The Analogous Workplace Method in Road Construction and Maintenance Enterprises

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Abstract. **The working environment typical of the industry of road maintenance is characterised by constantly changeable workplaces at different objects, great number of heavy machinery and equipment. For employees' training to be more effective, the authors propose, on the basis of analysis of workers' survey results and the analysis of working environment risks, to combine into groups the workplaces, where the factors of working environment risk are identical (analogous) in this way reducing the volume of documentation and information every employee should get acquainted with.**

Keywords: **labour protection, internal monitoring of working environment, analogous workplaces.**

I. INTRODUCTION

Labour protection system is an essential management component for every enterprise. The decision to establish labour protection system always has long-term effect from functional, as well as from financial point of view.

Motor road construction and maintenance enterprises represent construction branch. This theme is very topical for this branch, as there is a great number of active workers employed, a lot of different complicated equipment and technologies that can create trauma risk are met there, as well as specific character of work requires additional training and makes one pay more attention to the questions of labour safety.

For labour protection system at an enterprise to work and bring desirable results, it should not only be introduced and maintained, but also systematic and effective inner monitoring of the system should be ensured.

The problem discovered in the field of road construction and maintenance is the circumstance, that the biggest part of this field employees are employed in several workplaces. Especially it refers to construction equipment drivers. As a result, the problem is caused by excessive amount of information presented to employees. Mainly it refers to the volume of documentation on the analysis of working environment risks employees should be acquainted with. As a result training is not effective and employees get acquainted with it very superficially. That is why the possibility to lessen this amount of information without reducing the research of essential risk factors is examined in this article, as well as procedures of inner monitoring of labour safety will be examined and proposals for its improvement will be given, thereby creating safer working environment and lessening the risk of accidents.

II. ANALYSIS OF WORK RISKS FACTORS

Job hazard analysis includes:

- dividing each work into separate stages;
- analysis of risk factors on each stage, elaboration of limiting activities for these risk factors;
- description of safe working methods based on the analysis performed;
- checking, correction and introduction of the methods written;
- regular screening of each working method.

Workers inquiries (preferably anonimous) are being made to define risk factors, possible health damage, satisfaction with working conditions from the aspect of the worker himself. If workers are encouraged and stimulated to express their view on labour protection problems immediately, then it is a proactive way of averting injuries and diseases. That is why the system is necessary, which:

- requires and encourages to inform work superintendent about suspicions;
- protects workers from repressions, if they express their concerns about safety;
- requires from work superintendent to encourage workersand assure them that there will be no repressions;
- requires from work superintendent to immediately react on concerns and document actions;
- ensures evaluation of workers from the aspect of labour protection simultaneously to common evaluation [11].

It is also possible to perform informal interviews of workers to acquire the information about accidents or almost accidents. Evaluation of working environment risks is performed for corresponding activity types. If working conditions are similar enough, it is sufficient to perform such evaluation only once. Usually the identification of working environment risks is included into corresponding labour pr otection/ labour safety instructions, where preventive activities for preventing/ averting of these risks are also specified.

This field employees are often employed in several workplaces, as, for example, road grader driver can also be employed for work on a tractor or an excavator, if needed. So, he is acquainted with the results of working environment risks analysis for all these working places. Experience shows that the volume of information a worker should receive is often too large and, as a result, this process does not have any effect. While talking to employees, they often cannot precisely answer the question about what working environment risks are in one or another working place they are employed in.

1. TABLE

DISTRIBUTION OF THE NUMBER OF RESPONDENTS ACCORDING TO THEIR WORKPLACES

Workplace	Number	Workplace	Number	Workplace	Number
1	2	3	4	5	6
Accountant	3	Truck driver	18	Turner	4
Executive director	2	Bulldozer driver	3	Electrician	2
Mechanic	4	Road grader driver	13	Car electrician	2
Production engineer	2	Excavator driver	8	Office-cleaner	5
Chief of staff	2	Tractor driver	9	Car mechanic	7
Road construction worker	19	Heating furnace stoker	3	Metal materials welder	11
Grinding equipment operator	3	Car driver	7	Transport painter	2

Taking into consideration this fact, as well as to ease the work of the person in charge of labour protection, I whe propose, on the basis of analysis of workers' survey results and the analysis of working environment risks, to combine into groups the workplaces, where the factors of working environment risk are identical (analogous) in their structure, in this way reducing the volume of documentation and information every employee should get acquainted with.

To be able to objectively evaluate working environment risks and how essential they are, it is important that the employee of definite workplace also takes part in the inspection of workplaces, as he exactly knows better, what working environment risks are there at his workplace. In addition, workers' survey should be noted as good practice. Specially elaborated questionnaires handed out to employees for filling in serve this purpose.

Using questionnaires for evaluation of risk factors, the view of employees themselves about the conditions of their workplaces, possible working environment risks, as well as correspondence to their physiological (and psychological) requirements can be studied. One can get to know employer's opinion about necessary improvement, as well as possible illness symptoms (if an employee reflects it in diagrammatic representation of the parts of the body), etc.

With the help of questionnaires one can get to know «weak» spots of an enterprise, which should further be studied in details by a specialist or an employer.

During the inspection of workplaces inquiry and interviews of employees were made at the largest Latvia's motor road maintenance enterprise. Alltogether, 116 workers took part in the inquiry, including drivers, road construction workers and machine-shop workers and 13 office workers.

Distribution of workers, who have taken part in the inquiry according to their workplaces can be seen in the following table (see Table 1).

Analysing the data of questionnaires, one can conclude that road workers, road grader drivers and car drivers are mostly subject to dynamic work. Work monotony is noted only by car drivers, tractor drivers and a foreman.

Summarising the answers about pain or discomfort areas at the end of the working day, it is established that workers mainly note discomfort or pain in their arms, legs, spine and lower part of their back (see Fig. 1).

Despite the fact that noise is indicated as one of the main risks, workers practically do not use ear IPM.

Vibration in workplaces was noted by constructional machinery drivers, road construction workers, grinding equipment operators and a turner.

The results of inquiry testify that workers are also subject to dust influence, less often - to chemical risks. Only part of respondents use IPM (respirators and so on).

Pain or discomfort areas at the end of a shift mostly differ for each group of workplaces. Data show that road constructional workers noted the most pain and discomfort areas. The results summarised can be seen in the table (see Table 2).

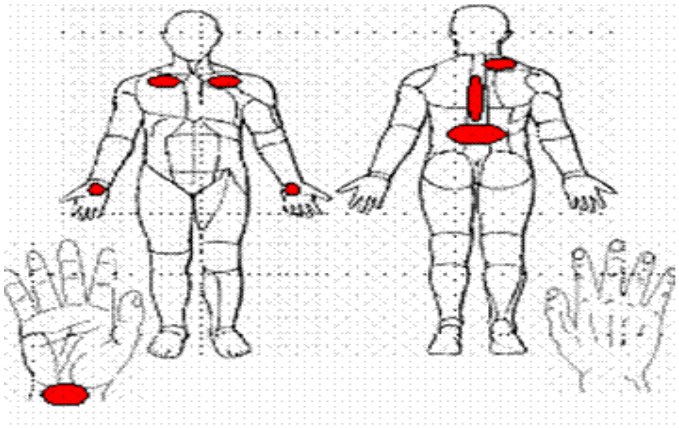

Fig. 1. Areas of pain or discomfort at the end of the working shift

2. TABLE

DISTRIBUTION OF PAIN OR DISCOMFORT AREAS ACCORDING TO WORKPLACES

Nr.	Workplace	Palm	Shoulders	Nape	Legs	Lower part of the back
1	2	3	4	5	6	7
1	Accountant	□		□		□
2	Executive director	□		□		□
3	Mechanic	□		□		□
4	Production engineer	□		□		□
5	Chief of staff	□		□		□
6	Truck driver	□			□	□
7	Bulldozer driver	□			□	□
8	Road grader driver	□			□	□
9	Excavator driver	□			□	□
10	Tractor driver	□			□	□
11	Turner	□			□	□
12	Electrician	□			□	□
13	Car electrician	□			□	□
14	Office-cleaner	□			□	□
15	Car mechanic	□	□		□	□
16	Road construction worker	□	□	□	□	□
17	Grinding equipment operato	□			□	□
18	Heating furnace stoker	□			□	□
19	Car drive	□			□	□
20	Metal materials welder	□		□	□	
21	Transport painter	□	□		□	□

Analysing the opinions about the length of breaks expressed in the questionnaires, one can conclude that the biggest part of the workers admits that it is not sufficient. In particular, construction machinery drivers, road construction workers and office workers note the insufficiency of breaks. It is connected with the volume of their work and shortage of working time.

Car mechanics, metal material welders and a transport painter noted that thay are subject to unbalanced noise effect in their working process, as thay often have to use hand tools (hammers and so on), as well as electric hand tools (electric grinder, drilling machine, etc.) in their work.

As for draught in a room, one can conclude that in the working places of a car mechanic, heating furnace stoker, grinding equipment operator, car electrician and metal materials welder this factor is present. It is connected with frequent gate opening for construction machinery to be able to come in a construction area, as well as with low quality window-frames, doors or gates.

III. FORMATION OF GROUPS OF WORKING PLACES DEPENDING ON WORKING ENVIRONMENT RISKS

Basic steps of risk evaluation are the following[2]:

- workplace check should be performed, defining the factors of working environment risk, that create or can create risk for workers' safety and health (for example, draught, noise, vibration, dangerous substances, etc.) and which it is necessary to avert or reduce to ensure workers' safety and health.

- workers and other persons, whose safety and health are subject to certain working environment risk, should be defined, including the workers who are subject to special risk. Evaluate how many and which persons are subject to rik at a certain workplace, if working environment risk affects only one worker or it influences also other workers, if it affects visitors and other persons.
- the volume of working environment risk should be evaluated (degree of succession heaviness) and realisation probability (frequency). For example, noise - if it exceeds allowed norms and if it endangers workers' ear or just makes a little troublesome sound (volume), if the noise is continuous or lasts for a short time while starting some machine (realisation probability).
- labour protection activities and their performance procedures should be defined. It is necessary for averting or reducing working environment risks.

Taking into consideration working environment risks employees are subject to, all workplaces can be divided into 12 groups:

A. Workplace of construction equipment driver

In this group, taking into account the fact, that working environment risks are analogous in their structure, such workplaces as road grader driver, excavator driver, bulldozer driver, tractor driver, car driver and truck driver can also be included.

B. Working place of engineering personnel

In this group, taking into account specific features of work and existing risks, accountant, work superintendent, brigade leader, personnel manager, production engineer, executive director, road master, mechanics engineer, production engineer, building and territory keeper, labour protection engineer, mechanic and road construction engineer are included.

- Workplace of a road construction worker;
- Workplace of an office-keeper;
- Workplace of a turner;
- Workplace of a car mechanic;
- Workplace of a car electrician;
- Workplace of an electrician;
- Workplace of a transport painter;
- Workplace of a heating furnace stoker;
- Workplace of a grinding equipment operator;
- Workplace of a metal materials welder.

When performing working environment risk evaluation, labour protection specialist inspects all workplaces, in cooperation with the representative of workers and the person employed in this workplace performs risk identification for workplace group and records it in the record «Working Environment Risk Identification». But in the record «Analysis of Working Environment Risks» the risks that are present in the particular workplace, not in the group, are described and analysed, and certain risk reduction or avertion activities are described. For the next step of risk evaluation and analysis it would be more appropriate to use Finnish Five point system [11], Work Ability Index method (WAI) [12], and Key Indicator Method [13].

Working environment risks characteristic for some of these groups are summarised in the following table (see Table 3).

Creating such groups of workplaces, which are combined into analogous workplaces according to the working environment aspects, the volume of documentation employees should be acquainted with can be reduces sufficiently. Quality of information presented does not lower, so this presentation would be more effective and valuable, as well as it would significantly ease the work of the person in charge of labor safety.

We believe that this improvement would also reduce the number of accident at work risks, as employees would get acquainted with documentation on the analysis of working environment risks at their workplaces more carefully

3. TABLE

FACTORS OF WORKING ENVIRONMENT RISKS CHARACTERISTIC FOR GROUPS OF WORKPLACES

Nr.	Work place	Factors of Working Environment Risks
1	2	3
1	Workplace of construction machinery driver	Physical factors (noise, vibration, light, microclimate), physical factors (working poses, lifting heavy objects), chemical factors (oil products, window cleaning liquids, combustion gases, etc.), trauma risk factors (CSN, falling from height, hand tools, risk of burning oneself, etc.), psychological and emotional factors.
2	Workplace of road construction worker	Physical factors (noise, vibration, microclimate, meteorological weather conditions), physical factors (working pose, hard work), chemical factors (dust, oil products, solvents, etc.), biological factors (ticks, insects, animal bites, hogweed, etc.),trauma risk factors (hand tools, working at height, possibility of stumbling, mechanized tools and equipment, risk of burning yourself, CSN, etc.), psychological and emotional factors.
3	Workplace of engineering personnel	Physical factors (light, planning of working space, microclimate), chemical factors (dust, copying machines, detergents, etc.), physical factors (working pose - sitting, working with a computer, long-term work without breaks, workplace equipment, high sight effort, etc.), psychological and emotional factors (shortage of working time, monotonous work, high responsibility, etc.), trauma risk factors (risk uf stumbling, etc.)

IV. CONCLUSIONS

In the field of road construction and maintenance, as in any other field, it is important for workers to understand their labour protection responsibilities and to fulfil them.

For labour safety organisation at an enterprise to be successful:

1. the head of an enterprise should be interested in investing into labour protection, as well as understand that correctly formed system can be cost-effective;

2. one should make sure that workers understand labour protection requirements correctly and what benefit they can get from its use [11].

For employees to understand labour protection requirements, training in labour protection is an important process. It is essential for this training to be effective and for employees to use the knowledge acquired in their working process. As a result, accident risk for them and other employees can be reduced or averted.

Essential aspect of employees' training process is proportional volume of information presented. If it is excessively large, this training can appear to be ineffective.

Inquiry of workers was performed within this research. As a result, the opinion of employees themselves about their workplace condition, possible working environment risks, correspondence to their physiological (and also psychological) requirements was studied. Also, one can get to know workers' opinion about necessary improvements, as well as possible illness symptoms (if an amployee reflects it in diagrammatic representation of the parts of the body), etc.

Having analysed the results of the inquiry, authors have come to conclusion that persons employed in several working places indicate the same working environment risks as concerns their classification as well as their essentiality. Also, examining and analysing working environment risk documentation, authors came to a conclusion that in several workplaces risks are similar as to their structure. On the basis of the results of this research, similar workplaces were combined into unified grups. Establishing such workplace groups helps to acquire two essential improvements in the organisation of labour protection:

1. the volume of documentation, the employees should be acquainted with, is reduced sufficiently, as a result, training process becomes more effective, employees perceive it more easily;

2. at an enterprise, where there is a great number of different workplaces with technological equipment and processes, construction machinery, etc., establishing such workplace groups facilitates the work of the person in charge of labour protection sufficiently.

The effective method of improving employees' traning process at enterprises has been elaborated, in this way creating safer working environment, considerably reducing accident risk, as well as probability of occupational diseases.

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