WORK ENVIRONMENT RISK MANAGEMENT AT PETROL STATIONS

DARBA VIDES RISKU PĀRVALDĪBA DEGVIELAS UZPILDES STACIJĀS

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Abstract

Work environment risk factors have a big influence in the daily life of employees at every company and work environment. In this study, a wide-ranging work environment risk assessment was carried out, using qualitative, quantitative, and semi-quantitative risk assessment methods, comparing the obtained results, and influencing factors, as well as evaluating the work environment management system and recommending possible improvements in its future development. The importance of the topic is justified by the fact that petrol stations are sites of heightened danger, where employees must pay greater attention to ensuring and maintaining a safe and secure environment to prevent the transformation of potential risks into real accidents or incidents. The work was developed at a company in Riga, Latvia, and station surveys were conducted in March 2021. As part of the work environment risk assessment process, four petrol stations in Pardaugava, Riga, were chosen for the risk assessment and measurements. In addition to station evaluations, an employee survey was conducted at 66 petrol stations throughout Latvia.

Keywords: *gas stations, work environment risks, qualitative and quantitative assessment, environmental risk management*

Introduction

Even though alternative energy sources are increasingly replacing traditional fuel, petrol station networks in Latvia continue to develop; currently 516 petrol stations of various types are registered in Latvia. As the number of petrol stations increases, so does the number of people employed there, which means that safety in these facilities requires more attention, as they become much more complex, combining an ever-wider range of services and equipment (Gas Stations Latvia, 2020).

According to data from the State Labour Inspectorate, the industries with the most accidents in recent years have been the manufacturing industry, the transport and storage industry, and construction. Fuel retail does not appear among the most dangerous sectors; however, as the network of petrol stations expands, as does the range of services provided, the number of risks that employees in this sector may face only grows and expands with every year. An important factor to consider is that the average age of employees in the industry is decreasing as more and more young

people are hired. This is often their first job, and so there is a lack of general understanding of how to work safely (2020. gadā darbā notikušo nelaimes gadījumu statistika, 2021).

Fuel is considered dangerous to the environment and employees because the presence of fuel creates an explosive environment; moreover, an accident or a leak at a petrol station can, depending on its volume, cause serious environmental pollution. Petrol station employees are also exposed to various and numerous risks, a large number of which are not regulated by legislation at all: for example, the standards set for moving weights are recommendatory, and psycho-emotional risk factors cannot be measured at all. In order for employees to feel safe in such an environment, and not to endanger employees' or customers' health, life and safety, it is very important to sufficiently quickly identify and eliminate both existing and potential risks in the work environment which could pose any kind of threat to employees or customers (Chijioke, 2020; Ahmed et al., 2014; Dispensing petrol, S.a.).

In creating a safe working environment, it is very important to ensure a relevant work protection and work environment management system, which in the context of this paper is perceived as continuous monitoring of the existing situation to assess the real work environment, and not based on the subjective opinion of a work protection specialist. Equally important is the involvement of employees and analysis of the obtained data, which also helps with getting a much broader picture of the situation (Covello et al., 2013; Ramos, 2019).

The purpose of this work is to assess the diversity of risks in the work environment, to improve the risk management system by preparing a comprehensive risk assessment of the work environment for petrol station employees, and to develop preventive risk reduction measures. At the beginning of the research, it was assumed that the methods used in the assessment of the risks of the working environment and the requirements set forth do not fully characterise the level of risk in the working environment, and they are insufficient to evaluate the situation objectively and critically.

Data and methods

Semi-quantitative, quantitative and qualitative methods were used in the risk assessment, which was carried out for risks related to employee training, physical risks, chemical risks, biological risks, mental or psycho-emotional risks, and physical and mechanical risks. In order to make the risk assessment more complete, measurements were made of parameters such as microclimate, noise level and lighting. Data was obtained using direct measurement methods that characterise the data of this moment, but do not provide information about the correlation of data over time (Moraru et al., 2014; Klotiņa, 2011).

To perform this risk assessment, four petrol stations located in Riga, in Pardaugava region, were selected for the work: X (56º54'44.926; 24º7'23.312), Y (56º54'34.434; 24º5'4.014), Z (56º55'39.391; 24º6'24.864) and Q (56º56'4.302; 24º0'23.27). The schematic arrangement of these stations can be viewed in Figure 1, where the stations are marked with dots.

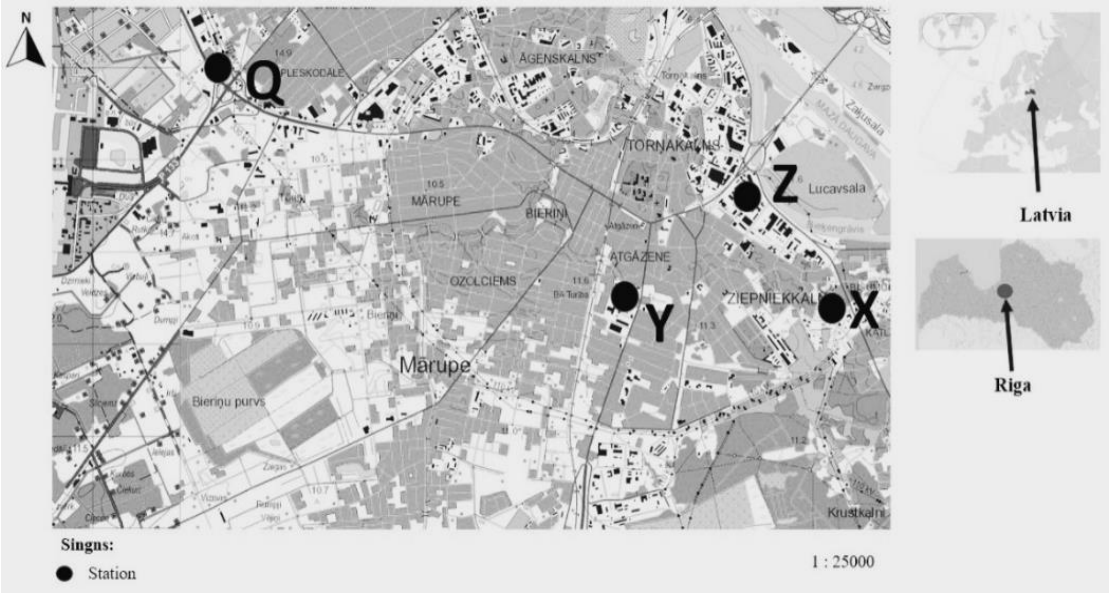

Figure 1. **Schematic arrangement of stations in Pardaugava** (author's figure using LGIA topographic basemap)

In the period from 8 March 2021 to 18 April 2021, direct measurements of the parameters of air temperature, relative air humidity, noise and lighting were carried out at each of the four selected stations. Measurements were repeated twice at each of the stations during the indicated time. The Multi-Functional Environment Meter PCE-EM882 was used to measure relative air humidity, temperature, noise and lighting.

A qualitative risk assessment was carried out at all stations using the results of the obtained indicative measurements, as well as assessing each station, the risk factors of the work environment were assessed according to the Finnish 5-point method, according to which risk factors are evaluated with a level from 1 (insignificant risk) to 5 (unbearable risk). For each level of risk, appropriate preventive measures must be taken to reduce the level of risk. No measures are necessary for insignificant risks, and it is not necessary to document the risk. For an acceptable risk, special measures should not be taken to reduce the risk, but the risk must still be controlled. If, however, some measures are to be taken, then it is necessary to evaluate what they could be in order to use as little funds as possible. For severe risks, it is necessary to find and take measures to reduce the risk, but their implementation is not urgent, and the reduction measures can be taken within 3–5 months of the risk being eliminated. In case of significant risks, the work must not be carried out until measures

have been taken to reduce or eliminate the risks. If it is not possible to stop the work immediately, the extent of the consequences and the number of employees should be considered, but measures should be taken within 1–3 months. In case of an intolerable risk, work is not allowed until the risk factor is reduced (Kaļķis, 2008).

To verify the author's accuracy in determining risk factor values according to the Finnish 5-point method, risk factors were also evaluated according to the semi-quantitative Finnish method in order to assess whether the use of different methods affects how high a risk level each specific risk is assessed. The semi-quantitative Finnish method is also very similar to the Finnish 5-point method. In this case the risk index R_i is determined, after which the belonging to the risk level from I to V is evaluated, like the above-mentioned 5-point method. To obtain the risk index, it is necessary to evaluate the likelihood/probability of the accident and explanation of the consequences of the accident. Once these parameters are obtained, a risk index can be calculated. To determine the risk index (R_i) it is necessary to use a special matrix. Using this matrix, according to the probability of the accident and the possible consequences of the accident, R_i attention is determined, which shows what the level of the determined risk is (Darba vides riska …, S.a.).

In total, in the period from February 15th 2021 to February 26th 2021, the survey was completed by 66 petrol station managers, who expressed not only their own opinions, but also the general opinion at their station on the various risks of the work environment.

To assess the relationship between the work environment and risk levels, data on risk levels and categories were entered into the statistical analysis programme JASP. Descriptive statistics were obtained with the JASP programme, and a univariate non-parametric analysis and Poc-Hoc test were carried out to determine whether there were statistically significant differences between workplaces and the risks assessed there. Risk assessment environments were divided into six basic categories:

1. employee training; 2. physical risks; 3. chemical risks; 4. biological risks; 5. psycho-emotional risks; 6. physical/mechanical risks.

Looking at the summary of risk categories and their distribution by risk level throughout the stations (Figure 2), it can be observed that the most stable are employee training and physical factors. The explanation for why these two categories of risks are best managed is that it is related to the fact that these are clearly internal risks, because the level of training depends on the company's internal training system. In the same way, physical risks are also considered to be easily regulated internally, because by carrying out regular measurements it is possible to monitor changes (temperature, relative air humidity, lighting) and, if necessary, deviations can be relatively easily eliminated. The category of risks which in general is the closest to level III and has the highest potential to move to level IV (significant risks) is mental risks. This result was also reflected in employee surveys, where most employees acknowledged that they

faced stress at work every day or at least every week. An increased mental load for station employees is not only due to customer service. It should be mentioned that station employees can quite regularly find themselves in various crisis situations, such as fuel or LPG leaks.

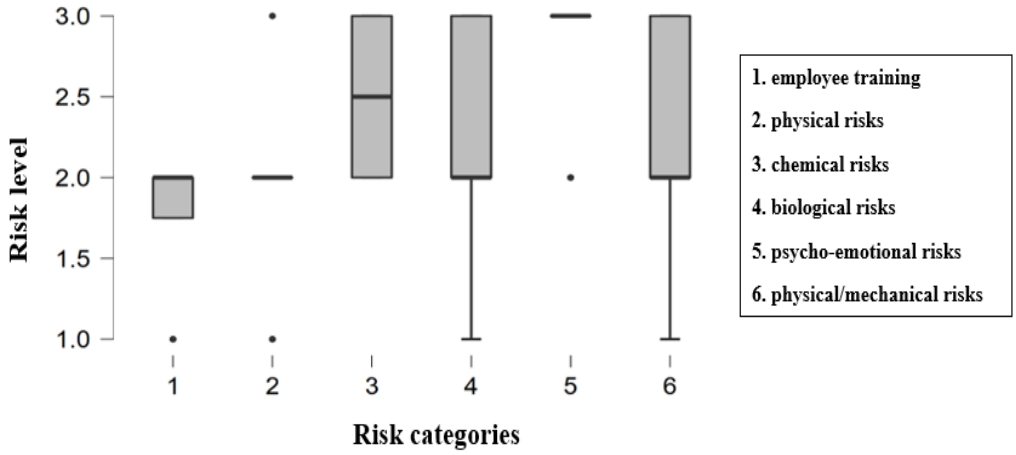

Figure 2. **Distribution of risk categories by risk levels at stations** (author's figure using JASP programme, 2022)

When carrying out a non-parametric data analysis test to determine whether there are statistically significant differences between risk levels in different petrol station environments (Figure 3), the null hypothesis remains valid as the obtained test significance values are greater than 0.05. The post hoc test shows that environment 1 (work inside station) and environment 2 (work on the premises of the station) are more like each other, because in both environments employees are constantly in contact with customers and risks associated with inappropriate behavior on the part of customers.

When analysing work at the station offices, the risk factors for lighting, according to the Finnish 5-ball method, were assessed at risk level II (acceptable risk). Although employees do not mention lighting among the most frequent risk factors that they have to deal with which are considered disturbing, the experience of recent years at companies in Latvia shows that in only 50.8% of cases does lighting in the workplace meet the legislative requirements (Darba apstākļi un.. 2018). Although the currently observed situation is appropriate, no threats to the health of employees are visible; at the same time, if the established requirements for providing adequate lighting are not met in the long term, there is a possibility that this risk may change from acceptable to severe (III). When evaluating this risk factor according to the semi-quantitative method, the probability of the accident is assessed as unlikely (Q2) and the consequences of the accident are assessed as acceptable (p2). According to these

results, the risk index is 4, which means that the risk is identifiable as an acceptable risk (II).

Table 1**. A non-parametric test to determine whether there are significant differences between risks in work environments at different stations** (author's figure using JASP programme, 2022)

ANOVA					
ANOVA – risk level					
Case	Sum of Squares	df	Mean Square	F	p
Vide	0.767	2	0.383	0.857	0.428
Residuals	39.387	88	0.448		
Note. Type III Sum of Squares					
Post Hoc Tests					
Standard					
Post Hoc Comparisons – work environment					
		Mean Difference	SE	t	P_{tukey}
1	2	0.010	0.171	0.056	0.998
	3	0.200	0.173	1.158	0.481
2	3	0.190	0.171	1.111	0.510
Note. P-value adjusted for comparing a family of 3					

Factors of psychological overload for the manager of petrol stations according to the Finnish 5-point method are assessed with risk level III. As previously mentioned, psycho-emotional risk factors have become the most common risk category in recent years, and have a tendency to worsen. This is also confirmed by trends in recent years in Latvia, since according to 2018 data, 75.8% of employers cite psycho-emotional risk factors as decisive (Psychosocial risks in.. 2014; Darba apstākļi un.. 2018). Evaluating these risk factors according to the semi-quantitative method, the accident the possibility is evaluated as possible (Q4), and the consequences of the accident are evaluated as permissible (p2). According to these results, the risk index is 8, which means that the risk can be identified as a bearable risk (III).

When evaluating work in indoor spaces at petrol stations, the influence of microclimate is a risk factor which according to the Finnish 5-ball method is assessed at risk level 2, which is considered an acceptable risk. Although air temperature and relative air humidity are considered to be parameters of the working environment for which compliance with regulatory requirements in Latvia is considered to be very high, as in 79.8% of cases the air temperature and in 63.4% of cases the relative air humidity correspond to the regulatory limits set in workplaces, however, in the long

term, an inadequate microclimate can cause serious health problems (Darba apstākļi un.. 2018). When evaluating the risks created by a microclimate according to the semi-quantitative method, the probability of an accident is considered unlikely (Q2), and the consequences of the accident are assessed as acceptable (p2). Summarising these results shows that the risk index is 4, and so this risk can also be identified as an acceptable risk (II).

Of all the risks of the work environment that petrol station employees may encounter, ergonomic risks are very significant, considering the work specifics, which involve long-term work at the cash register, irregular rest breaks, active work in the store and warehouse, when to replenish the goods. The fact that working in a forced posture is a significant risk factor is also confirmed by the fact that in a survey of the employed population in Latvia conducted in 2018, 75.1% of employed people admitted that they spend their working day in a forced posture (Darba apstākļi un.. 2018). In the case of petrol stations, it is long-term work while standing at the cash register, as well as monotonous movements when operating the cash register. According to the Finnish 5-point method, this risk is assessed as bearable (III). When evaluating according to the semi-quantitative method, the probability of the risk is assessed as rare (Q3) and the consequences of the accident are assessed as significant (p3). From this the risk index is 9, the risk can be identified as bearable (III). However, when it comes to ergonomic risks, when evaluating the probability of an accident, it could also be Q4 in many cases, which means that the occurrence of the risk is very likely. This is since the regulations do not strictly define the permissible maximum weight the employee can move. Furthermore, in a situation where two different workers lift the same box, one of them may be able to do it without any effort and with lasting consequences, while the other one may find it too heavy; injuries can also be obtained during the lifting process, which in the long run can have a significant impact on the health of the worker and ability to work. Therefore, when developing a risk assessment of the working environment and regularly following up on the functionality of the management system, it is essential to include risk-mitigating factors that would equally protect all employees.

When evaluating work in the outdoor area of petrol stations, one of the most serious risks of the work environment, which according to the Finnish 5-ball method is assessed as an acceptable risk (II), is the risk factor associated with the use of personal protective equipment, because it is very important that, when carrying out any kind of cleaning work, for example at pumps, where workers may come into contact with fuel, which is a dangerous and carcinogenic substance, workers use appropriate personal protective equipment. In general, the use of personal protective equipment is one of the simplest ways to protect employees from various risks, and as both employers and employees recognise, the main cause of accidents in the workplace is precisely inappropriate behavior on the part of employees, failure to follow instructions and

non-use of personal protective equipment (Darba apstākļi un..2018). When evaluating this same risk according to the semi-quantitative method, the probability of an accident is assessed as unlikely (Q2), because all employees are properly instructed and have the necessary qualifications to perform the work properly. The consequences of the accident can be assessed as acceptable (p2) because it is most likely that in such a situation the damage to the employee's health would not be immediate and irreversible. In this case, the total risk index is 4, which means that this risk is also considered acceptable (II) according to the semi-quantitative method.

Comparing the assessed risk level according to the Finnish 5-ball method and the semi-quantitative Finnish method, the obtained results are the same and it is possible to determine the same risk level. The usual 5-point method is faster and more convenient to apply, however, in cases where there is doubt as to what level of risk to apply to a given factor; the semi-quantitative method is a good way to base the choice not only on subjective experience, but on a slightly broader risk review.

Good risk management of the work environment is related to the ability to adapt a system to a specific situation, so it is essential that the responsible persons are ready and able to develop the system by combining various risk assessment methods, employee involvement and assessment of the environment around them. It is also very important to monitor changes both in the working environment itself and in the legislation, to prepare preventively and prevent risk, or if the risk turns into an accident, ensure the consequences are as minimal as possible. A very important part of a successful risk management system is support from the company's management, both at the level of ideas and financially. Preventive, structured and timely action can significantly reduce the financial resources needed. This means supplementing the existing labor protection system, in which the risks of the working environment are assessed once a year, with several preventive and very important measures: for example, regular monitoring of risk factors and surveys at stations, supplemented with long-term environmental parameter measurements, which are statistically analyzed, thus ensuring even the smallest changes and deviations from the norm are noticed, the necessary actions are applied, and the risk factor is prevented from developing. Furthermore, the previously mentioned employee interviews and surveys, if they are not formal, but carried out with the aim of obtaining in-depth information, can provide timely and very relevant information. By proactively noticing a risk factor that has not yet developed, or caused accidents or employee health problems, it is possible to eliminate it immediately by making only organizational changes in the work process or by training employees to work according to a specific situation. On the other hand, if the risk is allowed to develop, significant changes in the work process, equipment or technologies are required.

Conclusion

1. During the development of the work, it was seen that the Finnish 5-point method is good enough to objectively assess the risks of the work environment; however, in cases where it may be difficult with this method to determine the level of a risk factor, because the specialist's opinion may be too subjective, it is recommended to use the semi-quantitative method to ensure the objectivity of the chosen risk level. Likewise, in cases where one of the determined risk levels is on the borderline, if reduction measures are not taken, there is a possibility that this risk may move to a higher level, it is very important to carry out regular inspections specifically to monitor this risk – including indicative measurements, visual assessment onsite and employee surveys.

2. For the risk management system in the company to function better, it is very important to involve the company's employees in it, regularly conducting surveys and finding out their opinion about the risks of the work environment. When analysing the survey data, employees' opinions do not always coincide with the results of the measurements – there are cases when the measurements do not show the limit values being exceeded, yet employees still complain of discomfort.

3. To ensure good management of the risk management system, monitoring should be carried out not only for factors of the working environment, such as microclimate, a noise and lighting, for which regulations are defined in the legislation, but also for those risk factors for which no specific regulations have been developed.

4. After developing the work, it can be concluded that the proposed hypothesis has been partially confirmed, because the generally used method of assessing the risks of the working environment (in this case, the Finnish 5-point method) is sufficient to assess the risks of the working environment; however, in order for the working environment management system to be more complete, it is important to supplement the assessment with interviews of employees, taking measurements and a regular daily survey of the workplace, in order to be able to follow up, monitor and predict possible changes in the level of risk as a preventive measure.

Kopsavilkums

Apkopojot darba izstrādes procesā iegūto informāciju, ir skaidrs, ka darba vides risku pārvaldība ir ļoti komplicēts process, kura veiksmīgas uzturēšanas pamatā ir nevis vienas konkrētas sistēmas izmantošana, bet gan starpdisciplināra pieeja, kas apvieno gan visaptverošu un mērījumos pamatotu risku novērtēšanu, gan regulāru un aktīvu nodarbināto iesaisti. Šādi veidota darba vides risku pārvaldības sistēma ne tikai pildīs formālās funkcijas, ko nosaka likumdošanas prasības, bet ilgtermiņā arī uzlabos darbinieku darba apstākļus.

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