Organization of propaganda for the safe work production of a signaller and an automobile crane operator

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Abstract. Violations of the labor safety regulation and disregard of the rules concerning work performance are the main causes of industrial accidents. Labor safety propaganda should be organized at each enterprise. Propaganda teaches workers to have clearly perceived need to comply with the requirements for safe work performance, and is also an integral part of injury prevention. The paper presents the results of improving the safety of the work of the signaller and an automobile crane operator by means of promoting labor safety. The main traumatic factors for the above professions were identified. They are: the work of the machine operator, not performed at the signal of the signaller; work with a faulty safety lock, as well as work with faulty safety devices and faulty equipment; unloaded cargo at the end of work and during work breaks, excess load capacity; performance of works when there are people in the danger zone (unfenced territory), and as a result, presence of the injured person in the danger zone of the crane work; contact with electric current, in the absence of grounding of the crane. For each identified factor, a poster was developed reminding of the need to comply with labor safety rules. The developed posters were introduced into production during the operation of automobile cranes in the Izhevsk branch of Federal State Unitary Enterprise “Main Military Construction Directorate No. 7” (FGUP “GVSU No. 7”).

1. Introduction and Background

According to the statistics of Federal Environmental, Industrial and Nuclear Supervision Service of Russia on the distribution of breakdowns by type of equipment, breakdowns with hoisting cranes account for 42% of all breakdowns (27% fatal), 17% of them during operation of automobile cranes [1]. The number of accidents and the number of fatalities in accidents that occurred during the operation of hoisting devices significantly exceeds the number of breakdowns (approximately three times) [1-4]. The current situation requires a preventive style of labor protection management, one of the ways of which is to promote safe work production [3].

2. Materials and Methods

To develop the most effective means of promoting safety at work, the constituent technological processes were selected that are associated with the greatest professional risks of a signaller and an automobile crane operator [4,5]. For this, the provisions of the main regulatory documents of the Russian Federation and international standards in the field of hazard identification were applied [6-8].
3. Experimental Section

The procedure for detecting, identifying, recognizing and describing hazards was carried out after considering the technological processes of workers, equipment, tools and devices used in the production of works, types of standard works [9-12]. Labor protection instructions for the signaler and the automobile crane operator, technical documentation for production processes, the installation and operation of equipment, the use of tools or equipment, safety rules, and materials for assessing working conditions were used as a source of documented information [13]. The decisive source of information in compiling a list of causes of breakdowns and accidents during the operation of an automobile crane was the outcome of an analysis of the causes of breakdowns and fatal accidents at supervised facilities of Federal Environmental, Industrial and Nuclear Supervision Service of Russia [14] table 1.

Table 1. Causes of breakdowns and accidents during the operation of an automobile crane.

| Technical reasons                                                                 | Organizational reasons                                                                                                                                 |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Break of removable load-grappling device (sling).                                | - Presence of the injured person in the danger zone of the crane work;                                                                               |
|                                                                                  | - the workers are not familiar with the installation (removal) instructions for the crane;                                                            |
|                                                                                  | - the maintenance of the hoisting device in operable condition is not ensured;                                                                        |
| Faulty safety devices.                                                           | - the person responsible for the implementation of process monitoring has not been appointed;                                                          |
|                                                                                  | - the signaler has not passed training and knowledge testing;                                                                                       |
|                                                                                  | - the use of unsuitable removable load-grappling devices, including unmarked.                                                                       |
| Faulty safety devices.                                                           | Presence of the injured person in the workplace while intoxicated is allowed.                                                                       |
| Faulty safety devices.                                                           | - The person responsible for industrial safety during the operation of the hoisting device has not been appointed;                                    |
|                                                                                  | - combination of two or more crane operations in violation of the requirements of the hoisting device passport;                                       |
| Faulty safety devices.                                                           | - lack of process monitoring during the operation of the hoisting device;                                                                         |
| Faulty safety devices.                                                           | - crane operation without industrial safety expertise, timely inspections, repairs and technical examinations.                                      |
| Faulty safety devices.                                                           | - Poor process monitoring of compliance with industrial safety requirements by enterprise managers;                                                     |
| Faulty safety devices.                                                           | - violation of the slinging scheme;                                                                                                                   |
| Faulty safety devices.                                                           | - presence of the injured person in the danger zone during the operation of the hoisting device.                                                     |
| Failure of process monitoring during the operation of the hoisting device.        | Failure to properly implement the process monitoring during the operation of the hoisting device.                                                     |

1) Non-compliance of the attachment of the hoisting rope on the right side of the hoist with the requirements of the installation instructions;  
2) Failure of the safety catch on the right side of the lift;  
3) Lack of operating documentation for the lift.
The pressure on the metal structure of the crane loads that occurred during its fall due to entry into the territory that does not have adequate coating strength. The excess of the dynamic load over the bearing capacity of the welds of the mounting structure of the rotation mechanism base to the rotary frame of the installation (destruction of welds).

1) Application of the slinging scheme during removal, not provided for by the work performance plan;
2) The absence of fixation of the outriggers in the extended position with the locking fingers, as well as the absence of inventory pads under the supports.

1) Exceeding the passport carrying capacity of the hoisting device. Operation of the hoisting device that has worked out its standard service life without expert examination of industrial safety;
2) Security appliance malfunction.

1) Excessive wind load relative to passport load;
2) Destruction of anti-theft grips, cable-roped cable break.

1) Overload capacity of the hoisting device is allowed;
2) Faulty crane capacity limiter.

Other reasons

- Violation of the technical process;
- the crane is not maintained in working condition;
- expert examination of industrial safety of the hoisting device that has fulfilled a standard service life has not been carried out;
- no process monitoring is carried out during the operation of the hoisting device;
- performance of construction and installation works using a hoisting device without a work performance plan;
- not instructing on labor protection before starting a one-time job;
- there is no established procedure for the exchange of signals between a signaler and a crane operator;

- Poor process monitoring by enterprise managers;
- design documentation for changing the construction of the crane is not agreed with the manufacturer.

- Poor organization and implementation of process monitoring and technical supervision by managers and specialists for compliance with industrial safety requirements.
- The procedure for periodic inspections, maintenance and repairs has not been established;
- a full technical expert examination of the hoisting device has not been carried out.

- The person responsible for the industrial safety has not been appointed;
- deviation from the design project;
- application of construction master plans not provided for by the design project.

Process monitoring of compliance with industrial safety requirements has not been properly organized.

- Implementation of unloading in the absence of a technological chart;
- process monitoring of compliance with industrial safety requirements is not properly implemented.
- lack of proper process monitoring over compliance with industrial safety requirements;
- performance of work when there are people in the danger zone;
- loss of stable contact of the float of the hydraulic lift cylinder with the crane tower post (inaccurate landing of the float on the tower post, as well as a violation of the installation sequence);
- poor organization of process monitoring;
- admission to work of employees who have not passed the knowledge test of labor protection requirements.

After analyzing the statistical data and the results obtained, a conclusion can be made that the most common causes of injury at construction sites are:

- Work of the machine operator, not performed at the signal of the signaler;
- Work with a faulty safety lock, as well as work with faulty safety devices and faulty equipment;
- Unloaded cargo at the end of work and during work breaks, excess capacity;
- Performance of works when there are people in the danger zone (unfenced territory), and as a result, presence of the injured person in the danger zone of the crane work;
- Contact with electric current, in the absence of grounding of the crane.

4. Results and discussion
As the means of improving labor safety during the work of a signaler and an automobile crane operator, visual forms of propaganda were developed for the most common causes of injury at construction sites figure 1-5[15-20].

![Figure 1](image1.png)
**Figure 1.** The poster “Work only with a non-faulty safety lock”.

![Figure 2](image2.png)
**Figure 2.** Poster “Fence the working site”.
Designated posters are recommended to be placed rationally: in places of gatherings of specialized specialists, in locker rooms, recreation rooms. They should be located at eye level; the center of the poster (A2 format) should be at a distance of 1.5-1.7 meters from the floor. Posters attract the most attention if they are placed on plain walls. Visual forms of propaganda of labor safety can be arranged in separate stands and placed in the street, at construction sites. A well-thought-out location will increase the readability of the poster and improve the perception of information, and this is the main goal for promoting labor safety and preventing injuries.

5. Summary and Conclusion
The developed posters were introduced into production during the operation of automobile cranes in the Izhevsk branch of Federal State Unitary Enterprise “Main Military Construction Directorate No. 7” (FGUP “GVSU No. 7”). The work was carried out at the financial support by Kalashnikov Izhevsk State Technical University within the framework of the grant No. IIPO/20-86-11.

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