SAFETY ENGINEERING OF ANTHROPOGENIC OBJECTS

SAFETY AND HEALTH PROTECTION (S&HP) IN MANAGING CONSTRUCTION PROJECTS

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Abstract

Construction objects arise during the implementation of construction projects. Participants in these projects are interested in taking systematic actions to improve the state of occupational safety and health protection. The effectiveness of these activities requires that they be carried out as part of a comprehensive system of managing the construction project implementation process. The safety management and health protection system is part of the overall project management system, which includes: organizational structure, planning, responsibility, rules of conduct, procedures, processes and resources and requires analysis of safety and health protection issues in its individual areas, phases and stages. This is primarily due to the fact that proper management is the most effective way to ensure an adequate level of safety and health protection (S&HP), desirable both due to the need to comply with legal provisions in force in construction, social expectations, and the possibility of obtaining positive economic effects by individual process participants in the scale of the entire construction project.

The article proposes a theoretical model of the built undertaking that can be used to recognize the state of bioses. The model distinguishes parts, activities and areas in accordance with the logical course of the process, which was assigned to individual stages of the project. A research tool - RADAR S&HP - was developed to identify the factors affecting S&HP. To assess the condition of bioses, an analytical and mathematical model of the examined undertaking was formulated to ultimately determine the directions of preventive actions in the field of safety and health protection at individual stages, phases and areas of the construction project implementation process.

Key words: safety and health protection, managing, contrtuction projects

INTRODUCTION

Safety and health protection at work is an ambiguous concept and, depending on the area or field of research, was interpreted differently in the literature. In most cases, it was associated with safety (Stańczyk 1996), (Czaputowicz 1998), work safety (Tytyk 2002) and management (Klamut 2012).

Historically, safety at work has been equated with technology. From ancient times to the industrial revolution in Great Britain (1750-1840) the development of technology was small and the issues of safety and health at work were invisible (Tytyk 2002). Changes in the approach to occupational safety issues began with the first technical revolution (Szlendak, Obolewicz 2002), (Szlendak, Obolewicz 2005). The mass production scale, a large number of technical facilities and a large number of workers required a new safe organization of work. The production process was more and more technically complex and generated accidents. Research on work processes until the 1970s focused mainly on increasing work efficiency and on improving workplace equipment, selecting equipment, machinery and equipment. This period was characterized by a low level of safety and the measure of this level was the number of accidents at work (Ejdys et al. 2008; Obolewicz 2012a, 2012b). The first laws on safety at work began to be created regarding work processes and workers to prevent accidents. There were two basic views regarding the advisability of actions in the field of labor protection. Some

authors believed that the purpose of labor protection is to protect the health and life of employees in the work environment to protect their ability to work. Others, in turn, claimed that the primary goal of labor protection is to protect the health and life of the employee and the fact that the employee is healthy gives him a guarantee of his ability to work. Issues of work processes and its safe organization, over time, have become part of currents in organization and management sciences and have become complementary to four main directions: technical-physiological, administrative, psychological-sociological and contemporary (Szlendak, Obolewicz 2002, 2005). Supplementing the directions of organization and management with the issues of occupational safety has become the foundation for the development of occupational safety sciences (Stelmach 2008; Obolewicz 2019).

Along with the development of organization and management directions, the idea of labor protection in Poland developed objectively and objectively.

In terms of the subject, in legal sciences the concept of labor protection was interpreted in a broad and narrow sense. In the narrower sense, labor protection was a set of legal norms aimed at ensuring safety by employers by protecting employees' health against the harmful effects of the work environment on his health and against the threat to his life. In a broader sense, the protection of employees' health included labor law norms and provisions regulating the obligations and principles of liability for non-compliance or labor law norms having a protective nature, e.g. protection of employment relationship duration, remuneration for work, setting a minimum working time or setting a minimum leave.

From the subjective perspective of labor protection, there were also two interpretations. Narrower treated labor protection as universal protection ensuring safety and health protection of all employees and broader treating labor protection as special protection for the work of women and young people (Kowalski, Krzyśków 2000).

In his studies, Szubert ordered the current knowledge and defined labor protection as a system of legal, economic, organizational and technical measures to provide employees with safety and health protection in the work process, the system treated as a set of ordered units forming the organizational whole serving a specific purpose (Szubert 1966).

In international law, provisions aimed at providing employees with safety and health protection at work have been separated from the general protection of labor and defined as safety and health protection provisions for employees. In Polish law this distinction is defined as health and safety regulations. Despite the convergence of the names used in international and Polish law, the term in Polish law refers to the subject of regulations and applies to work or working conditions, while in international law these provisions apply to the subject of work which is the employee (Kowalski, Krzyśków 2000).

The term "labor protection" has not been clearly defined in Polish labor law and in many cases the literature uses a mental shortcut in which labor protection concerns an employee and not the work he does. The same applies to the definition of occupational health and safety. This name appears in the Polish Labor Code, but is not legally defined.

At the end of the 1980s, a trend related to organizing safe working conditions appeared in Poland. These activities were given the name of security management (Ejdys et.al 2008).

METHODOLOGY

As part of the research work, secondary and primary research on work safety issues in the management of construction projects was carried out. Secondary research included a review of the literature on safety and health protection as well as organization and management in the basic directions of development in this field.

The first area of secondary research on occupational safety in the basic directions of the development of organization and management sciences was the technical current coinciding with the technical and physiological direction. One could distinguish the general direction related to accident and occupational diseases (Hoła 2001, 2003, 2004; Hinze et al. 2006; Nielsen 2007; Lopez et al. 2008; Annual reports of the State Labor Inspectorate of the Republic of Lithuania 2009; Mc Donald et al. 2009; Lovem et al. 2016). In the general direction, a traditional approach to work safety was used, in

which reports on accidents at work and information obtained from their analysis were used in preventive measures (Jorgnesen 2008, 2009). The experience gained in the analysis of individual cases was treated as a source of knowledge for use in future preventive actions (Korvers 2008).
The second area of research in the technical trend was the subject area related to construction processes and events that resulted in injuries (Abudayyeh et al. 2003; Hsio, Simeonov 2007; Stankiuviene 2008; Hallowell, Gambatese 2009; Enshassi et al. 2009; Perera 2009).
The third area of research in the technical trend was the law-normative direction, in which selected aspects of technical safety were analyzed to subsequently include them in the legal regulations or regulations of the audited enterprise (Hola 1999; Sawacha et al., 1999; Hinze and Gambatese, 2003; Hola, Sawicki 2005; Carter, Smith 2006; Lee, Halpin 2003; Laila, Anuar 2013).
In the organizational current three research directions were noted: administrative, systemic and procedural. In the administrative direction, the organization of work in the enterprise and the organization of work positions covering the scope of public matters as well as general regulations and legal norms regarding work in the construction industry were analyzed (Langford et al. 2000; Koehn et al. 2003; Lee, Halpin 2003; Chua, Goh 2004; Podgórski, Pawłowska 2004; Słomka 2005; Hernaus et al. 2008; Patrick et al., 2013; Mohammed 2002). Researchers focused on actions to reduce accident rates by introducing changes to the organization of workplaces regarding subjective safety.
In the systemic direction of the organizational trend, researchers treated objects related to work safety as open systems (sets, systems) connected into a whole, in which they distinguished those having a large impact on work safety in a given environment (Hale, Hale 1971; Brenner 1975; Studenski 1986, 1996; Pietrzak, 2002a, 200b; Arboleda and Abraham 2004; Hua, Goh 2004; Mitropoulos et al. 2005; Alinaitwe et al., 2009; Seoko, Sangwon 2013; Izatul et al. 2013; Bryan Lawson 2013). Researchers searching for the causes of accidents built models focused on areas where there were factors affecting human safety in the work environment.

In the procedural direction, the main goal of the research was to identify data and analyze the tasks and responsibilities of participants in the construction process in ensuring work safety in order to formulate new procedures that affect OSH.
In the human (human) trend, researchers focused on three main directions of OSH research: general, subjective and sociological. Researchers in the general field focused on issues related to labor protection and identification of sources and causes of accidents on the part of the contractor. These factors were associated with OSH behavior and interpersonal cooperation (Newcombe 1996; Abdelhaimd, Everett 2000; Toole, 2002; Huang, Hinze 2003, 2006; Enshassi et al. 2009).
Subject studies have mainly covered the subject of work (Sanvido et al. 1992); Haras-Ringdahl 1993; Sawacha et al. 1999; Rumaizah Mohd Nordin et al. 2013). Researchers focused on identifying factors that pose a threat to man in the work process. These factors were divided into dangerous, harmful and onerous (Obolewicz 2018).
The sociological direction of research concerned rules, processes and structures that influenced people's behavior and the process of their change. In this direction, in relation to occupational safety, two sectors can be distinguished: occupational safety culture (Studenski 1996; Mielczarek, Najmiec 2004; Hoła 2007; Babichenko, Babichenko 2008; Bryan Lawson 2013; Nik Mastura et al. 2013; Lingard 2013; Rakowska, 2013) and the climate of work safety (Diaz, Cambrera 1997; Mohamed 2002; Toole 2002; Huang, Hinze 2003, 2006; Jorgensen et al. 2007).
In 1986, it was discovered that the so-called safety culture has a large impact on safety and health at work. The term safety culture was first used in the Chernobyl disaster report (Summary report the past accident review meeting on the Cherbobyl Accident 1986). In the labor safety literature, the issues of safety culture have been treated from the beginning as components of organizational and social culture (Means, Flin 1999; Glendo, Stanton 2000; Guldenmund 2000; Rakowska 2013) and as a general collective activity combining individual protection of employees with collective protection of the entire environment work (Gherardi, Niccolini 2000; Obolewicz 2014a, 2014b, 2015).
In the years 1996–1997 studies in the United Kingdom were carried out which clearly showed the relationship between work safety culture and accident (Horbury, Bottomley 1997) and determined the impact of the human factor on the causes of accidents (Goszczyńska 1997).
Behavior analysis and shaping employee attitudes have become the key to achieving the required safety culture over time by following established rules, work procedures, the constant search for better solutions and striving to develop safe behavior in employees (Ejdys 2008). Increasingly, the influence

of security culture on behavioral patterns within the organization (Shaw, Blevitt 1996; Rakowska 2013) and the role of empetic communication (Brounstein 2001) and the impact of culture on behavioral safety initiatives (Stanley 2008) have been noticed.

Researchers noticed the relationship between culture and work safety in their considerations and searched for ways to measure S&HP culture (Liu et al. 2015). Based on the results of research over several decades in various industries, they assumed that the visible part (image) of safety culture is the safety climate. According to American researchers, the climate of safety was associated with the subjective perception of employees of various aspects of safety in workplaces (Wiegmann, Thaden 2001) and was a visible sign of the attitude of employees to issues of occupational safety in a given period and thus constituted a fragment of a safety culture treated as a set of basic beliefs and values of employees in relation to occupational safety and protection (Stankiewicz, Sznajder 2010).

Contemporary organizational culture research includes attitudes, values and norms of behavior common to all employees. Sociologists study social rules and processes that connect and divide people, create or are a manifestation of bonds between people and also influence the process of their change. This creates new research areas of culture related to the climate of security.

Zohar (Zohar 1980) described the safety climate as the first term. Since then, safety climate research has helped to improve the level of occupational safety in the organization (Cheyne et al. 1998) and provided the basis for identifying areas of occupational safety culture (Milczarek 2002) and creating models of excellence (Basu 2004; Sutton 2012; Jaeper 2014). There have been statements that safety improvement should cover all participants of a construction project (Jaeper 2014).

The most commonly used elements (issues) in assessing the organization's safety culture were: management involvement, OSH training, motivation, safety rules, accident records, control and communication system effectiveness, technical equipment (Flin et al. 2000). These issues were grouped into three groups: security at the strategic, tactical and operational level, which took into account the individual needs of employees (Grote, Kunzler 2000).

In modern literature, a comprehensive approach to occupational safety is increasingly being noticed (Koźlik 2008; Baryłka et al. 2019) and combining the content of research directions in technical, organizational and human trends, in which the issues of safety and health protection are recognized along with the use of the achievements of organizational and management sciences (Nevan 1995; Erling et al. 1995; Rajesh, Zabihollan 1996; Giretti et al. 2009; Idoro, 2008; Liaudanskiene et al. 2009; Turskis et al., 2009; Jimmie et al. 2013; Sabarinah et al., 2013; Grit Ngowtanasuwan, 2013; Millais 2017).

The comprehensive approach results mainly from the fact that there are no clearly defined provisions or guidelines that would regulate the measurement of work safety in an organization. There are no standards or quantitative reference points in this respect that an organization should meet. There are also no legal regulations regarding an acceptable level of occupational safety. Having a high level of security is information that the organization attaches great importance to issues related to the life and health of employees (Stankiewicz, Sznajder 2010, 2010b) and employees use the available knowledge in the area of management and create safe conditions for contractors and local communities by including them in internal regulations in the form of rules, certificates, conference papers, standards and national agreements that have a fundamental impact on maintaining safety during work (Baryłka 2019a, 2019b, 2019c).

The subject of the work required reliable information on the factors that generated threats, as they had a direct impact on S&HP during the implementation of construction projects. They were carried out on the basis of reports of the Central Statistical Office and reports of the Main Labor Inspector in Poland. The results of secondary research on occupational safety topics highlighted the high level of accident rates in the construction sector (Fig. 1,2) and the incorrect behavior of employees. The analysis of the causes of accidents according to the TOL(ang. TOH - Technical, Organizational, Human) classification of the period of 10 years allowed to identify the main causes of incorrect behavior of employees in which accidents occurred. These are usually:

- human causes (48%), including:
  - for incorrect employee behavior (60.8%), including:
    - surprise by an unexpected event (33.6%)
  - for incorrect independent behavior of an employee (22.6%), including:

- passing or passing places (31.3%)
  - not using protective equipment (9.4%), including:
    - employee not using personal protective equipment (60.3%),

— organizational reasons (40.0%), including:
  - improper general organization of work (84.2%),
    - lack of supervision (24.5%),
    - tolerance by those charged with governance of deviations (24.4%),

— improper organization of the workplace 15.8%), including:
    - no personal protective equipment (37.5%),
    - improper selection of personal protective equipment (35.6%),

— technical reasons (12%), including:
  - structural defects of the material factor being the source of the danger (90.0%),
    - lack or inappropriate safety devices (57.2%).

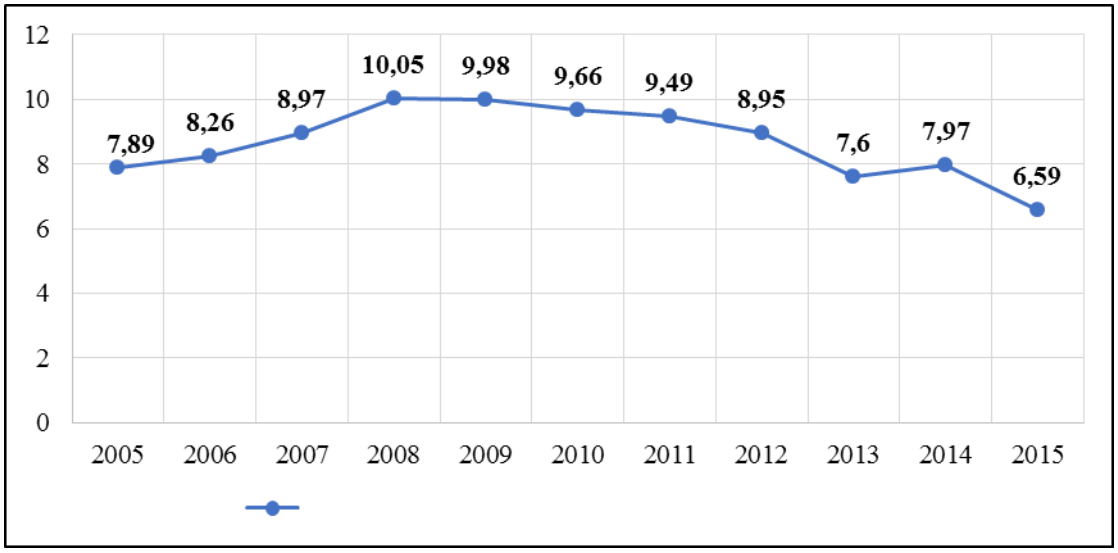

Fig.1. Share of the construction sector in accidents at work in 2005-2015;
source: own study

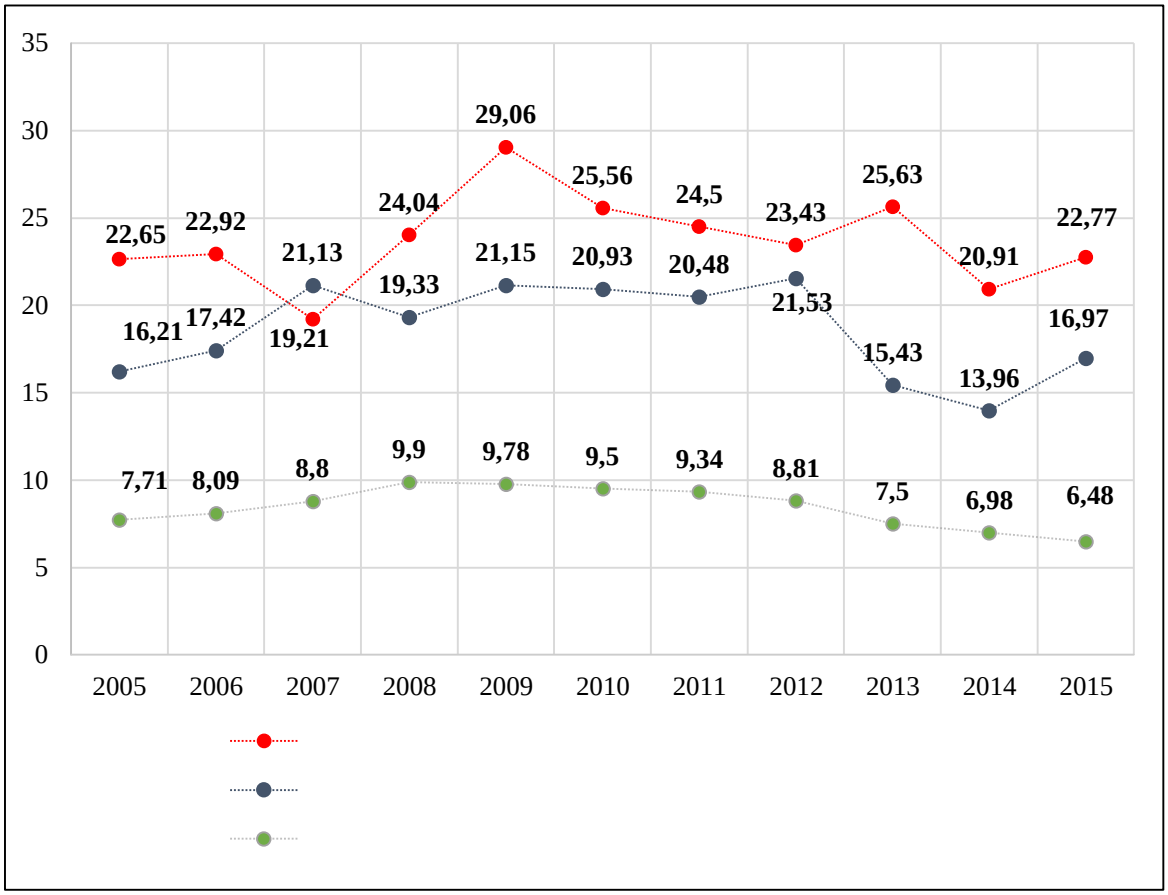

Fig.2. Share of the construction sector in fatal, heavy and light accidents at work in Poland in 2005-2015; source: own study

Secondary research and the assignment of the issues of safety and health protection to the basic directions of organization and management development have confirmed the correlation between the issues of safety and health protection at work with the issues of organization and management, and outlined a new comprehensive approach to occupational safety, which should take into account employee behavior. Secondary research provided information on the need to conduct research on primary risk factors that have a direct impact on safety and health protection during the implementation of construction projects.

Primary research was carried out during the implementation of two projects: the BALTIC SEA TRADE UNION NETWORK project (2004-2006) and the Ministry of Science Grant N N 11534703 (2010-2013).

The European Union project Baltic Sea Trade Union Network on Health and Safety was implemented in 2004-2006 and provided information on the safety and health protection of employees of the construction, forestry and wood industry sectors at the national levels of Poland, Lithuania, Latvia and Estonia. The research was carried out by European trade union organizations: Northern Federation of the Wood Industry and Workers (NFBWW), Danish Trade Union (SID), Estonian Union of the Wood Industry Workers (EMT), Latvian Trade Union of Construction (LCA), Trade Union of the Forestry Industry in Lithuania (LMNA) , The Federation of Woodworking Workers in Lithuania (TARYBA), the Lithuanian Union of Construction Workers (LSPS), NSZZ Solidarność Budownictwa i Timood Industry (NSZZ Solidarność), the Association of Polish Foresters in Rzeczpospolita (ZPL in Poland) and the Trade Union of Construction Workers (ZZ Budowlani).

At national levels, trade union representatives collected regional information on safety and health protection, which was presented at 28 national and international seminars and conferences held in individual countries (Obolewicz, 2005).

In Poland, research on the issues of occupational safety and health protection was conducted among 330 respondents, using a questionnaire.

As part of the project N N115 34703 on Identification of the state of safety and health protection in Polish construction companies after joining the EU and designing a biose management model that meets European quality criteria, environmental protection, ergonomics and occupational protection (2010-2013), the issues of occupational safety research continued and health protection in construction at the national level. First, secondary research was conducted, based on which the knowledge of legal, normative, social, ethical and economic conditions necessary to build a research tool for primary research was systematized. Updating the state of knowledge and legal regulations as well as consultations with representatives of selected construction companies allowed for the development of an appropriate research tool and conducting basic research on the subject of S&HP subjectivity. The real "picture" of the state of safety and health protection obtained in this way was used to build a S&HP model that meets the criteria of quality, environmental protection, ergonomics and occupational protection (Obolewicz 2018).

RESULTS AND DISCUSSIONS

The analysis of test results required the definition of a construction project model. The proposed process model consisted of four stages and nine phases. The analysis of test results required the definition of a construction project model. The proposed process model consisted of four stages and nine phases and included:

- Area A- construction investment process (virtual):
  - stage I. Preparation of the construction project for execution, which included three phases: pre-design, design, preparatory,
  - stage II - Implementation of a construction project, which included stage 1 of construction preparation and construction works,
- Area B - operational investment process (real):
  - III Stage III - Use (operation) of the building, which included two phases: preparation for use and use of the building,
  - Stage IV - Liquidation of the building structure, which included three phases: building diagnostics, demolition or modernization, and completion of the investment (project).

The RADAR research tool was proposed to identify factors affecting the safe behavior of employees during the construction process. This tool consisted of two parts: the safety and health protection platform (S&HP platform), which is the starting point for the next stage of the procedure and the culture of occupational safety and health protection (S&HP culture). The first part of RADAR is the visible part, in which the S&HP platform was treated as a reference level for the analyzed state of the building process. The purpose of the S&HP platform survey is to identify health and safety regulations, principles and assumptions arising from a specific law and principles regarding a given stage of the process. The second part of RADAR is the invisible part, in which hidden behaviors (manifestations (perception) called S&HP culture should be investigated. The purpose of the second part is to obtain information on the behavior and behavior of employees regarding motivating safe behaviors of cooperation between employees, communication, participation, OSH education or accident analysis (Obolewicz 2018).

Summary of the results of tests carried out with the help of the RADAR tool on an individual basis for each construction project.

CONCLUSIONS

Analysis of the results of secondary tests enabled the preparation of the subjective characteristics of occupational safety and health protection of construction projects.
Incorrect employee behavior was a major cause of construction accidents. Employees who have had accidents have participated in events that are a deviation from their normal state due to slipping, tripping or falling due to impact on a stationary object or object while moving or operating a trowel object, hand tools and during manual transport. Injuries suffered by the injured employee were most often surface wounds, injuries, fractures, dislocations and dislocations of the upper and lower limbs and head.
Precise determination of the causes of accidents gave the starting base (repository) to determine the factors affecting work safety at a selected stage of the investment process. The analysis of the causes of accidents according to the TOL classification over a 10-year period showed that the main causes causing accidents at work are human and organizational reasons.
Analysis of the results of primary tests as part of the international Baltic Sea Trade Union Network on Health and Safety project (2004-2006) showed a wide diversity of knowledge regarding the behavior of employees in the field of S&HP in construction in the economic, cultural and organizational context. In all countries participating in the project (Lithuania, Latvia, Estonia and Poland) attention was drawn to the subjective aspect of S&HP and to the special importance of social dialogue in the area of occupational safety.
Analysis of research results of the project N N115 34703 on Identification of the state of safety and health protection in Polish construction companies after joining the EU and designing a model for managing bioses that meets European quality criteria, environmental protection, ergonomics and occupational protection (2010-2013) confirmed the importance of S&HP subjectivity in construction projects and the impact of employee behavior on work safety at the stage of the construction process. The perception of S&HP of all participants in the process and the behavior of employees are conditioned by knowledge of current regulations and rules regarding occupational safety and health protection in construction.
General conclusions:

- a new scientific discipline of safety science is being formulated in Poland, which requires ordering and locating the place of safety and health protection at work,
- the current methodology of S&HP research in construction is used primarily for the stage of construction works based on accident statistics; a deeper analysis of this guessing is recommended throughout the entire lifecycle of a construction project,
- there is a lack of a comprehensive approach to designing and maintaining / raising the level of S&HP during the construction project implementation process.

BIBLIOGRAPHY

1) Abdelhamid, T.S.; Everett J.G.2000. *Identifying root causes of construction accidents, Journal of Construction Engineering and Management*, p. 52-60,
2) Abudayyeh, O.; Federicks, T., Palmquist M., Torres H. 2003. *Analysis of occupational Injuries and Fatalities in Electrical Contracting Industry, Journal of Construction Engineering and management*, ASCE March-April/ 2003, p.152-158,
3) Baryłka A., *The impact of fire on changing the strngth of the underground shelter structure*. Rynek Energii nr 1(146), 2020 (str. 71-75),
4) Baryłka A., *Obiekty budowlane jako przedmioty procesu budowlanego (inwestycyjnego i eksploatacyjnego)*. Inżynieria Bezpieczeństwa Obiektów Antropogenicznych nr 1-2, 2019,

5) Baryłka A., *Zagadnienie zdatności obiektu budowlanego do użytkowania w problemach inżynierii bezpieczeństwa tych obiektów*, w: Inżynieria Bezpieczeństwa Obiektów Antropogenicznych nr 4 (2019), wyd. Centrum Rzeczoznawstwa Budowlanego, Warszawa,
6) Ejdys, J.; Lulewicz, A.; Obolewicz, J. 2008. *Zarządzanie bezpieczeństwem w przedsiębiorstwie*, Wydawnictwo Politechniki Białostockiej, Białystok 2008, s. 287,
7) Enshassi, A.; Mohamed, S.; Mustafa, Z.A.; Mayer, P.E. 2009. *Factors affecting the performance of construction projects in the Gaza strip*, Journal of Civil Engineering and Management, 15/3, p. 269–280,
8) Erling, S.; Andersen, Kristofer V Grude; Terry Gibbons 1995. *Goal Directed Project Management*, p. 244,
9) Filipkowski, S., *Powstawanie wypadków przy pracy i zasady profilaktyki*, wyd. IWZZ, 1975, Warszawa,
10) Flin, R.; Mearns P.; O'Connor P.; Bryden R. 2000. *Measuring Safety Climate: identifying the common teatures*, Safety Science, vol. 34 no1-3
11) Gherardi, S.; Niccolini, D. 2000. *The organizational learning at safety in comunities of pracive, Journal at Management Inquary*, vol. 9 no,
12) Giretti, A.; Carbonari, A.; Naticchia, B.; De Grassi, M. 2009. *Design and first development of an automated real-time safety management system for construction sites*. Journal of Civil Engineering and Management 15(4) p. 325–336,
13) Glendo, A. I. Stanton, N.A. 2000. *Perspetives of safety culture*, Safety Science, vo. 34 no 1-3,
14) Goszczyńska, M. 1997. *Człowiek wobec zagrożeń. Psychospołeczne uwarunkowania oceny i akceptacji ryzyka*, wyd. Żak, Warszawa,
15) Grit Ngowtanasuwan 2013. *Mathematical Model Optimization of Construction Conctracting in Housing Developing Project*, Procedia – Social and Behavioral Sciences 105/2013, p. 94-105,
16) Grote, G.; Kunzler, C. 2000. *Diagnosis of Safety Culture in Safety Management Audits, Safety Science*, vol. 34 no1-3,
17) Guldenmund, F. 2000. *The nature of safety culture: a review of theory and research*, Safety Science 2000 vol.34, no1-3,
18) Hale, A.R.; Hale M. 1971. *A review of industrial accident research*. Her majestys safety office, London,
19) Hallowell, M.R.; Gambatese, J.A. 2009. Construction safety risk mitigation.
20) Haras-Ringdahl L. 1993. Safety analysis. Principles and Practice in occupational safety, Elsevier
21) Hernaus, T.; Skerlavaj, M.; Dimovski V. 2008. Relationship between organisational learning and organisational performance.The case of Croatia. Transformations in Business & Economics, 7/2/14)) p.32–48
22) Hinze, J.; Davenport, J.; Giang, G. 2006. *Analis of construction worker, Injuries That do not result in lost time*, Journal of Construction Engineering and management, ASCE, p.321-326,
23) Hoła, B. 2003. *Analiza sytuacji wypadkowej w polskim budownictwie*, Przegląd budowlany 10/2003, s.45-48,
24) Kowalski, J.; Krzyśków B. 2000. *Procesy pracy, pojęcia podstawowe, geneza idei ochrony pracy*, Nauka o pracy – bezpieczeństwo, higiena, ergonomia, red. naukowa D. Koradecka, Wyd. Centralny Instytut Ochrony Pracy, Warszawa, s.13,
25) Obolewicz, J. 2005, 2006. Raport Projektu badawczego cz.1 cz.2 " *Doskonalenie możliwości związków zawodowych w zakresie bhp w sektorach budownictwa, przemysłu drzewnego oraz leśnictwa w Estonii, Łotwie, Litwie i Polsce*", Politechnika Białostocka, Białystok,

26) Obolewicz, J. 2012a. *Bezpieczeństwo pracy w budownictwie*, Wyd. Unimedia, s.254
27) Obolewicz, J. 2012b. *Koncepcja zarządzania bezpieczeństwem i ochroną zdrowia w budownictwie* [rozdz. w:] Bezpieczeństwo systemu. Techniczne organizacyjne i ludzkie determinanty bezpieczeństwa pracy, monografia / red. nauk. Szymon Salamon, Politechnika Częstochowska, Wydział Zarządzania, s. 291-306,
28) Obolewicz, J. 2014a. *Kultura bezpieczeństwa pracy i ochrony z*drowia, Praca i Zdrowie, nr 6-7(2014b), s. 9-14,
29) Obolewicz, J. 2014b. *Klimat BIOZ budowy*, cz. 2, Praca i Zdrowie, nr 9 (2014c), s. 8-12],
30) Obolewicz J. 2015. *Bezpieczeństwo i ochrona zdrowia w budowlanym procesie inwestycyjnym*: [rozdz. w:] Bezpieczeństwo pracy w budownictwie / Ewa Błazik-Borowa, Krzysztof Czarnocki, Andrzej Dąbrowski, Bożena Hoła, Andrzej Misztela, Jerzy Obolewicz, Jolanta Walusiak-Skorupa, Anna Smolarz, Jacek Szer, Mariusz Szóstak, Politechnika Lubelska. Wydział Budownictwa i Architektury, s. 51-60,
31) Obolewicz, J. 2018. *Demoskopia bezpieczeństwa pracy i ochrony zdrowia przedsięwzięć budowlanych*, Oficyna Wydawnicza Politechniki Białostockiej, Białystok, s.184,
32) Owczarek M., Baryłka A., *Estimation of thermal diffusivity of building elements based on temperature measurement for periodically changing boundary conditions*. Rynek Energii nr 5(144), 2019 (str. 55-59).
33) Owczarek M., Baryłka A., *Determining the thermal diffusivity of the material based on the measurement of the temperature profile in the wall*. Rynek Energii nr 4(143), 2019 (str. 76-79).