FOREIGN WORKERS IN INDUSTRY – PREVENTION OF ACCIDENTS

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The increasing need for a labour in the Czech Republic and other countries of Central Europe will lead to employing of foreigner workers. It is possible to assume that foreigners will be employed in positions, where the chosen decision can result in major accidents with fatal injuries followed by environmental or a property damage. These actors include operators in chemical or power plants, etc. As can be seen from foreign experience, poorly understood information leads to wrong decision-making process of operator resulting in accidents. The aim of this work is to map the situation in countries with traditionally large share of working foreigners (for example UK, France, Germany, etc.) and to identify the ways for prevention of these types of accidents. Subsequently, to create the set of recommendations for companies, which desire to employ foreign workers.

KEYWORDS

Safety, foreigners, industry, recommendation

1 INTRODUCTION

Countries such as the United Kingdom, Germany, Spain or France. have rich experience with a labour migration. The data from [EUROSTAT] shows that a total of 4.3 million people immigrated to one of the EU-28 Member States during 2016, while at least 3.0 million emigrants were reported to have left an EU Member State. These total figures include also flows between different EU Member States. There were an estimated 2.0 million citizens of non-EU countries and 1.3 million people with citizenship of a different EU Member State from the one to which they immigrated. Germany reported the largest total number of immigrants (1 029.9 thousand) in 2016, followed by the United Kingdom (589.0 thousand), Spain (414.7 thousand), France (378.1 thousand) and Italy (300.8 thousand) in year 2016. Luxembourg recorded the highest rates of immigration in 2016 (39 immigrants per 1 000 persons). Simultaneously, Germany also reported the highest number of emigrants in 2016 (533.8 thousand), followed by the United Kingdom (340.4 thousand), Spain (327.3 thousand), France (309.8 thousand), Poland (236.4 thousand) and Romania (207.6 thousand). A total of 21 of the EU Member States reported more immigration than emigration in 2016, but in Bulgaria, Croatia, Latvia, Lithuania, Poland, Portugal and Romania the number of emigrants outnumbered the number of immigrants.

On the basis of the CZSO (Czech Statistical Office) information, it is clear that as at 31 December 2017 there were in total 24,753 Employee Card holders registered on the territory of the Czech Republic. Between 2009 and June 2014 it was possible to apply for a Green card, a type of the long-term residence permit for the purpose of employment in special cases. As at 31 December 2017, 7 Green Card holders in total were registered on the territory of the CR. Since 1 January 2011, Blue cards system was introduced permitting of employment and residence of foreigners on the territory of the Czech Republic for the purpose of performance of highly qualified employment. As at 31 December 2017, 413 Blue Card holders in total were registered on the territory of the Czech Republic. According to the estimate, the respective regional labour offices registered 472,354 foreign nationals in total on the territory of the Czech Republic as at the end of 2017. Despite the increase of the total number of foreign employees (by 89,465 persons compared to 2016), it can be stated, that the number of foreign workers, who need a work permit for their work continued to decrease, and, on the contrary, the number of foreigners, who do not need a work permit has been increasing as well as the number of the EU/EEA citizens and citizens of Switzerland and their family members, who have free access to the labour market. At the same time, the number of foreigners, who need the Employee Card for their work activities, has been increasing [CZSO].

Countries like the Czech Republic, Poland orHungary have norich experience with a labour migration compared to countries like Germany, UK or France, etc. It is a relatively new phenomenon in a Central European environment. However, it is changing due to labour shortages.

The study [TNS 2006] shows that 44 % of Europeans know only their native language. This percentage increases for people with lower education [Paul 2013]. Employees with not sufficient language skills are exposed to a higher risk of work or fatal injuries. It is evident for example from work by [Cha 2014]. A language problem or a language barrier are mentioned also in others works [Ismail 2014; Paul 2013; Guldenmund 2013]. These authors mentioned the language problem as one of the factors influencing the risk of an accident at work. Authors [Guldenmund 2013] describe migrant workers directly as a vulnerable group of workers. The increased number of foreigners´injuries at work may also be related to the sector in which they work most often. For example, the study by [McKay 2006] states that migrants are more likely to be working in sectors or occupations where there are existing health and safety concerns, moreover, it is their status of new workers that may place them at added risk.

In addition to that, foreigner workers belong to a group, where a greater risk, due to an instruction misinterpretation or misunderstanding, exist and may cause an accident. If done by the operator of technology in a process industry or energetics, consequences can be serious.

The aim of this contribution is to point out the problems related to hiring of foreign workers as documented by literary sources. Simultaneously, the experience from abroad andthe evidence of accidents will be used to suggest a set of recommendations and measures to mitigate the risk. These recommendations and measures can be used by the operator for hiring of non-native workers.

2 CAUSES OF ACCIDENTS RELATED TO FOREIGN WORKERS

It is generally assumed that about 30% of all labour errors are due to a human factor [Crowl 1990]. Author [Broadribb 2012] states that human factors are involved in most incidents that

occur in the process industries. In nuclear power, this value is around 40%, some authors state even the value 50% [NEA/CSNI/R(98)1]. In any case, this is one of the main causes of mistakes that is given the least attention.

Phenomena and events in which planned sequence of mental or physical activity has no intended effect, and where the failure is not attributed to the presence of some random factors, are usually marked as human errors.

A lack of communication or some deficiency in communication are often key factors in occurrence of incidents [Broadribb 2012]. From the point of view of foreign employees (who do not speak the same language, are socio-culturally different with different customs, behavioural patterns, traditions, norms and values), causes of undesirable events (accidents) are associated with following:

- A language barrier,
- A misunderstanding of instructions (due to different terminology),
- An assignment of different meanings to gestures and nonverbal communication in general,
- A disrespect to authority or non-compliance of instruction (due to a racial or gender status),
- A lack of experience,
- A stress from a different work environment,
- errors caused by the non-adaptation to the work environment.

For the determination of a general quantification of the error frequency we can use Rasmussen's taxonomy of human errors [Crowl 1990]. The approximate range of a likelihood of operator´s human error we can determine from this study where human errors are divided by type of activity as:

- Skills based activities: a person performs only rehearsed tasks, they are performed automatically, and need not consciously concentrate on them. Likelihood of error is about 10^{-4}–10^{-2}.
- Rules based activities: a person applies well-known rules, he/she must focus on classifying the situation and remembering procedures. Likelihood of error is about 10^{-3}–10^{-1}.
- Knowledge based activities: in the given situation, no behavioural patterns are created, new rules must be created to address the problem, analytical thinking and knowledge must be used. Likelihood of error is about 10^{-2}–1.

In the case of new employees of foreign nationality, we descend one level below. For example, if the worker who performs the required action in the home country is employed, we must classify this action as rules based activity. In this case, the likelihood of human error is therefore at least 10 times higher.

3 EXPERIENCE WITH THE EMPLOYMENT OF FOREIGNERS IN VARIOUS SECTORS OF ECONOMIC ACTIVITY

Very important issue is the employment of foreigners in industry and related problems, which are caused by the constant development of industrial production and considerable pressure to increase production and reduce wages. There is usually a very high national diversity which leads to a safety discrimination against certain national groups. In accordance with the study [Casey 2015], the solution of this can be: the identification of a cross-cultural safety leadership competencies and culturally-sensitive health and safety interventions such as employee training which should be given a priority. (For the purpose of this text we do not explore in details the difference between the national, resp. ethnic identity).

The knowledge of safety culture and monitoring of safety culture indicators are important aspects to measures can effectively applied. Continuous monitoring of safety culture (and their proper interpretation) can help to detect problems in process connected with language barrier before serious accident.

Various approaches can be used for identification of safety culture in the company. These approaches is possible to find in works [Fedorycheva 2015; Fedorycheva 2017]. In the work by [Kotek 2018] is possible find the example of application of metrics in medium-size enterprise, which can use as safety culture indicator.

Human errors, which are related to cooperation of foreigners, can be found in a wide range of sectors of economic activity. Very common and well-described are, for example, in aviation. The technical report [Drury 2002] notes that up to 70% of the reports (out of a total of 28,000) were due to a communication error. This report shows that miscommunication may cause:

- The use of incorrect information,
- Limited caution,
- Unrealistic image of the current situation created by a communications participant.

Given the increasing volume of air transport and socio-cultural and linguistic differences, it is likely that the number of air transport communications errors will increase [Orasanu 1997].

The next branch where communication errors are common is safety and security of customers in stores. Proper communication between workers and the security employees in the store is very important in tense moments. Yet it is a poorly paid profession, which is often accepted by foreigners. The study by [Paul 2013] describes several possibilities for improvement of communication in this branch.

The construction industry is the next sector where the occurrence of foreigner workers is very high. At the same time, it is a sector where the injury rate is very high. In the study by [Bust 2008] is stated that 50% of construction workers are foreigners in the UK and Ireland. A large number of them speak no English and alternative ways of communication are used for their safety (for example pictures, pictograms, translator, etc.).

The number of communications with foreigners also increases in the medicine (whether patient or medical staff). The alternative communication strategies need to be developed from a patient safety point of view [Delp 1990, Starlander 2005]. It can reduce the human errors, which can lead to endangering the health of the patient.

The freight is the next sector, where many foreigners are employed. The author [Leviäkangas 1998] states that driving habits and skills as well as driving behaviour are largely the products of culture and the social environment: patterns of behaviour and attitudes are learned and thus they do not necessarily mean consciously directed aggression towards other drivers [Leviäkangas 1998]. The same author states that the risk of a foreign driver driving a heavy vehicle to be involved in an accident was roughly double the risk of Finnish heavy vehicle drivers in Finland [Leviäkangas 1998].

4 ACCIDENTS IN A PROCESS INDUSTRY AND A STORAGE OF HAZARDOUS SUBSTANCES

The opportunities for human errors increase exponentially as the system size and complexity grows [Bowonder 1987]. Systems with a high degree of complexity can be find above all in chemical, petrochemical industry, in the production and processing of explosives or energetics. Operators who work in

these sectors may be under great psychical pressure. Especially in the case of extraordinary events. These employees can by their decision influence the cause of an extraordinary event - whether a major accident occurs or does not. In the case the position is occupied by a non-native speaker (who did not use the language of the country where the facility is located), the risk of an error increases.
A separate issue is the work done by external contractors (these are mostly maintenance workers of various components of the equipment or their installation). Workers of contractors have no knowledge of the work environment. Moreover, if it is a contractor with foreigner workers or it is directly a contractor from abroad, the risk of human error increases. For example, workers from Romania were victims of major accident in a chemical company in Czechia in year 2018. However, the causes of the accident can only be speculated at this time. Investigation into the causes of the accident have not yet come to an end.
Accidents with a common denominator - language problems of foreign workers – are stated in following text. The list of accidents is the result of own research from databases eMARS (Major Accident Reporting System) [eMARS] and ARIA (La référence du retour d'expérience sur accidents technologiques) [ARIA].

France, 2009 (Industry: Manufacture of synthetic rubber in primary forms):
The German driver, trained since 12. 1. 2009, unloads the soda truck with French operator. Neither of them speaks the language of the other. The driver does not know the site's facilities and practices. He was hit by synthetic soda ash solution. Despite its full anti-acid suit and visor helmet, the driver is touched to the eyes and face, the product being passed under the protective visor. Following measures are proposed: implementation of a transport protocol in several languages and distributed to the suppliers, better specifying the unloading operations of the trucks of corrosive substances, communication aid document, based on diagrams and photos. Finally, the operators will have to make sure that the drivers know the procedure and that they are equipped with the appropriate individual protections.

USA, 2009 (Industry: Processing and preserving of potatoes):
Two employees were using an oxygen-acetylene torch to loosen a fitting on an old fuel tank. The tank was not cleaned or purged before work began. Shortly after applying heat to the tank, an explosion occurred. Both were treated for burns covering 30 to 50% of their bodies. The facility had no formal hot work program, and no permit was issued for the hot work being performed. In addition, many workers were mono-lingual Spanish speakers and had not been trained on safe hot work procedures or on the proper use of gas detectors in their native language.

Germany, 2008 (Industry: Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms):
The external technician performs repair work on a compressor that is out of order in a cooling system. The latter opens the machine under pressure, without authorization. An ammonia leak occurs. The measure put in place by the company suggests that it was a foreign worker.

USA, 1998 (Industry: Manufacture of explosives):
Two massive explosions 3.5s apart destroyed an explosives manufacturing plant, killing 4 workers and injuring 6 others among the 11employees present. The investigation carried out by the CSB revealed a lack of adherence to various process safety principles: for example, no workers were involved in conducting the company's process hazard analysis for the booster operation, plant design was insufficient and even minimal safety distances were not respected. Raw materials, equipment, and work procedures were altered without an analysis of the hazards of these changes. Furthermore, the majority of workers spoke only Spanish, but the plant had no operational policies, safety videos or procedures in that language. The information relied only upon informal translation, created opportunities for error and miscommunication.

Denmark, 1985 (Industry: Casting of other non-ferrous metals):
The chlorine leak occurs on a hot water spray system used to evaporate chlorine from an aluminium smelter. Chlorine is used to remove magnesium from the melt. The site has two 500-liter chlorine cylinders located in a special, partially open room. One cylinder was connected to one chlorination unit while the other was kept in reserve. The closing valve on the cylinder is provided with an extension rod which can close the valve from the outside. This rod can be activated only in emergency situations as instructed by the chlorine supplier.
The cause of the accident is the unscrewing of the socket and the valve stem. These have been unscrewed by force, avoiding the locking provided by a locking screw. After that, the socket and the valve stem would have been ejected or removed, causing chlorine to leak. The operator reports that the workers present at the time of the leak are foreigners and that, consequently, language problems may be involved in the accident.
Above mentioned accidents can provide us with the evidence which can be used for prevention of accidents. The strategy how to avoid accidents can be applied in operations. A summary of the proposed information is given at the conclusion of the paper. This information can serve as a guide for implementing rules for the admission of foreigners to various sectors of economic activity – above all to process industry or energetics. Here, the human errors can cause major accidents with fatal injuries or environmental or property damage.

5 CONCLUSIONS

Based on the information from accidents and literary sources, the authors recommend the following:

- Recruitment of employees – selecting suitable staff for the given type of activity through tests.
- Language barrier – to ensure that key employees are able to communicate effectively in the language of country where are employed. Offer training to other workers in the practical use of a foreign language. To provide instructions in all languages that are used in the workplace.
- Training of staff – training is a method to increase the skills and knowledge of workers about the process. Sometimes it is also necessary to use the so-called relearning, that is to say, complete automation of the activity. In the training phase, human error has also a positive effect, it is the most effective way of learning. If we have the opportunity to learn from our mistakes, the learning process is the most effective. Simulators are used in the case of the most hazardous operations. Simulators enable to offer a feedback and together

eliminate the negative consequences of errors and mistakes.

- The communication – the effectivity of communication decrease in the case of routine system operation. The communicator begins to assume that the meaning of his message must be clear to everyone. Slang expressions will also be used for different activities and devices. Only narrow group of employees understand to expressions. Introduction of feedback (confirmation of the instruction, repetition of the instruction) can decrease the number of human error. For example, the author [Paul 2013] states tip to improve communication.
- Impact of work environment – limiting the impact of the work environment on employees, the possibility to control work environment parameters (increasing or decreasing temperature, humidity, etc.). Regular inspection of working conditions can decrease the number of human errors.
- It is evident that majority of these recommendation is possible to apply not only in companies employing foreign workers but also in other companies employing the native speakers.

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