of control procedures for occupational safety are presented in Table 1.

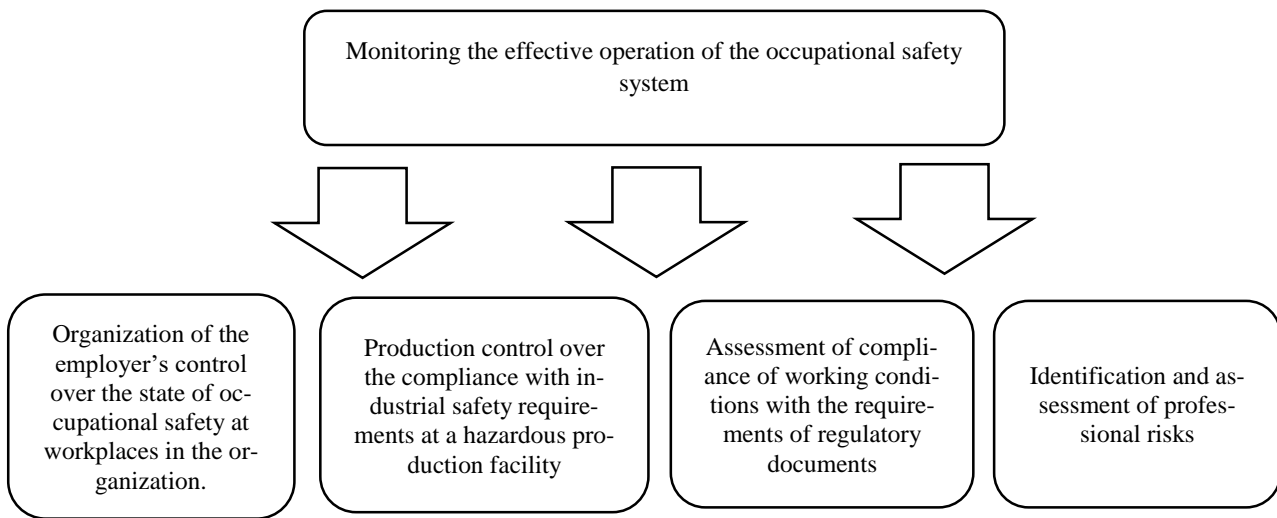
**Table 1** Comparative analysis of the forms and content of types of labour safety control in the organization

| Forms of control   | Form of organization and execution | Objects of control  | Document of the organization, which establishes the procedure protocol and content of control              | The frequency of the control               |
|--|------------------------------------|---|--|--|
| Organizing employer's control of the state of occupational safety at the workplaces in the organization      | Administrative and public control  | Instruction and training in occupational safety<br>Provision and usage of personal protective equipment (further in the text PPE)<br>Organization and execution of medical examinations<br>Providing employees with cleaning and degreasing agents, milk, medical and preventive nutrition<br>Work-rest schedule for employees<br>Serviceability and operability of collective protection equipment<br>Sanitation and consumer services for employees<br>Occupational safety documents<br>[1] | Regulations on administrative and public control<br>Plan of inspections                                    | Once a decade, month, quarter [2]          |
| Manufacturing control over compliance with industrial safety requirements at a hazardous production facility | Production control                 | Hazardous production facilities (further referred to as HPF)<br>Technical devices at HPF<br>Organization of training and certification of personnel in the area of industrial safety<br>Industrial safety documents<br>Compliance with licensing requirements in the area of industrial safety<br>Execution of industrial safety inspections<br>Organization of preparing the Declaration of Industrial Safety for the HPF  | Regulations on production control<br>The plan of measures to ensure industrial safety for the current year | Daily, once a month, half a year, year [3] |

|  |   |   |  |   |
|--|---|---|--|---|
|  |   | Liability insurance for damage caused during the operation of the HPF<br>Investigation of hazards, incidents and accidents at the HPF [4]   |  |   |
| Assessment of compliance of working conditions with the requirements of the regulatory documents | Production control of occupational safety | Buildings and premises of the organization<br>Sanitary protection zones, Equipment, tools, materials, transport<br>Organization and provision of medical examinations<br>Documentation on occupational safety<br>Production processes<br>Production factors [5] | Regulations on production control<br>The program of production control         | It is arranged in accordance with the objects of control and the hazard class of the controlled factors |
|  | Special assessment of working conditions  | Occupational hazards and harmful factors  | The procedure to organize and conduct special assessment of working conditions | Once every five years <sup>6</sup>  |
| Identification and assessment of professional risks  | Risk assessment in the workplace          | Factors of the work environment [2,7]   | The regulation on the assessment of occupational risks                         | Not regulated.  |
| Monitoring the effective operation of the occupational safety system                             | Internal audit                            | Occupational safety management system [1- 3]  | Regulations on the occupational safety and health management system            | Not regulated   |

Based on the comparative analysis, there is a need to study the issue of aligning control procedures by content, frequency and dates, and executors. This will make it possible to optimize financial, temporary, and human re-

sources when planning the measures to provide occupational safety. Below, there is a flowchart of control procedures (Figure 1).



**Figure 1** Flow chart of control procedures









Furthermore, there is analysis of the overlapping in control objects with the purpose to identify the intersection

of the control forms (Table 2). Separate control criteria are presented in larger categories for the comprehension of the overlapping elements.

1. Organizational issues related to occupational safety:

- Instruction and training on occupational safety;
  - Provision and use of personal protective equipment (further named PPE);
  - Organization and conducting of medical examinations;
  - Providing employees with cleaning and degreasing agents, milk, medical and preventive nutrition;
  - Work-rest schedule of employees;
  - Serviceability and operability of collective protective equipment;
  - Sanitary and consumer services for employees;
  - Documentation on occupational safety;
  - Buildings and premises of the organization;
  - Sanitary protection zones;
  - Equipment, tools, materials, transport.
2. Organizational issues concerning the provision of safe operation of hazardous production facilities:
- Hazardous production facilities (further named HPF);
  - Technical devices at HPF;
  - Compliance with licensing requirements for the activities in the area of industrial safety;
  - Organization of training and certification of personnel in the area of industrial safety;
  - Industrial safety documentation;
  - Conducting industrial safety inspections;
  - Organization of preparing the Declaration of Industrial Safety for the HPF;
  - Liability insurance for damage caused during the operation of the HPF;
  - Investigation of hazards, incidents and accidents at the HPF.
3. Production factors.

**Table 2** The analysis of overlapping control objects with the purpose to identify the intersection of control forms

| Types of control                          | Organizational issues related to occupational safety                                | Organizational issues for providing safe operation of hazardous production facilities | Production factors  |
|---|---|---|---|
| Administrative and public control         |   |   |   |
| Production control of HPF operation       |   |   |   |
| Production control of occupational safety |  |   |  |
| Special assessment of working conditions  |   |   |  |
| Risk assessment in the workplace          |  |   |  |

The conclusions based on the results of comparative analysis of control objects in the overlapping control areas:

1. Administrative and public control, industrial control and risk assessment in the workplace overlap with the control of safe operation of equipment, buildings, structures, tools and materials.

2. Occupational safety control, special assessment of working conditions and risk assessment at the workplace

intersect at the points of assessing the levels of production environment factors.

3. Production control for the operation of the HPF overlaps with the procedure for assessing risks in the workplace, in case of HPF and technical devices in operation.

4. Organization and provision of administrative and public control in organizations is guided by local regula-

tions, based on specific features of the management system of a particular organization, its occupational safety management system, the availability and terms of the collective labour agreement, employment contract.

5. Conducting a special assessment of working conditions does not exclude or replace the procedure for industrial control of occupational safety. The implementation of these two types of control is guided by different regulations, which indicate the obligatory implementation of these procedures. In addition, these types of controls differ by the types of factors under the present study and the timing of control. However, production control data can be used for conducting a special labour assessment (if there is a decision of the Committee and the appropriate dating), which means that a clear regulation of the schedule for conducting a special assessment of working conditions and production control will give a possibility for reducing resource and economic costs during a special assessment of working conditions.

6. The procedure for assessing professional risks includes all areas and objects of control. However, this procedure has a synthesizing function in the assessment of professional risks due to its content and results since it includes the assessment of equipment for structural and operational safety, factors of the production environment (physical, chemical, biological, ergonomic), provision and results of organizational measures (instructions, training, medical examinations, PPE, accounting for injuries and occupational illnesses, etc.). Therefore, the results of production control, special assessment of working conditions, and production control of the HPF are sufficient for monitoring the identification and assessment of risks. However, the frequency of production control according to the time criterion gives the possibility to identify and assess risks more often, which contributes to dynamic and relevant activities aimed at identifying risks, developing and implementing the measures to reduce risks. As a result, it helps to minimize the risk of hazards occurring in the production process as a whole.

### 3. CONTINGENT RANKING

The abovementioned information makes it possible to provide contingent ranking by the degree of using the results of a certain type of control for other types of control, by the schedule for the development and implementation of the program to provide occupational and technological safety in the organization. For the ranking, the following criteria will be used: time factor, or frequency of execution, and the possibility of using control results for other control procedures. The degree of importance and relevance of specific control procedures for the employer to address the issues related to providing safe working conditions and reducing occupational risks will be reflected in a higher indicator.

Equivalent weight coefficients of 0.5 points are introduced for each of the two criteria. The assessment scale for the criteria is divided into two indicators: for the time factor with the duration of the control procedure up to 1 year – 10 points, up to five years – 5 points. It is clear that the frequency of internal control procedures provides the possibility to respond promptly to any deviations in the operation of the occupational safety management system. For the criterion of implementing the result of the control procedure in other types of internal audit or control, the rating scale “used/not used” is introduced.

According to the results of the contingent ranking of control procedures in the organization (Table 3), the following conclusion can be made: the development of the program and execution of production control, taking into account additional criteria for supervision during the production control in the organization is the most optimal in content, timing and the possibility of using the obtained results for other control procedures in the organization, such as the special assessment of working conditions, risk assessment, occupational safety audit.

**Table 3** The results of contingent ranking of the control procedures.

| Ranking criteria                          | Scheduling of the control procedure | Using the results of the control procedure for other types of supervision | Final result |
|---|-------------------------------------|---|--------------|
| Administrative and public control         | 0                                   | 0   | 0            |
| Production control of HPF operation       | 5                                   | 5   | 10           |
| Production control on occupational safety | 5                                   | 5   | 10           |
| Special assessment of working conditions  | 5                                   | 2,5   | 7,5          |
| Risk assessment at the workplace          | 0                                   | 2,5   | 2,5          |

#### 4. CONCLUSIONS

All in all, our results show that design and implementation of management systems need well-balanced and well-designed organizing processes. Here is when the stakeholders might provide relevant assistance. According to the Order of August 19, 2016 No. 438 of the Ministry of Labour and Social Protection of the Russian Federation "On the Approval of Standard Provisions on the System of Occupational Safety Management", in order to improve the efficiency of controlling the operation of the OHSMS and monitoring the performance of the implementation procedures at each level of control, the employer introduces gradual control of OHSMS operation and monitoring the performance of the implementation procedures, and also provides the possibility for public control of OHSMS operation and monitoring the performance of the implementation procedures.

Therefore, the employer, on the basis of resource provision, has a possibility to introduce the forms of control in organizations, which take into account optimizing costs and effectiveness of using the inspection results.

#### REFERENCES

- [1] TECHPERT (2007) Occupational safety and health management systems. General requirements. Occupational safety standards system. GOST 12.0.230-2007. <http://docs.cntd.ru/document/gost-12-0-230-2007-ssbt> Accessed on 27 Oct 2020
- [2] Order of The Ministry of Labour and Social Protection of the Russian Federation, August 19, 2016, N 438, On the approval of standard provisions on the system of occupational safety management. <https://www.garant.ru/products/ipo/prime/doc/71413730/> Accessed on 20 Oct 2020
- [3] "Labor Code of the Russian Federation" dated 30.12.2001 N 197-FZ (as amended on 29.12.2020). [http://www.consultant.ru/document/cons\\_doc\\_LAW\\_34683/](http://www.consultant.ru/document/cons_doc_LAW_34683/) Accessed on 26 Oct 2020
- [4] Federal Law of 21.07.1997 N 116- FZ (ed. from 29.07.2018) FZ 116. On industrial safety of Hazardous Production Facilities. [http://www.consultant.ru/document/cons\\_doc\\_LAW\\_15234/6e24082b0e98e57a0d005f9c20016b1393e16380/](http://www.consultant.ru/document/cons_doc_LAW_15234/6e24082b0e98e57a0d005f9c20016b1393e16380/) Accessed on 20 Oct 2020
- [5] Resolution of the Government of the Russian Federation, March 10, 1999, N 263 About the organization and implementation of production control over compliance with industrial safety requirements at a hazardous production facility (with changes on October 25, 2019). <http://docs.cntd.ru/document/901728088> Accessed on 27 Oct 2020
- [6] The Federal Law the Russian Federation, FZ -426 On special assessment of working conditions. [http://www.consultant.ru/document/cons\\_doc\\_LAW\\_156555/](http://www.consultant.ru/document/cons_doc_LAW_156555/) Accessed on 27 Oct 2020
- [7] TECHPERT (2015) Dangerous and harmful production factors. Classification. Occupational safety standard system. GOST 12.0.003-2015, GOST 12.0.003-2015. <http://docs.cntd.ru/document/1200136071> Accessed on 27 Oct 2020
- [8] Presidium of the Central Committee of the Health Workers Union. Russian Federation Resolution of May 6, 2019 No. 14-94 On the approval of the guidelines for organizing control over the state of working conditions and occupational safety at workplaces by trade union occupational safety commissioners. <http://base.garant.ru/72253454/> Accessed 20 Oct 2020
- [9] I.V. Klimova, Yu. G. Smirnov, R.I. Fatkhutdinov, Application of fuzzy modelling methods for assessing the effectiveness of production control, Occupational-Safety in Industry 2 (2019) 54-59. DOI: <https://doi.org/10.24000/0409-2961-2019-2-54-59>.
- [10] I.A. Bobrov, Industrial process safety: Meeting the challenges of today, Occupational Safety in Industry 5 (2018) 21-27. DOI: <https://doi.org/10.24000/0409-2961-2018-5-21-27>.
- [11] C. Gheorghe, Study Regarding the Steps of Occupational Health in Safety Management System, International Journal of Economics and Management Systems 2 (2017), 13-16
- [12] Department of Mechanical Engineering, Transylvania University of Brasov, 500036 Bvd. Eroilor nr.29, Brasov, Romania, Oan Enescu, Quality Management System and Risk Estimate in Automotive Industry. [enescu@unitbv.ro](mailto:enescu@unitbv.ro) Accessed on 20 Oct 2020
- [13] N.K. Abdrakhmanov, G.A. Sharipov, A.V. Fedosov, K.N. Abdrakhmanova, W. Kozłowski, Improving the functioning of the integrated system for managing labor and industrial safety in the oil and gas industry, Bulletin of the national academy of sciences of the Republic of Kazakhstan 5(381) (2019) 184-190 DOI: <https://doi.org/10.32014/2019.2518-1467.138>
- [14] D. Merich, G. Forte, Support for risk assessment and identification of preventive measures in small and micro-enterprises: Occupational hazard datasheets, <https://pubmed.ncbi.nlm.nih.gov/22022758> Accessed on 20 Oct 2020
- [15] H. Louro, M. Heinälä, J. Bessems, and others, Human biomonitoring in health risk assessment in Europe: Current practices and recommendations for the future (Review), International Journal of Hygiene and Environmental Health 222(5) (2019) 727-737. DOI: <https://doi.org/10.1016/j.ijheh.2019.05.009>