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INSTRUCTIONAL MAPS OF SAFE WORKING METHODS AND PRACTICES FOR SEPARATE TYPES OF OPERATIONS CONDUCTED IN THE OIL MINE

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Instructing personnel in the issues of labor protection and industrial safety at hazardous facilities is one of the main tasks that face the employer; the quality with which this procedure is organized and carried out defines not only company's indicators, but the mere possibility of its normal functioning. The paper contains a detailed overview of the typical content of standard documentation, which is currently used when conducting operations in the oil mines of Yarega high-viscosity oil deposit. Distinct features and unique nature of this oil field require special measures to guarantee safety of personnel and all facilities in general.

The author proposes and reviews an additional type of operating guidelines – instructional map of safe working methods and practices. It is more illustrative than existing documentation (charts of inclined shaft development, labor protection regulations), which allows to upgrade the process of instructing personnel in the oil mines, to improve the quality of instructions and to reduce the risk of emergencies, accidents, industrial injuries.

The author reviews the structure of suggested instructional map, offers a detailed arrangement diagram for the main thematic sections of the map, as well as their content. Instructional maps are regarded as a type of operating guidelines that include: description and characteristics of equipment, instruments and appliances; general safety requirements; content and execution sequence of operational elements with their graphical images; distribution of responsibilities with an indication of their priority in case the operations are conducted by several workers; specific safety requirements for equipment, materials, instruments, safety clothes and footwear, personal protective gear etc. (prohibitions, warnings).

Advantages and disadvantages of proposed instructional maps of safe working methods and practices are highlighted.

Key words**:** instructional map, working methods and practices, safety of labor, oil mine, operational guidelines, training

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Introduction. Standard documentation used for conducting operations in the oil mines is basically a technological chart. A typical chart of construction and support of a development working includes the following sections:

1. Introductory sheet with technical documentation.
2. Report on the inspection of the working.
3. Table of contents.
4. Explanatory note.
5. Geological characteristic of the rocks.
6. Safety measures for blast-hole drilling.
7. Measures for safe conduction of switching operations.
8. Technical and organizational measures, eliminating the risk of injuries due to rock slides in the process of workings construction.
9. Plan of blasting operations in the oil mine.
10. Blast design.
11. Chart of hazardous zone safeguarding.
12. Measures for safe conduction of blasting operations.
13. Measures for safe degassing of the mine face.
14. Plan for boost fan installation.
15. Plan of antidust measures.
16. Lavatory location chart.
17. Chart of support.
18. Chart of temporary support.

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Each section is on the average no more than 2-3 pages long, and information on safety regulations in different sections may overlap and sometimes even contradict itself, as it is written by different people. Visual material is mostly presented in the form of charts, e.g. directions on where to place ventilation hose, type codes are introduced. But the major part of the documentation (around 95 %) is in the text form.

The purpose of this research was to develop new forms of operational guidelines – instructional maps of safe working methods and practices, examination of the possibility to create maps for separate types of operations conducted in the oil mine and their applicability in personnel instruction.

Research methodology. In Russian Federation, the legislation assigns to the employer the duty to organize personnel instruction and to test their knowledge. So, according to article 212 of the Labor Code of Russian Federation (LC RF) [10], the employer must provide for:

– training in safe working methods and practices, first aid treatment for industrial injuries, instruction in labor protection, traineeship at the workplace and test of knowledge of labor protection requirements;

– disqualification of persons who in the prescribed manner have not passed training and instruction in labor protection, traineeship at the workplace and test of knowledge of labor protection requirements.

Analogous to labor protection requirements set out in the article 212 LC RF [10], the law on industrial safety sets forth duties of companies, possessing hazardous industrial facilities, to train employees and to authorize them for work:

– to authorize for work at hazardous industrial objects only those persons, who satisfy relevant qualification requirements and have no medical contraindications to this work;

– to guarantee preparation and attestation of employees in the field of industrial safety.

Hence personnel training in the field of labor protection and industrial safety at hazardous industrial objects, and especially unique objects like oil mines, is one of the main objectives of the companies [8, 9, 13-17].

Organizational issues and requirements to personnel preparation and training in labor protection and industrial safety are specified in the Training Procedure [5], interstate standard GOST 12.0.004-90 [2] and RD 03-20-2007 [6]. Personnel training in safe working methods and practices is carried out using instructions on labor protection and operational guidelines [7].

Instructions on labor protection are developed relying on Methodological Recommendations [4], whereas operational guidelines, according to RD 03-20-2007 [6], must be based on the standards applied within the company. It should be noted that federal laws and regulations do not contain any methodological recommendations on the development of operational guidelines. Thus, the content of these guidelines and their correctness depend only on the knowledge, experience and competencies of specialists developing them.

Having thoroughly studied the process of personnel training in safe working methods and practices, the author offers to use instructional maps as an additional type of operational guidelines.

Instructional map is a detailed instruction-chart of conducting certain operations, which includes requirements towards technosphere safety (labor protection, industrial and environmental safety) [12].

The main purpose of development and implementation of instructional maps is to enhance the quality of training for primary occupation workers directly at their workplaces in order to prevent emergencies, accidents, industrial injuries at hazardous industrial objects.

The tasks of instructional maps are:

– visual representation and detailed description of every operation, conducted by the workers;

– emphasis on important aspects of operations that influence safety of the process and the facility;

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– development of worker's visual memory;

– elimination of inaccurate definitions and operations, which provide an opportunity for the worker to make the wrong choice of actions during operations;

– reduction of operation time with no compromise in safety levels of the facility and personnel.

When carrying out trainings in labor protection and safety, personnel, equipment and the facility itself have to be regarded as a single complex system. Basing on this, it is important to understand that distortions in the functioning of even one part of the system can lead to an emergency, accident or industrial injury. This principle is the cornerstone in the development of each instructional map. Hence the main supporting and basic elements of instructional maps are structured and visual means of presentation.

Results and discussions. Development of instructional maps for separate types of operations conducted in the oil mines included the following stages:

1) analysis of local documents;

2) selection of illustrations (photos, charts, figures);

3) formation of the instructional map (arrangement and adjustment to corporate style);

4) approval.

As a result of carried out research, general requirements to the map have been formulated. The following principal sections of instructional maps can be distinguished [2]:

1. Title: Instructional map of safe working methods and practices for … (type of operations should be specified).

2. Equipment characteristics. Description of equipment and technical appliances. This section must contain concise information on applied equipment with graphical materials.

If applicable, principal charts and equipment photographs can be included. Special attention should be given to the main elements and protection devices. With this in mind, any information should be ruled out that is not necessary for conducting operations and does not affect the safety of personnel and equipment in the working process.

3. Requirements to labor safety when conducting separate types of operations. It implies a detailed description of harmful and dangerous industrial factors, characteristic of conducted operations and applied equipment, which can cause an emergency, accident or industrial injury. It is important to identify safe methods of failure-free performance and practices in order to reduce or eliminate the influence of these factors on the personnel.

For illustrative purposes it is advisable to accompany the text with graphical materials. This section should also include information about necessary safety clothes and footwear, personal and collective protective gear.

4. Algorithm of operations. This is the main part of the instructional map, which contains an algorithm of worker's actions taking into account safe working methods and practices. This part of the instructional map can be logically divided into three sections: I – start of work; II – execution of operations; III – completion of work.

All the subsections of the instructional map are presented in the table with all the operations numbered in chronological order. Description of performed operations must be unequivocal and excluding any discretionary interpretation by the workers. It is also important to identify the location of the worker during operation.

In case of conditions, prohibitions, warnings that the worker has to pay attention to, they are described under the word «ATTENTION!» (written in red ink to highlight critical importance of the issue and to attract worker's attention to it). For illustrative purposes, as well as to promote better understanding and memorizing of the information, it is accompanied by photographs or graphical images. Conditions under the inscription «ATTENTION!» should be identified before or after description of the operation, depending on the time when the worker has to pay attention to them, i.e. in chronological order.

The resulting model form of the instructional map is presented in the figure [2].

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Instructional map
of safe working methods and practices for …

(type of operations specified)

Part 1. **Equipment characteristics**

Part 2. **Requirements to labor safety when conducting operations**

2.1. Harmful and dangerous industrial factors, and measures to reduce or eliminate the influence of these factors on the personnel

Harmful and dangerous industrial factors	**Measures to reduce and (or) eliminate their influence**	
Item specified	Measures to reduce and (or) eliminate the influence of these factors on the personnel specified	Photograph

2.2. Instruments, equipment, personal protective gear necessary for conducting operations

Item	**Image**
Item specified	Photograph

Part 3. **Algorithm of operations and safety measures**

3.1. Organizational measures

Number of operation	**Content and sequence of performing operational elements (number of personnel – three workers) Special attention when conducting operations**		
	Worker 1	**Worker 2**	**Worker 3**
1	Performs function 1.	Performs function 1.1.	
	Photograph		
2			

3.2. Execution of operations (description of the activities)

Number of operation	**Content and sequence of performing operational elements (number of personnel – two workers) Special attention when conducting operations**			
	Worker 1		**Worker 2**	
1	ATTENTION! When conducting operation 1, it is necessary … Photograph			
	Performs function 1.1.	Photograph	Performs function 1.2.	Photograph
2	Performs function 2.1.	Photograph	Performs function 2.2.	Photograph
	ATTENTION! **It is prohibited to** …			
3				

3.3. Completion of work

Number of operation	**Content and sequence of performing operational elements (number of personnel – three people) Special attention when conducting operations**		
	Supervisor	**Worker 1**	**Worker 2**
1		Performs function 1.1.	Performs function 1.2.
		Photograph	Photograph
2	Performs function 2.1.	Performs function 2.1.	
	Photograph	Photograph	
3			

Form of instructional map of safe working methods and practices

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So, the following instructional maps of safe working methods and practices have been developed for the oil mine section «Yareganeft» [1]:

• Performing operations on infrastructure development of the mine workings.
• Performing drilling and blasting operations.
• Maintenance of mine wells in the process of oil extraction.
• Performing operations on transportation of extracted oil and surrounding rocks.
• Maintenance of vessels functioning under pressure.
• Performing operations on carrying heavy objects, by human force or using means of small-scale mechanization.
• Performing high-rise operations.
• Performing ground works.
• Performing operations using small tools.
• Performing gas hazardous and fire works at the facilities of oil and gas extraction and processing.

Instructional maps as a type of operational guidelines on safety have the following advantages:

– visual representation and detailed description of every operation, conducted by the workers;
– emphasis on important aspects of operations that influence safety of the process and the facility;
– development of worker's visual memory;
– elimination of inaccurate definitions and operations, which provide an opportunity for the worker to make the wrong choice of actions during operations;
– reduction of operation time with no compromise in safety levels of the facility and personnel.

Alongside with apparent advantages, instructional maps have their drawbacks:

– impossibility to include all local laws and regulations of the company into instructional map;
– impossibility to specify and work out in detail certain types of operations;
– overlapping of local laws and regulations;
– high labor consumption;
– need to attract specialist from different areas;
– impossibility to photograph certain types of operations.

Nevertheless, research carried out in other companies, where instructional maps by the same developers have been introduced, showed a 20 % increase in the efficiency of personnel training.

Conclusions

1. Existing documentation on conducting operations in the oil mines contains insufficient amount of visual material, even despite the fact that development of each inclined shaft is documented with a separate chart.

2. According to Russian legislation, the duty of personnel training in safe working methods and practices is assigned to the employer, hence the company has to be interested in improving the quality of the material which is used in the training process.

3. In the course of instruction and training it is feasible to use additional visual material, such as instructional maps of safe working methods and practices for separate types of operations.

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