

Project of Occupational Safety and Health Management Comparison in Atlas Copco

Bc. Tereza Kalvodová

Master's thesis
2022

 Tomas Bata University in Zlín
Faculty of Logistics and Crisis Management

Univerzita Tomáše Bati ve Zlíně
Fakulta logistiky a krizového řízení
Ústav krizového řízení

Akademický rok: 2021/2022

ZADÁNÍ DIPLOMOVÉ PRÁCE

(projektu, uměleckého díla, uměleckého výkonu)

Jméno a příjmení:	Bc. Tereza Kalvodová
Osobní číslo:	L20130
Studijní program:	N1032A020002 Bezpečnost společnosti
Specializace:	Rizikové inženýrství
Forma studia:	Kombinovaná
Téma práce:	Projekt komparace řízení bezpečnosti a ochrany zdraví při práci ve společnosti Atlas Copco

Zásady pro vypracování

1. Na základě dostupné literatury zpracujte teoretická východiska diplomové práce.
 2. Analyzujte současný stav bezpečnosti a ochrany zdraví při práci na obou komparovaných pracovištích.
 3. Na základě výsledků analýzy vytvořte projekt komparace Bezpečnosti a ochrany zdraví při práci ve společnostech.
 4. Vámi navržený projekt zhodnoťte z hlediska jeho implementace do praxe.
-

Forma zpracování diplomové práce: **tištěná/elektronická**
Jazyk zpracování: **Angličtina**

Seznam doporučené literatury:

1. NEUGEBAUER, Tomáš. *Školení bezpečnosti práce, požární ochrany a motivační školení k prevenci rizik*. Praha: Wolters Kluwer ČR, 2018. ISBN 978-80-7552-957-2.
2. REESE, Charles D. *Occupational Safety and Health: Fundamental Principles and Philosophies*. Boca Raton: CRC Press, Taylor & Francis Group, 2017. ISBN 978-1-138-03505-8.
3. VALA, Jiří. *Systémové řízení bezpečnosti a ochrany zdraví v organizacích*. Praha: Wolters Kluwer, 2016. ISBN 978-80-7552-110-1.

Další odborná literatura dle doporučení vedoucího diplomové práce.

Vedoucí diplomové práce: **Ing. Eva Hoke, Ph.D.**
Ústav krizového řízení

Datum zadání diplomové práce: **1. prosince 2021**

Termín odevzdání diplomové práce: **6. května 2022**

L.S.

doc. Ing. Zuzana Tučková, Ph.D.
děkanka

Ing. et Ing. Jiří Konečný, Ph.D.
ředitel ústavu

V Uherském Hradišti dne 1. prosince 2021

PROHLÁŠENÍ AUTORA DIPLOMOVÉ PRÁCE

Beru na vědomí, že:

- diplomová práce bude uložena v elektronické podobě v univerzitním informačním systému a dostupná k nahlédnutí;
- na moji diplomovou práci se plně vztahuje zákon č. 121/2000 Sb. o právu autorském, o právech souvisejících s právem autorským a o změně některých zákonů (autorský zákon) ve znění pozdějších právních předpisů, zejm. § 35 odst. 3;
- podle § 60 odst. 1 autorského zákona má Univerzita Tomáše Bati ve Zlíně právo na uzavření licenční smlouvy o užití školního díla v rozsahu § 12 odst. 4 autorského zákona;
- podle § 60 odst. 2 a 3 autorského zákona mohu užít své dílo – diplomovou práci nebo poskytnout licenci k jejímu využití jen s předchozím písemným souhlasem Univerzity Tomáše Bati ve Zlíně, která je oprávněna v takovém případě ode mne požadovat přiměřený příspěvek na úhradu nákladů, které byly Univerzitou Tomáše Bati ve Zlíně na vytvoření díla vynaloženy (až do jejich skutečné výše);
- pokud bylo k vypracování diplomové práce využito softwaru poskytnutého Univerzitou Tomáše Bati ve Zlíně nebo jinými subjekty pouze ke studijním a výzkumným účelům (tj. k nekomerčnímu využití), nelze výsledky diplomové práce využít ke komerčním účelům;
- pokud je výstupem diplomové práce jakýkoliv softwarový produkt, považují se za součást práce rovněž i zdrojové kódy, popř. soubory, ze kterých se projekt skládá. Neodevzdání této součásti může být důvodem k neobhájení práce.

Prohlašuji,

- že jsem diplomové práci pracoval samostatně a použitou literaturu jsem citoval. V případě publikace výsledků budu uveden jako spoluautor.
- že odevzdaná verze diplomové práce a verze elektronická nahraná do IS/STAG jsou obsahově totožné.

V Uherském Hradišti, dne: 05.05.2022

Jméno a příjmení studenta: Bc. Tereza Kalvodová

.....
podpis studenta

ABSTRAKT

Tato diplomová práce se zabývá komparací dvou poboček společnosti Atlas Copco z pohledu systému řízení v oblasti bezpečnosti a ochrany zdraví při práci. Diplomová práce je rozdělena na tři části, v první části byla zpracována literární rešerše na dané téma, obsahující historii bezpečnosti a ochrany zdraví při práci, legislativu v Evropské Unii, České republice a Belgii, stejně tak jednotlivé orgány v této oblasti. Teoretická část se zabývá také aktuálními tématy v oblasti bezpečnosti a ochrany zdraví při práci, jako je například pohoda na pracovišti či Covid-19.

Druhou část tvoří představení společnosti Atlas Copco a dvou vybraných poboček pro finální komparaci – v Brně, a v belgických Antverpách. Obě pobočky fungují jako servisní a distribuční centra. U každé z nich je nejdříve přiblížen systém směrnic v oblasti bezpečnosti a ochrany zdraví při práci, následně provedena analýza rizik metodou SIPOC a PNH, a nakonec jsou zpracovány statistiky pracovních úrazů za rok 2020 a 2021.

Komparace systému řízení v oblasti bezpečnosti a ochrany zdraví při práci proběhla v oblastech dokumentace, zpracované analýzy rizik, pracovních úrazů a sestavené bezpečnostní pyramidy. Na základě výsledků komparace bylo navrženo možné zlepšení pro obě pobočky. Poslední část této diplomové práce tvoří implementace navržených zlepšení do praxe.

Klíčová slova: Bezpečnost a ochrana zdraví při práci, BOZP, Analýza rizik, Zaměstnavatel, Zaměstnanec, Komparace, Well-being

ABSTRACT

This Master's thesis focuses on the occupational safety and health management system comparison of two branches of Atlas Copco. This thesis is divided into three parts. In the first part, a literature search was prepared on occupational safety and health. This includes a brief history, legislation of the European Union, the Czech Republic, and Belgium, and its institutions in this area. The theoretical part also covers current topics in the field of safety and health at work, such as well-being or Covid-19.

The second part consists of an introduction of Atlas Copco and two selected branches for the final comparison - in Brno and Belgian Antwerp. Both branches operate as service and distribution centers. For each of them, the system of directives in occupational health and safety is mentioned, followed by a risk analysis using the SIPOC and LCO methods, and finally, statistics on work accidents for 2020 and 2021 are compiled.

To compare the management system, documentation, risk analysis, and the statistics, including the safety pyramid, were used. Based on the results of the comparison, possible improvements were proposed for both branches. The last part of this thesis is the implementation of the proposed improvements in practice.

Keywords: Occupational health and safety, OSH, Risk analysis, Employer, Employee, Comparison, Well-being

I would first like to thank all the employees of Atlas Copco who contributed to this master's thesis, especially Sofie for all her help and support. I would also like to thank my thesis advisor Ing. Eva Hoke, Ph.D. for all the support and comments while writing this thesis. Finally, I would love to express my gratitude to my parents, the closest friends, and to my amazing partner, for providing me with all the support and encouragement throughout my study, and especially during the process of writing this thesis. I would not be able to accomplish this without you. Thank you.

“In every ending there is a new beginning.”

— Deborah Harkness

I hereby declare that the print version of my master's thesis and the electronic version of my thesis deposited in the IS/STAG system are identical.

CONTENTS

INTRODUCTION	11
OBJECTIVES AND METHODOLOGY	12
I THEORY.....	13
1 OCCUPATIONAL HEALTH AND SAFETY.....	14
1.1 DEFINITION AND AIM OF OSH	14
1.2 HISTORY OF OSH.....	15
1.3 LEGISLATION AND OSH INSTITUTIONS.....	16
1.3.1 EU legislation.....	16
1.3.2 OSH institutions in the EU.....	18
1.3.3 EU Strategic Framework on Health and Safety at Work 2021-2027.....	19
1.3.4 CZ legislation.....	21
1.3.5 OSH institutions in the Czech Republic.....	22
1.3.6 Belgian legislation.....	23
1.3.7 OSH institutions in Belgium	24
1.4 EMPLOYER'S OBLIGATIONS	25
1.5 EMPLOYEES' RIGHTS AND OBLIGATIONS	25
1.6 OSH TRAINING.....	27
1.6.1 Training on OSH legislation	27
1.6.2 Familiarization with risks and applied measures	27
1.6.3 Professional trainings	27
1.7 CURRENT TOPICS IN OSH.....	27
1.8 OSH AND COVID-19.....	27
1.9 EUROPEAN WORKING CONDITIONS SURVEY	29
1.10 WELL-BEING	30
1.11 STATISTICS OF WORK ACCIDENTS IN THE CZECH REPUBLIC	31
2 OSH MANAGEMENT SYSTEMS IN THE ORGANIZATION.....	34
2.1 ISO 45001:2018.....	35
2.2 SAFE ENTERPRISE.....	35
2.3 METHODS OF RISK ANALYSIS IN OSH.....	36
CONCLUSION OF THE THEORETICAL PART.....	38
II ANALYSIS.....	39
3 INTRODUCTION OF THE COMPANY	40
3.1 COMPANY CHARACTERISTICS	40
3.2 COMPANY HISTORY	41
3.3 EVALUATION OF THE YEAR 2021 IN THE COMPANY	43
3.4 CHARACTERISTICS OF SELECTED BRANCHES	45

4	OSH MANAGEMENT - BRNO	46
4.1	BASIC INFORMATION	46
4.2	OSH DOCUMENTATION	50
4.2.1	Training	51
4.2.2	Risk assessment.....	52
4.2.3	Communication	52
4.3	RISK ANALYSIS.....	53
4.3.1	SIPOC	53
4.3.2	LCO method.....	55
4.4	WORK ACCIDENTS	61
4.4.1	Risk observations	61
4.4.2	Near misses	63
4.4.3	First aid.....	63
4.4.4	Safety pyramid	64
4.5	SUMMARY – BRNO	65
5	OSH MANAGEMENT ANTWERP	66
5.1	BASIC INFORMATION	66
5.2	OSH DOCUMENTATION	67
5.2.1	Employer, Employees	67
5.2.2	Responsibilities	68
5.2.3	Analysis of health and safety aspects.....	68
5.2.4	Objective	68
5.2.5	Communication	68
5.2.6	Well-being.....	69
5.2.7	Last Minute Risk Assessment	69
5.3	RISK ANALYSIS.....	71
5.3.1	SIPOC	71
5.3.2	LCO method.....	73
5.4	WORK ACCIDENTS	79
5.4.1	Risk observations	80
5.4.2	Near-misses	81
5.4.3	Minor injuries.....	82
5.4.4	Lost time injuries.....	83
5.4.5	Other recordable injuries.....	84
5.4.6	Safety pyramid	85
5.5	SUMMARY - ANTWERP	86
6	PROJECT OF OCCUPATIONAL SAFETY AND HEALTH MANAGEMENT COMPARISON IN ATLAS COPCO.....	88
6.1	A PROJECT OBJECTIVE	88
6.2	DATA COLLECTION METHODS.....	88
6.3	BENCHMARKING OF OSH MANAGEMENT	89

6.3.1	Comparison - OSH documentation	89
6.3.2	Comparison – risk analysis	90
6.3.3	Comparison – work accidents	92
6.3.4	Suggested improvements	95
6.4	PROPOSAL OF THE DIRECTIVE ON WELL-BEING	97
6.5	PROPOSAL OF THE SHAREPOINT ADJUSTMENT	99
6.6	PROJECT NR. 2022003 - EXTENDED TRAINING FOR EMPLOYEES	100
6.6.1	The objective and characteristics of the project	100
6.6.2	Stakeholders	100
6.6.3	Project lead time.....	101
6.6.4	Work Breakdown Structure – WBS.....	101
6.6.5	Gantt diagram.....	103
6.6.6	Project costs	103
6.6.7	The evaluation of the project.....	105
	CONCLUSION	106
	BIBLIOGRAPHY.....	108
	LIST OF ABBREVIATIONS	113
	LIST OF FIGURES.....	114
	LIST OF TABLES	116

INTRODUCTION

Health and safety at work affect almost every one of us. Occupational safety and health should be a priority because our health is our most valuable asset. Health and safety should not only be a legislative obligation for employers. The employer should protect his employees so that they feel safe at work and there are no work accidents that could lead to loss of lives. An employee who feels satisfied and safe in his work is a long-term benefit for the company.

The topic for this master's thesis because occupation safety, and health are always current topics. Moreover, with the digitization, modernization, or other situations, such as the Covid-19 pandemic, occupational safety and health need to be answered. Therefore, the main idea of this thesis is to compare the management in Atlas Copco. Specifically in Antwerp and the branch in Brno, and to find out how both branches manage health and safety and suggest a possible improvement in the occupational health and safety area.

The theoretical part will focus on the basic information about occupational safety and health, including the brief history, the legislation in the European Union, the Czech Republic, and Belgium, including the occupational health and safety institutions in all three areas. Further, the fundamental rights and obligations of the employer and employee, occupational health and safety training, and current health and safety topics.

The analysis part will first focus on analyzing the current system of both branches in terms of occupational health and safety management systems. Then, the focus will be on comparing the directives, risk assessment of the immediate Pick-to-Ship process, and finally, the statistics of work accidents for 2020 and 2021.

Based on the above criteria, both branches will be benchmarked in the Project of Occupational Safety and Health Management Comparison in Atlas Copco, and possible improvements will be proposed. The last part of this thesis is devoted to implementing these proposals in practice.

OBJECTIVES AND METHODOLOGY

The main objective of this master's thesis is to create a project of occupational safety and health management comparison in Atlas Copco. Two branches of Atlas Copco company compared – one in Brno, Czech Republic, and the second one in Antwerp, Belgium.

This thesis is into two parts – the first one is the theoretical part, and the second one is the analysis part. The main goal of the theoretical part is theoretical research based on Czech and foreign professionals, scholarly literature, and other related sources. The analysis part follows the theoretical part. The analysis part aims to analyze the status of OSH management in both selected branches. The critical method for the analysis is SIPOC, also known as the method of a turtle diagram. In SIPOC, the “Pick – to – ship” process will be analyzed, one of the main processes in both selected branches. The output of this method will be the list of activities that pose a risk for employees. Those risk activities will then be rated with the PNH method, and the output will be risk acceptability. The following tool for the comparison is the statistic of reported incidents and accidents in 2020 and 2021. Based on these statistics, a safety pyramid will be built, also used for the final comparison. For data collection, brainstorming, observations, and interviews were used.

Based on this analysis part, the project of OSH management comparison is created. A possible rectification solution will be proposed and implemented in business practice for any negative findings from this comparison.

I. THEORY

1 OCCUPATIONAL HEALTH AND SAFETY

Occupational health and safety (in the future referred to as OSH) should be a priority for us, whether we are employees, employers, or entrepreneurs. We should always protect our health. After all, our health is our most valuable asset. It is essential to constantly evaluate the system of OSH at work with the changing situation – new technologies, new production processes, pandemic Covid-19, etc. No matter where or how we work, health protection and safety at work should always be first.

1.1 Definition and aim of OSH

The official definition of OSH does not exist so far and therefore every source may have its own definition, often adapted to the related area (safety on the construction site, safety at the office etc.). (Janáková, 2018, p. 25) defines OSH as *“Safety at work is an interdisciplinary field that studies technical, technological, organizational, educational, and other measures. The aim is to create such a workspace where the work accidents will be limited to a minimum.”*

Portal BOZP.cz (BOZP a PO, 2021) defines OSH as *“an interdisciplinary field, which is also possible to define as rules laid down by the legislation or measures, whose main task is to prevent danger and health damage while working.”*

No matter how many definitions are there, the core of all of them is the same and it is to ensure a safe working environment and minimize accidents at work and loss of life at the workplace. (Janáková, 2018, p. 25)

There are many reasons to keep a workplace safe. One of the reasons is legislation, which orders employers to provide a safe workplace for employees. However, this should not be the only reason for the employer to care about the OSH. A well-functioning OSH management system leads to a safe work environment, which leads to satisfied and motivated employees, and it increases the quality and reputation of the company. An effective system of OSH in the company could also motivate potential applicants to join the company. Another reason could be the cost of each work accident. Because with each work accident, the cost increases (sick leave cost, compensations for employees, legal cost, property damage, loss of profit etc.). It also does not need to be only about money. The loss of a good employee means a loss of knowledge for the company. Also, each work accident decreases the good name of the company on the market. This also requires a time investment

– to investigate the work accident, to provide first aid for the injured employee, overtime for the employees to cover the work of the injured employee, and very importantly, employees' motivation to work decreases with each accident. (Ferrett, 2016, p. 14-15)

1.2 History of OSH

The first mention of OSH comes from the 18th century BC to the King of Babylon, Hammurabi. Hammurabi issued the code of Hammurabi, which should have protected the safety of the workers. The most famous code of law was “*Eye for eye, tooth for tooth*”, but another related one to OSH was:

- § 197 – “*If he breaks another man's bone, they shall break his bone.*”
- § 229 – “*If a builder builds a house for a man and does not make its construction sound, and the house which he has built collapses and causes the death of the owner of the house, the builder shall be put to death.*” (Historie bezpečnosti a ochrany zdraví při práci, 2014)

In 1786, a court decree was issued setting out the occupational hygiene requirements for children – a separate accommodation for boys and girls, one bed for each child, once a week, the children could wash and brush their hair, and every eight days, they could get clean clothes). From 1802 also, other countries started to regulate conditions for children. For example, England limited working hours for disciples to 12 hours a day. In 1993, England banned work for children younger than nine years in the textile industry; for older children, the working hours were limited, and in 1842, England banned work for children younger than ten years and women in the mines. In the same year, France banned work for children younger than eight years. (Neugebauer, 2016).

After 1811, the basic principles were set for the Czech countries. Those principles included the obligations of the employer to protect employees' lives and health. The public Act No. 259/1859 Coll. ordered the employer to set up the machinery and equipment to not endanger their health and safety. This law was amended in 1913. The business owner had to follow all the occupational health requirements by the new obligations. (Historie bezpečnosti a ochrany zdraví při práci, 2014).

After World War II, the emphasis was on workers' productivity. Demands for quality products were increasing, and companies started to realize that only by ensuring the occupational safety and reliability of the production the high quality of the product could be

achieved. In 1948, the UN proclaimed the Universal Declaration of Human Rights, which included the right to fair and satisfying working conditions. (Neugebauer, 2016)

In 1951, a new OSH law was issued, which imposed supervision of the observance of OSH by the trade union. This law was replaced in 1961 by Act No. 65/1961 Coll. on occupational safety and health protection. (Historie bezpečnosti a ochrany zdraví při práci, 2014).

In 1989, Council Directive 89/391/EEC introduced measures to encourage improvements in the safety and health of workers at work. This directive became the basis for OSH in the European Community. In the mid-1990s, the European Agency for Safety and Health at Work (OSHA) was established. OSHA was based in Bilbao, and its main task was to collect and analyze information leading to improving OSH conditions. (European Agency for Safety and Health at Work, EU-OSHA).

A fundamental change began in 2001 when the Czech Republic needed to align the European Union legislation (in the future referred to as the EU). Risk identification, risk assessment, and prevention started to play a significant role in the OSH system and included employees in the OSH system. (Neugebauer, 2016)

1.3 Legislation and OSH institutions

For the analysis part of this thesis, this chapter is divided into three parts, the EU legislation, the Czech Republic legislation, and the Belgium legislation system. Of course, as both countries are part of the EU, their legislation system is aligned with the EU one. However, I also find it important to mention the individual laws of both countries for later comparison.

1.3.1 EU legislation

The first OSH directives were established with market harmonization. Until the mid-1980s, no legislation power was introduced in the OSH area. A big step forward was the introduction of the Single European Act of 1987. A new legal provision regarding social policy was introduced to improve the working environment for employees in the OSH area. (European Directive on Safety and Health at Work, 2021)

A key document in improving OSH in the EU was the European Framework Directive on Safety and Health at Work No. 89/391/EEC in 1989. It guarantees minimum OSH requirements throughout Europe, and the EU Member States can accept the requirements as mentioned in this directive or even with more stringent measures. (Evropské směrnice o

bezpečnosti a ochraně zdraví při práci, 2021). This directive defines the employer's and employee's obligations and other provisions regarding health surveillance, risk groups, or committees. The main principles for prevention include risk prevention, risk assessment and treatment, adaptation to technological progress, and prioritization of collective protection measures over individual protection. (EU, 1989). Based on this directive, every employer has to do a risk assessment and create a safe working environment for the employees. Furthermore, all employers have to implement measures that improve the level of protection provided to their employees, consult this with employees, and introduce them to the new technologies in the company. Other employers' obligations include the measures for fire prevention, evacuation of the employees, first aid, and other serious hazards. In addition, they must keep the OSH documentation (e.g., a list of occupational accidents).

This Directive obliges employees to follow the right procedure for using the machinery, tools, dangerous substances, vehicles, and other personal protective equipment (PPE). All employees must immediately inform the employer in case of any hazardous conditions or defects in the PPE kits and seek employers to meet all the OSH requirements. (EU, 1989)

Another important document of the EU in the OSH area is the European Council Framework Directive 91/383/EEC which supplements measures improving safety and health for workers with a fixed-duration employment relationship or a temporary duration of employment. This directive has been issued with increasing application of these employment contracts. These employees face the hazard situations and occupational diseases more than the employees with a permanent contract. The Directive covers the employers' obligation to inform their employees about the hazardous situations and possible risks at the workplace and to provide the training appropriate to the employee's job position. Last but not least, this Directive also orders the employer to provide a medical supervision or protection and prevention services. (EU, 1991)

There are even more directives focusing on various areas of OSH in the EU legal system, e.g.:

- *Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work (fourteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC)*

- *Council Directive 89/654/EEC of 30 November 1989 concerning the minimum safety and health requirements for the workplace (first individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC)*
- *Directive 2001/45/EC of the European Parliament and of the Council of 27 June 2001 amending Council Directive 89/655/EEC concerning the minimum safety and health requirements for the use of work equipment by workers at work (second individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC)*
- *Council Directive 89/656/EEC of 30 November 1989 on the minimum health and safety requirements for the use by workers of personal protective equipment at the workplace (third individual directive within the meaning of Article 16 (1) of Directive 89/391/EEC)*
- *Regulation (EU) 2016/425 of the European Parliament and of the Council of 9 March 2016 on personal protective equipment and repealing Council Directive 89/686/EEC (Text with EEA relevance)*
- *Council Directive 90/269/EEC of 29 May 1990 on the minimum health and safety requirements for the manual handling of loads where there is a risk particularly of back injury to workers (fourth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC)*
- *Council Directive 92/58/EEC of 24 June 1992 on the minimum requirements for the provision of safety and/or health signs at work (ninth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC)*
- *Directive 2002/44/EC of the European Parliament and of the Council of 25 June 2002 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (vibration) (sixteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) - Joint Statement by the European Parliament and the Council (Evropské směrnice o BOZP, 2021).*

1.3.2 OSH institutions in the EU

The European Commission prepares proposals for the priorities and requirements in the OSH area, including the OSH documentation. More than twenty directorates-general (referred to as DGs) within the European Commission, including DG for Employment,

Social Affairs, and Inclusion. This DG addresses OSH in Section 3 – Health and Safety. This DG is responsible for the advisers to the Commission in the OSH area (Systém BOZP v Evropské Unii, 2020-2022).

The European Commission manages several **European Commission Committees** which oversee many different areas of the OSH:

- Advisory Committee on Safety and Health at Work, for which the main aim is to assist the European Commission in the preparation and implementation of OSH activities and developing cooperation with public authorities, trade unions, and employers in Europe (Systém BOZP v Evropské Unii, 2020-2022)
- Scientific Committee on Occupational Exposure Limits (SCOEL) It was first set up as an informal advisory body, but now It is an official committee of the European Commission. SCOEL is responsible for providing opinions and recommendations on the limit values of harmful pollutants for human health. (Systém BOZP v Evropské Unii, 2020-2022).
- Senior Labor Inspectors Committee – this Committee aims to provide information to the European Commission regarding all issues related to law enforcement and comments on the EU legal documents draft in the area of OSH. (Systém BOZP v Evropské Unii, 2020-2022)

The European Agency for Safety and Health at Work (EU-OSHA) was established in 1994. Its headquarter is in Bilbao. EU-OSHA is responsible for research, development, and distribution of health and safety information. EU-OSHA also organizes Europe-wide campaigns and enables the cooperation of representatives of the European Commission, Member State governments, Employers' and employees' organizations, and experts from the EU and other countries. (Systém BOZP v Evropské Unii, 2020-2022)

The European Foundation for Improvement of Living and Working Conditions has its headquarter near Dublin and provides the EU institutions and Member States with health and safety information and analysis. (Systém BOZP v Evropské Unii, 2020-2022)

1.3.3 EU Strategic Framework on Health and Safety at Work 2021-2027

The new OSH Framework for 2021-2027 sets up the priorities and measures to improve the OSH. This new Framework also includes the measures regarding the Covid pandemic and

safety in the following years after the pandemic. The fatal accidents decreased from 1994 to 2018 by 70 %. Health care, which is available nowadays, or reducing the number of workers in the factories, and the OSH system in the EU plays an important role. But of course, the main reason for an effective OSH system is to ensure good conditions for the health and safety of the employees. One of the many reasons is the financial difficulty of the work accidents or the occupational diseases. Approximately 460 billion EUR is paid annually from the EU economy. (EU, 2021)

This EU Strategic Framework for Health and Safety sets itself three main objectives. The first goal is to anticipate and manage changes in the new world of work. Job tasks and workplaces are constantly changing; new job positions are created, automated production, robotization is coming, etc. The Green Agreement for Europe, the EU Digital Strategy, and the New Industrial Strategy for Europe are supposed to help develop, innovate, new job positions, and open opportunities for all. A huge topic is also population aging. There is a debate about the involvement of older workers in the job market. It is necessary to adapt the work environment so that it is a safe workplace for these workers. Progress in technology and digitalization leads to the reduction of the risks from the dangerous tasks. The integration into the labor market of the workers who have some kind of disabilities. With Covid-19, working from home increased enormously. Therefore, this Framework aims to analyze workers' exposure to optical radiation, etc., when working remotely.

Regarding the Green Agreement for Europe, the limits of some hazardous substances (such as lead, cobalt, or asbestos) will be reviewed. Psychosocial and ergonomic risks also play a key role in this Framework, especially during the Covid-19 pandemic, when many workers began working remotely. According to Eurofound (Eurofound and EU-OSHA, © 2014), almost 80 % of senior workers experience occupational stress. That is why it is necessary to pay attention to good mental health. Therefore, a campaign will be launched to create a safe and healthy digital future, focusing on mental health and ergonomics (EU, 2021).

The second objective of this EU Strategic Framework is to improve the prevention of the accidents at the workplace and occupational diseases. The European Parliament issued a resolution in December 2020, where the Member States should commit themselves to elimination of the fatal accidents and occupational diseases by 2030 (European Parliament resolution, 2020).

The big question marks are heart diseases or stroke. Cardiovascular diseases are the second most common cause of work-related death in the EU. Because there is not much information about the causes, it is necessary to gather data and do research to implement effective measures. Part of this second objective of the Strategic Framework is also hazardous substances, a healthy work environment for all employees, health promotion at work, gender balance, and improving the employment opportunities for workers with disabilities. It is also important to prevent violence, harassment, and discrimination (EU, 2021).

The third goal is to be prepared for a possible future health crisis. Covid-19 plays a major role in this goal. This pandemic proved the important role of the risk assessment and preventive measures in the workplace in case of health risks. E.g., to have a secured workplace to prevent the spreading of the viral disease. According to the EU, It is very important to take this pandemic as a lesson and be stronger than any other. In addition to prevention, the EU is also working on supporting workers who had Covid-19 or have lost family due to Covid. Therefore, this Framework recommends accepting Covid-19 as an occupational disease, which has already been done by 25 Member States (EU, 2021).

1.3.4 CZ legislation

The basic principle of OSH in the Czech legislation comes from the Charter of Fundamental Rights and Freedoms of the Czech Republic. It says that everyone has the right to satisfactory work conditions. Also, the Charter guarantees the right to increased health protection at work for women, juveniles, and disabled people. Also, according to Article 31, everyone has the right to health protection. (Neugebauer, 2016)

The primary legislation for occupational health and safety is Act No. 262/2006 Coll., The Labour Code. The fifth part of this law focuses on safety and health as prevention of life and health threat at work, employer's obligations as ensuring the health and safety of his employees or covering all the costs incurred to ensure health and safety in the workplace. This Act also orders the employer to identify the risks, apply measures and ensure a safe work environment. Furthermore, there is also a list of the employees' rights and obligations, the employer's obligations in the case of work accidents and occupational diseases, personal protective equipment (referred to as PPE), or employees' participation in OSH. (THE CZECH REPUBLIC, 2006)

Another important law in the field of OSH is Act No. 309/2006 Coll., Act on Further Requirements on OSH, focusing on protection in activities provided outside labor relations. Within the primary legislation, also Act No. 258/2000 Coll, On Protection of Public Health, can be mentioned, as well as Act No. 174/1968 Coll., On State Inspection of Labour Safety. Even more legislation in the Czech Republic law system focuses on different areas of this field: OSH in transport, OSH in construction, Etc. (Vala, 2016).

Furthermore, there are several government regulations and decrees in the Czech legislation:

- *Government Regulation No. 101/2005 on detailed requirements for the workplace and the working environment*
- *Government Regulation No. 378/2001 Coll. laying down detailed requirements for safe operation and use of machinery, technical equipment, instruments, and tools*
- *Government Regulation No. 362/2005 Coll. on more detailed requirements for OSH when in workplaces with the hazard of falling from a height or depth*
- *Government Regulation No. 11/2002 Coll., establishing the appearance and placement of safety signs and introduction of signals*
- *Government Regulation No. 361/2007 determining conditions of occupational health protection*
- *The Ministry Decree No. 79/2013 Coll., On the Implementation of Certain Provisions of the Act on Specific Health Services*

And other regulations depend on the researched area (Vala, 2016).

1.3.5 OSH institutions in the Czech Republic

The most important institutions in OSH in the Czech Republic are the State Labour Inspection Authority, Public Health Authorities, the National Institute of Public Health, and the Occupational Safety Research Institute. (BOZPinfo, 2021)

Act No. 251/2005 Coll governs the State Labour Inspection Authority and regional labor inspectorates. On labor inspection. The main activity of this institution is to control compliance with the labor relations and working conditions and their protection. The

inspected persons include mainly employers and their employees, natural and legal persons in the business according to a special legal regulation, contractors, etc.

The Regional Labour Inspectorate has the authority to check the causes and circumstances of work accidents, then participate in investigations at the work accident site. This Inspectorate also comments on construction project documentation that will be part of the public interest or as a workplace with employees. (SUIP, 2021)

Regional Public Health Authorities are established by Act No. 258/2000 Coll. to protect public health. The main task of the Authority is to manage the health risks and also to issue permits, regulations, and other tasks in the protection of public health. One of the activities of this Authority is also to perform the state health supervision and check compliance with hygienic requirements. (KHS JmK, 2021)

The National Institute of Public Health is part of the Ministry of Health, and its competencies are published in Act No. 258/2000 Coll., on the protection of public health. These competencies include the documents' preparation for national health policy, health protection, also monitoring and research on the relationships between living conditions and health, or providing health education for the population. (SZÚ, 2021)

Occupational Safety Research Institute is a public institution established by Act No. 341/2005 Coll., on public research institutions. The main task of this institute is research in the OSH area, fulfillment of the activities and tasks which come from the Conventions of the International Labour Organization, the health and safety regulations, and the need for labor inspections. The aim is to identify and verify methods preventing health and lives, property, and the environment from the risks and improving the well-being and quality of working life. (VÚBP, 2021)

1.3.6 Belgian legislation

The main law in Belgian OSH legislation is the Act from 1996, „*The well-being of workers*“. This law orders employers to avoid risks, treat unavoidable risks, replace hazardous activity with less hazardous ones, and inform employees about the nature of their work and the risks arising from their job position. Also, employers must give employees appropriate training and provide appropriate safety signs and PPE if needed in the workplace.

Furthermore, this Act mentions the rights and obligations of employees and special provisions for mobile and temporary workplaces. Act also mentions the prevention of psychological risks in the workplace, including stress, violence, or sexual harassment. (Belgium, 1996)

The Belgian National Strategy for Wellbeing at Work has replaced the 2008-2012 Strategy. The main aims of this Strategy are:

- **Safety and health at work** – constantly identifying and analyzing new risks. Reducing workplace accidents and not getting carried away by the statistics as they do not include fully correct data – e.g., foreign companies operating in Belgium may not report the work accidents in Belgium. Attention must be paid to the psychological risks as well. For example, working under pressure could lead to burnout and psychological issues such as depression.
- **Strengthening labor market participation** – the emphasis is on the involvement of young and older people and people with disabilities in the working life. Young people need to know the risks at work and learn to be careful about these risks.
- **Prevention** – this Strategy emphasizes strengthening prevention, whether by employers, the government, or the employees themselves, who should be involved in OSH issues and contribute to making this area more effective. (The Belgian Strategy, 2016)

1.3.7 OSH institutions in Belgium

Occupational health and safety is a matter for the Federal Public Service Employment, Labour, and Social Dialogue. The main executive agencies are the Directorate General of Labour and the General Division for Monitoring Well-being at the Workplace.

The General Division for the Monitoring of Well-being at the Workplace is an inspection service with three main departments – the Regional Control Department, the Chemical Risk Control Department, and the Knowledge Management Division. The directorate covers all areas defined by the Act 1996. This inspection service aims to reduce workplace accidents and health problems arising from employment and public services. This authority also monitors compliance with the rules and acts as an advisory body.

The General Division for the Monitoring of Well-being at the Workplace is divided into the Legislation Preparation Division, the Well-Being Support Division, and the Social

Counseling Division. The Legislation Preparation Division deals with preparing and implementing European and International standards into Belgian legislation. The Well-Being Support Division provides promotion and information on well-being in the workplace at the international and Belgian levels. And the Social Counseling Division organizes consultations at the level of standards concerning well-being at work. (OSH WIKI, 2020)

1.4 Employer's obligations

The main obligations of the employer (according to Act No. 262/2006 Coll., Labour code) are:

- To ensure safety and health at work. This obligation applies to all persons present in the workplace,
- The employer must pay all costs incurred for safety and health at work,
- The employer must constantly identify risks and do the risk assessment to prevent the lives and health of his employees,
- Another obligation is to keep a book of work accidents,
- Regularly check the level and condition of safety at work and technical equipment,
- The employer must have a statutory employer's liability insurance for injury or disease to his employees arising out of their employment,
- The employer must not allow employees to do a prohibited work,
- The employer must inform his employees about the work category to which their work belongs,
- The employer must inform his employees about the occupational health services that will provide a preventive examination,
- The employer must provide employees with appropriate training on safety and health at work and acquaint them with the safe work procedures with machines and equipment they must work with. (ZSBOZP, 2021)

1.5 Employees' rights and obligations

The employer's obligations, employees' rights, and obligations are also covered in Act No. 262/2006 Coll., Labour code.

All employees have the right:

- To work in a safe and healthy environment,
- To be provided with information on possible risks carrying out their work and information on how to protect themselves from these risks,
- To refuse work if his life or health may be endangered. (Bezpečnost práce, 2014)

All employees have an obligation:

- To take care of the safety and health at work for themselves and for the persons who may be affected by their work,
- To participate in mandatory OSH training,
- To complete a working examination by a company doctor or by related occupational health services,
- To follow legislation and internal instruction of the employer,
- To follow established procedures in the performance of their work,
- To be tested for alcohol or other addictive substances,
- Immediately notify their employer or manager of any hazardous situation which can represent a danger to health. (Bezpečnost práce, 2014)

According to Charles Reese (Reese, © 2017, p. 40), there are five principles of workplace safety:

- All risks can be prevented,
- All employees are responsible for safety,
- All employees have a responsibility not only for themselves but also for their colleagues and their families in terms of safety at work,
- To prevent risks, employees need to be adequately trained to carry out their work activities,
- All employees must be involved in workplace safety simply because people are happy to be involved in areas that affect them.

1.6 OSH training

As already mentioned in the chapter on the employer's obligations, the employer must provide appropriate OSH training for employees. The employees are then obliged to participate in this training.

1.6.1 Training on OSH legislation

This obligation also applies to the employer who employs only one employee. This training must be done before a new employee starts the work, also when changing the job position or when there is a new technology or changes in production and work processes. The training should be tailored to the organization and job description. (Neugebauer, 2018, p. 17-18)

1.6.2 Familiarization with risks and applied measures

Another employer must inform employees about the risk assessment result and the applied measures to reduce the risk. Risk = likelihood x consequence. All employees should be informed about the consequences and the likelihood rate, e.g., how often they will probably have occupational back pain handling a heavy load. (Neugebauer, 2018, p. 20-21)

1.6.3 Professional trainings

In addition to the OSH legislative training and familiarization with the risks and measures. According to the relevant technical standards, professional training must be repeated every three years. These training may include e.g., training of vehicle drivers, handling of dangerous goods, training for electricians, etc. (Neugebauer, 2018, p. 40-54)

1.7 Current topics in OSH

The second chapter will be focused on the current topics in the field of OSH. One of the biggest current topics is the Covid-19 pandemic, which has affected all areas of our lives, including work. Other very often discussed topic in OSH these days is well-being. Well-being was also mentioned in the Sixth survey of working conditions in Europe, which has its place in this chapter.

1.8 OSH and Covid-19

Continuous risk assessment in the workplace is a successful tool for effective OSH management. With the Covid-19 pandemic, It was necessary to include this risk in the risk management. This is not just about ensuring a safe environment for employees but also

keeping employees safe and in good well-being. With the onset of the Covid-19 pandemic, It was necessary to implement various measures depending on the job positions and activities. First of all, It was important to increase hygienic measures, such as more frequent disinfection of the most occupied places in the workplace, promoting hand washing, or implementing disinfectants all over the workplace. (Dokumentace BOZP, 2021)

As already mentioned in the chapter [Employer's obligations](#), the employer must constantly identify risks in the workplace. Therefore, it is necessary to also consider the Covid-19 pandemic. Here, the healthcare providers could assist the employers. One of the measures to prevent the spread of this virus (which is also recommended by the European Agency for Safety and Health at Work) is to allow employees to work from home if their job position allows it. For those employees who cannot work from home, it is recommended to keep distance between each other as much as possible and avoid contact with third parties. Using various materials to create a "wall" between individual employees is possible if there is no other way to keep at least two meters distance between each other. However, this wall cannot create any additional risks (e.g., falling off an object from a height). It is advisable to consider wearing face masks or respirators in the workplace, to place posters with the instructions on how to properly wash hands or what to do in case of any respiratory infection symptoms. To restore original operation at the workplace, it is recommended to create a return plan and perform this return of employees to the workplace slowly and partially. (Cockburn, 2020)

Recently, Covid-19 has been recognized as an occupational disease. According to a survey conducted by Eurostat at the end of 2020, seventeen European Member States (dark orange in Figure 1), such as Bulgaria, the Czech Republic, France, Slovakia, and Sweden, recognize Covid-19 as a work accident. Countries that recognize Covid-19 as an occupational disease or injury, depending on national criteria, are marked in light blue Figure 1). Greece and Ireland have not specified whether Covid-19 is considered an occupational injury or disease. (Eurostat, 2021)

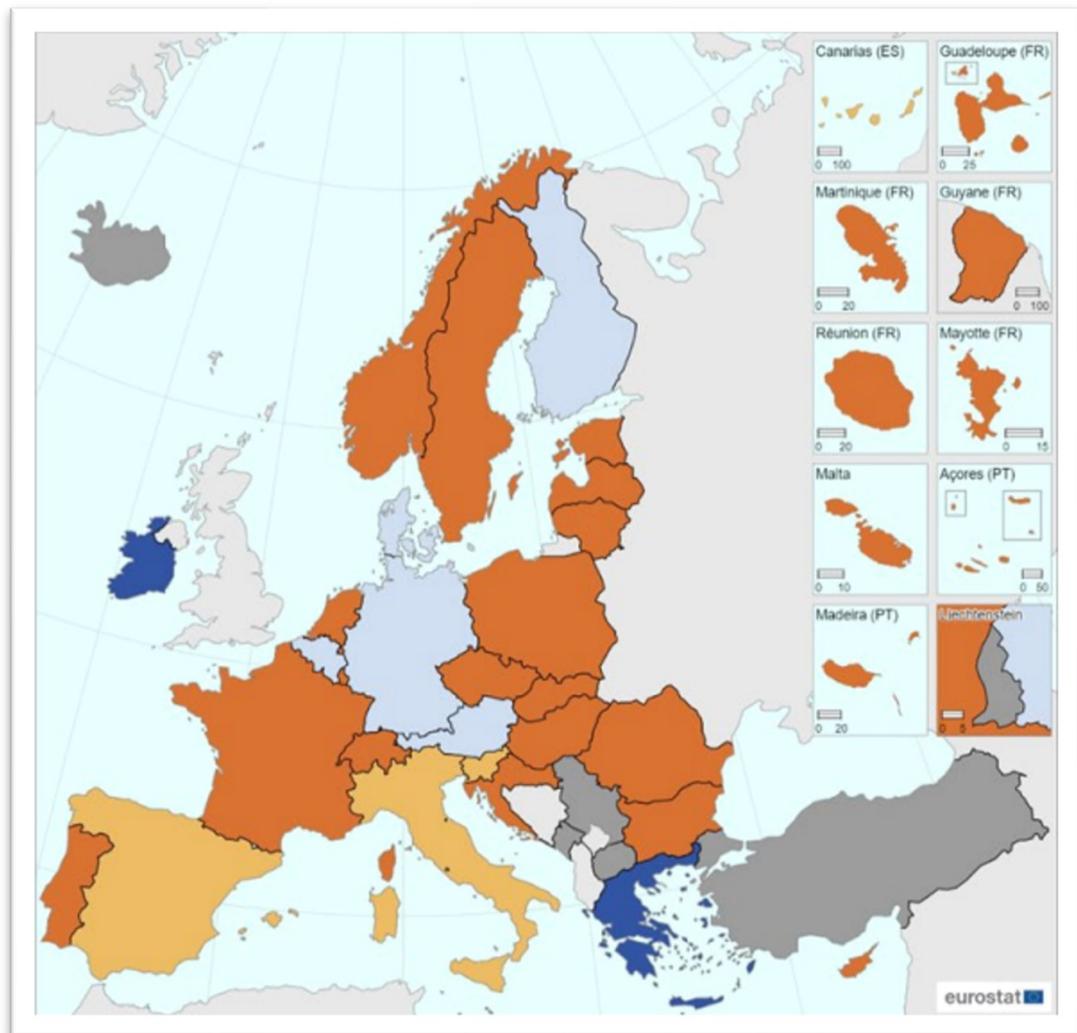


Figure 1: Covid-19 as an occupational disease (Eurostat, 2021)

1.9 European Working Conditions Survey

Since 1991, the Eurofound Foundation has been conducting the European Working Condition Survey to evaluate working conditions in Europe. This survey highlights, e.g., the vulnerable groups, areas where progress has been made, or problem areas to improve job quality in Europe. The last survey started in 2021, but due to the Covid-19 pandemic, it was terminated after a few weeks. Therefore, for the theoretical part of this thesis, the results of the last fully conducted survey from 2015 will be used. This 2015 survey was the sixth survey of working conditions in Europe by Eurofound. (Eurofound, 2022)

The sixth survey of work conditions in Europe identified 7 job quality indexes:

- The first index is the physical environment in which the physical risks in the workplace are being assessed. Here, of course, it depends on the industry and the professions; in any case, the key finding in this area was that there was no balanced improvement. The good news is the reduction in noise exposure in the workplaces, but unfortunately, there has been an increase in exposure to the chemicals.
- The second index is the intensity of work (the workload of the employee), whether it is, e.g., speed of work or emotional burden. Based on this survey, health professionals face the highest intensity of work.
- The third index is the quality of working time. Within this category, working hours, breaks at work, and the flexibility of working hours were examined. It has been found that almost half of the workers have regular working hours and also that one in five workers has to work in their free time a few times a month to meet the job requirements.
- Another category is the social environment. Almost 90 % of employees feel good and satisfied at work. The index of skills and discretion has shown that the gap between men and women is narrowing.
- The next index belongs to employees being involved in the decision-making. It has been found that one-third of employees (who do not work as direct managers) are involved in the decision-making.
- The penultimate index belongs to the prospects. Almost one-fifth of respondents answered that they feel the risk of losing their job in the next six months. Related to career development, full-time workers have a higher chance than part-time workers.
- The last index is income. The result of this index is that men have a higher income than women. This is partly related to the length of working hours, but significant differences and inequalities between men and women are one of the key findings of this survey from 2015. (Parent-Thirion et al., 2017)

1.10 Well-being

Recently, there has been an increasing mention of mental health and well-being in the workplace. Work and work environments can develop an employee's mental health problems, such as depression, alcohol or drugs, or anxiety. In 2005, the European Commission published a Green Paper promoting the mental health of the population in

response to the World Health Organization (from now on referred to as WHO) "Declaration on Mental Health for Europe". Emphasis is placed on the workplace as one of the most important social contexts. In the workplace, there is a need to talk about mental health issues and promote the mental health and well-being of the worker. (OSH Wiki, 2020)

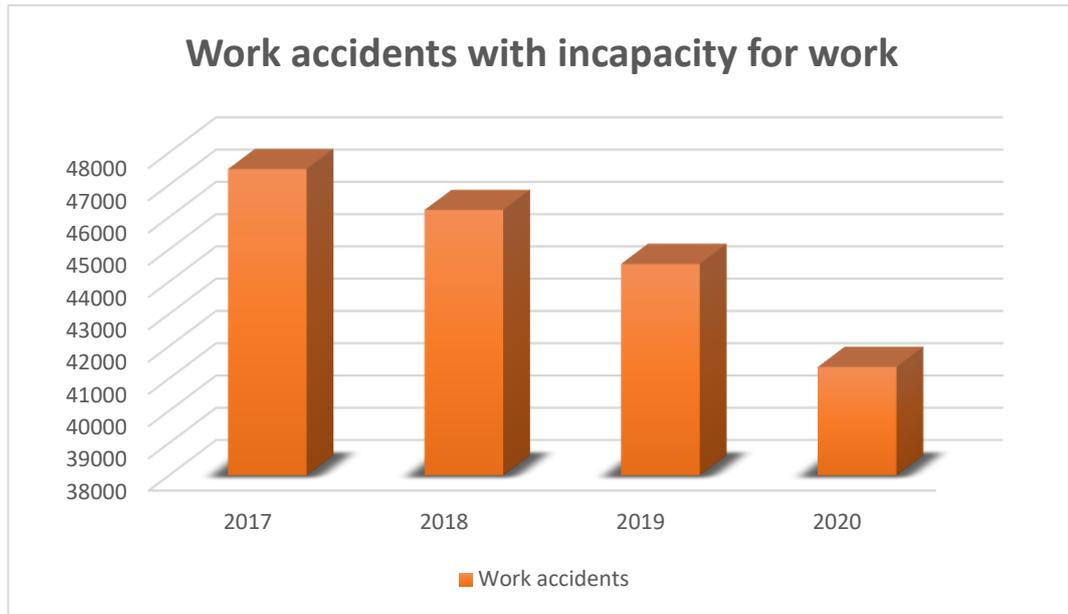
The 6th European Working Conditions Survey shows that work and health interact. Work can affect our health, and good health allows us to work. There are positive aspects that positively affect our mental health as a good salary, the security our work provides us, the quality of relationships in the workplace, and, e.g., the opportunities for personal and career development. Based on the WHO well-being index, it is possible to measure well-being in the workplace. Respondents were asked to assign 0-5 points to five statements about how they felt in the last 14 days. The maximum number of points earned is 100. The higher the number of points the respondent earned, the better is his mental health. A low score is associated with a risk of mental health problems, such as depression. Respondents assign points to the following statements:

- I felt cheerful and in a good mood,
- I felt calm and relaxed,
- I felt active and energetic,
- I woke up fresh and relaxed,
- My daily life is full of things that interest me.

The average score of EU workers was 68 points; men earned two more points than women. 6 % of employees were on the edge of mental problems; more affected are women than men. (Parent-Thirion et al., 2017)

1.11 Statistics of work accidents in the Czech Republic

According to the decision of the Ministry of Labour and Social Affairs, the task of the State Labour Inspection Office is to prepare a report on occupational accidents in the Czech Republic and to keep statistics on occupational accidents. Because statistics for the year 2021 have not been published at the time of writing this thesis, the last year in the below graphs is 2020. (SÚIP, 2021)



Graph 1: Work accidents statistics – with incapacity for work (SÚIP, 2021)



Graph 2: Work accidents statistics – fatal work accidents (SÚIP, 2021)

According to the Labour Code, an occupational accident is defined as „a damage to health or death of the employee if this occurred independently of will by short-term, sudden, and violent action of external influences in the performance of work tasks or in a direct connection.“ (THE CZECH REPUBLIC, 2006)

Despite a high-quality OSH management system in the company, it is not possible to eliminate the risks of work accidents. All statistics on work accidents are published annually. For this chapter, the data of work accidents that have required incapacity for work and fatal accidents are used. (ZSBOZP, © 2016–2022)

Graph No. 1 shows that the total number of work accidents decreases every year. For example, in 2020, there were 41 358 work accidents with incapacity for work, which is 3 194 work accidents less than in 2019, and even 6 133 work accidents less than in 2017, when 47 491 work accidents were registered. Most of the work accidents in 2020 (slightly over 40 %) occurred in the manufacturing sector, followed by wholesale, retail, and vehicle repairs (almost 12 %). The third sector with the most work accidents is transport and storage (10 %).

The most common source of the work accidents in 2020 was material, loads, products, and machine parts. This category was the source of almost 34 % of registered work accidents, followed by building and structures and hand tools categories. Around 90 % of the work accidents were caused by poorly or insufficiently estimated risks. For 6 % of work accidents, the cause was not found, and slightly over 2 % of work accidents were caused due to hazardous work procedures. Compared to previous years, the number of work accidents caused due to the lack of personal preconditions for proper work performance decreased. (ZSBOZP, © 2016–2022).

However, over the last twenty years, the total number of accidents with incapacity for work has decreased every year. In 2002, 90 867 work accidents were registered, and in 2005, it was 82 042 work accidents. So current data are almost half lower than registered work accidents a few years ago. (ČSÚ, © 2021) Unlike registered accidents at work with incapacity for work, which are decreasing every year, unfortunately, the fatal accidents do not follow this curve. As shown on chart nr. 2, the curve moves up and down. The increase in fatal work accidents is often caused by mass incidents, such as car accidents, etc. In 2020, a total of 108 fatal work accidents occurred. This was 13 more than in 2019 but 15 less than in 2018. Most tragic accidents occurred while driving automobiles or other vehicles (almost 40 %), and less than 18 % of fatal accidents occurred while working on buildings and structures. As in the case of accidents at work, which required incapacity for work (see Graph 1), the fatal work accidents were most of the time caused by an incorrect or insufficiently estimated risk (56,5 %). Another 11 % of incidents, the cause was unsafe practices and unsafe working methods. (ZSBOZP, © 2016–2022)

2 OSH MANAGEMENT SYSTEMS IN THE ORGANIZATION

An OSH management system can be implemented for better quality OSH management in the organization. This is a proactive approach to this field, which may be relatively time-consuming to implement depending on the size of the organization, but the advantage of this OSH management system implementation is the improvement of the OSH performance by the legislation. The basic steps for implementing the OSH management system in the organization include setting goals, summarizing all the processes and activities in the company, identifying hazards, risk assessment, measures, control, and monitoring. (Vala, 2016, p. 18-19)

The Deming cycle, also called the PDCA cycle, can help implement the OSH management system. This method can be used at any stage of the process. For any solution to a problem, or as a tool for improvement. The PDCA cycle consists of 4 steps:

- **P-PLAN:** It is important to identify and evaluate the risks and legal requirements in this step. Based on this, goals can be set and processes by which the organization achieves the set goals.
- **D-DO:** In the next step, the plan is implemented. There is also a need to establish responsibilities, provide training, communicate, manage, and implement management system processes.
- **C-CHECK:** This step monitors whether the selected goals and results are achieved. There is a need to monitor processes and report results.
- **A-ACT:** Implementation of measures for continuous improvement in the field of OSH in the organization. This cycle can be repeated in case of deficiencies until the desired goals are achieved. (ELSSC, © 2015-2021)

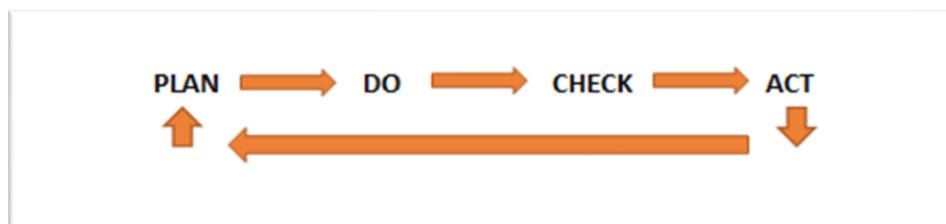


Figure 2: PDCA cycle (ELSSC, © 2015-2021)

2.1 ISO 45001:2018

International Organization for Standardization (referred to as ISO) also includes an ISO standard for occupational safety and health, and It is ISO 45001:2018, which has replaced OHSAS 18001. ISO 45001:2018 is in line with ISO 9001 and ISO 14001 for creating the management system simultaneously within health and safety management, quality management, and environmental management. (CQS, ©2022)

The advantage of implementing ISO 45001 is the cost reduction for legal fees and compensation based on the reduced risk of injury and work accidents; also, this standardization brings a stronger name in the market because ISO 45001:2018 means that the organization cares about the health of the stakeholders. Also, the company will comply with the legislation, and risk management will be improved. (NQA, © 2021)

This standard can be implemented in all types of organizations, regardless of the company's size. The main objective is to prevent hazards, eliminate or reduce risks so all employees will not work in a hazardous environment, prevent work accidents, minimize costs related to work accidents, and implement such an OSH management system which will be adopted on all levels and all the job positions in the organization. (CQS, ©2022)

ISO 45001:2018 is divided into several chapters that deal with various OSH management areas. The first chapter introduces the ISO 45001 standard itself, this management system's goal, and Deming's PDCA cycle. Furthermore, the standard mentions definitions such as organization, employee, injury, risk, etc. Also, this standard specifies the context of the organization, management, and staff involvement in health management, planning, risk identification, and risk assessment. It mentions that the organization must provide the necessary resources for the implementation, maintenance, and continuous improvement of the OSH management system, monitor and analyze new risks, follow legislation, etc., and continuously improve the OSH management system. (ČSN ISO 45001, 2018)

2.2 SAFE ENTERPRISE

Another way to increase the level of OSH system in the organization is the Czech national program Safe Enterprise. The principles of this program come from ISO 45001, ISO 9001, and ISO 14001. It focuses on preventing emergencies by minimizing the risks in the workplace. The National Safe Enterprise Program was first announced in 1996 by the

Ministry of Labour and Social Affairs and the State Labour Inspection Authority. This program is designed primarily for manufacturing companies with 100 and more employees or for companies with many identified risks. This program also includes inspections in fire protection, occupational hygiene, and environmental impact. (Vala, 2016, p. 30-31)

To participate in this program, one needs to prepare an internal audit according to the checklist available in the Safe Enterprise manual. First, the company must answer all questions in the affirmative; if the company answers the question with a negative answer, the company must correct it. In the next step, the company must write a report on implementing a health and safety management system in the company. In this report, the company will mention how the individual control requirements were met and in which internal documents could be this information found.

To participate in the Safe Enterprise program, It is necessary to meet the requirements in fire protection, verified by the fire department, and the requirements of health protection and working conditions of employees, which must be verified by the regional Public Health Office or the District Mining Office. If the company does not have ISO 14001 certification, It is necessary to obtain a positive statement from the Czech Environment Inspection.

After meeting all the requirements, the organization receives a "Safe Enterprise" certification valid for three years. However, It is necessary to keep doing the internal audit and verify that the system is still up to date and meets all the conditions. After these three years, It is necessary to re-apply and repeat the whole process. Companies with Safe Enterprise certification get a functioning OSH management system, the work accidents are reduced, and the organization's name will be improved. (Bezpečný podnik, © 2021)

2.3 Methods of risk analysis in OSH

Many methods can help the organization identify risks, and their assessment, with an internal auditor while ensuring the requirements for a health and safety management system. Some of the methods are mentioned below

- Check List - a simple method for easier orientation in the process or activity, includes the steps to be followed. The employee follows the list of steps/tasks, and with each

task, he chooses to yes / no / do not know or not applicable. (Veber a Pincová, 2008, p. 133 - 134)

- PHA - preliminary hazard analysis, is mostly used in the phase of the designing or development and identifies possible hazards. It identifies dangerous situations, their causes, and their consequences. (Veber a Pincová, 2008, p. 135)
- What-if - the participants of this method, are introduced to the problem, and with the brainstorming method, the answer to various "what-if" situations. It is important to have a relaxed atmosphere and a professional moderator who must know the problem and manage the whole discussion in the right direction. There is no guarantee that this method will cover all the risks, but this method will bring a lot of new ideas. It is recommended to have a checklist and lead the discussion accordingly. (Veber a Pincová, 2008, p. 135)
- HAZOP - this method aims to identify risk scenarios and assess possible threats to the systems and the possible risks coming from these threats. Based on a standardized table and guiding words, a list of dangerous situations, detection of the causes of failures, risk consequences, risk assessment, and possible measures are created. The team that works on this method determines the purpose, deviations, causes, consequences, and hazardous situations. By combining keywords and the device's purpose, all variants that the deviations can cause are examined. After this step, it is necessary to evaluate each variant, find its cause, and identify all the risks. (Veber a Pincová, 2008, p. 136-137)
- FMEA - Failure mode and effects analysis is a method whose main goal is to define possible defects and consequences in the early development phase and thus implement preventive measures. The method can also be applied to already established equipment, systems, and possible hazards that lead to work accidents. (Veber a Pincová, 2008, p. 138-139)
- SIPOC – a very simple method, also called a turtle diagram. This method analyzes business processes, considers inputs, and outputs, and includes the influence of suppliers and customers. The letters in the method name represent the areas that are included in this method: S (Supplier), I (Input), P (Process), O (Output), C (Customer). (SIPOC, © 2017–2022)

CONCLUSION OF THE THEORETICAL PART

In the theoretical part of this thesis, the most important findings in OSH have been summarized with the help of professional literature and other sources.

The first part includes the OSH introduction, purpose, and meaning in our lives, both from the employer and employee's perspectives. The next chapter presents a brief history and development of safety and health at work. Although the current system of OSH cannot be compared to OSH hundreds of years ago, there are certain elements of OSH in the history, such as the rule of placing railings on a new house in the fifth book of Moses 1500 years BC. (Historie bezpečnosti a ochrany zdraví při práci, 2014).

As the analysis part of this thesis will compare occupational safety and health management in Atlas Copco, specifically in the Brno and Belgian branches, the theoretical part also includes OSH legislation and institutions in the EU, Czech Republic, and Belgium.

In the theoretical part, there is also a chapter on how the Covid-19 pandemic has affected the area of OSH. Another chapter focuses on the current topic that is often discussed related to OSH, which is well-being. The European Working Condition Survey results follow this chapter; the survey monitors working conditions in Europe and has been carried out by Eurofound since 1991 (Eurofound, 2022)

As this thesis will, among other things, focus on work accidents, therefore one chapter of the theoretical part mentions the statistics of work accidents in the Czech Republic. The last part mentions selected health and safety management systems, specifically ISO 45001:2018 and the Czech national program "Safe Enterprise". This chapter is followed by a few selected risk analysis methods, which can help with the risk assessment in the field of OSH.

II. ANALYSIS

3 INTRODUCTION OF THE COMPANY

In the analysis part, the OSH management system in Atlas Copco will be compared. For the comparison project, two branches were selected, one in Brno and one in Belgian Antwerp. Both branches operate as service and distribution centers.

3.1 Company characteristics

The Swedish company Atlas Copco is an industrial company with a global presence. It was founded in 1873, and currently, the company has over 43000 employees and customers in more than 180 countries. Atlas Copco products can be found almost everywhere, such as compressors, vacuum solutions, generators, pumps, power tools, etc. Atlas Copco believes in a better tomorrow and therefore focuses on long-term innovations. In meeting customer requirements, the company minimizes the impact on the environment, emphasizes the safety and health of its employees, thinks about ethical growth and respect, and promotes human rights.

Atlas Copco operates in four areas (Atlas Copco Group, © 2022):

- **Compressor Technique (CT)** such as compressors, air, and gas treatment equipment...
- **Vacuum Technique (VT)** focused on vacuum products
- **Industrial Technique (IT)** such as power tools, quality assurance products...
- **Power Technique (PT)** such as mobile compressors, pumps, generators...



Figure 3: Atlas Copco logo (Atlas Copco Group, © 2022)

3.2 Company history

The company was founded in 1873 by railway engineer Eduard Fränckel together with David Otto Francke and André O. Wallenberg to offer equipment for the construction and operation of the railway networks. After 1887, based on declining sales, they decided that the production must be focused on more advanced products such as steam engines and pneumatic equipment. The products had a huge success, and the company's fame grew.



Figure 4: Company history (Atlas Copco Group, © 2022)

Before the First World War, the company (at that time called Atlas Diesel) expanded its products offered with air compressors. With the war, exports of products stopped, and the trade network collapsed, followed by another crisis. The company cooperated with a minimum of customers but tried even harder to listen and fulfill their wishes. The motto "*our customer, our master*" still punches in the company today. The company grew over time, the number of employees increased, and 97 % of sales came from export. In 1956, the company decided to deal only with compressor equipment. The name was changed to Atlas Copco, according to the subsidiary of Compagnie Pneumatique Commercial. In the 80s, the company became a world leader in the production of drills and compressors and began to purchase strong companies worldwide and further strengthen its position in the market.

In the Czech Republic, the first representation of this company dates to 1969. A year later, the company's products were used to build the longest Czech D1 highway. The first service

branch was established in 1987 and serviced all Atlas Copco products. At the beginning of the 1990s, the company was divided into individual divisions (CT, VT, IT, PT, as mentioned in the chapter Company characteristics). (Atlas Copco Group, © 2022)



Figure 5: AC Compressor – history (Atlas Copco Group, © 2022)



Figure 6: AC Compressor – now (Atlas Copco Group, © 2022)

3.3 Evaluation of the year 2021 in the company

Mats Rahmström, President and CEO of Atlas Copco Group, considers the company's main achievement in 2021 to be the constant striving to find better ways, an increase in R&D investments, and participation in the market areas potential for sustainable, profitable growth. Atlas Copco company has also raised climate ambitions to reduce greenhouse gas emissions by the Paris Agreement. Emissions from the company's products will be reduced in the coming years. (AC annual report, © 2022)

From the financial point of view, the company managed to achieve a record number of orders received in 2021 (SEK 129,5 mil.) as well as a record turnover (SEK 110,9 mil.) and a record operating profit (SEK 23,6 mil.)

Table 1: Orders received and revenues 2021 (AC annual report, © 2022)

Area	Region	Revenues	Revenues total	OR total
Compressor Technique	Asia / Oceania	34%	49.7 MSEK	55 MSEK
	Africa / Middle East	6%		
	Europe	34%		
	North America	21%		
	South America	5%		
Vacuum Technique	Asia / Oceania	65%	29.2 MSEK	39.5 MSEK
	Africa / Middle East	1%		
	Europe	13%		
	North America	21%		
Industrial Technique	Asia / Oceania	29%	19.4 MSEK	20.5 MSEK
	Africa / Middle East	1%		
	Europe	36%		
	North America	31%		
	South America	3%		
Power Technique	Asia / Oceania	21%	13.2 MSEK	15.2 MSEK
	Africa / Middle East	8%		
	Europe	36%		
	North America	27%		
	South America	8%		

Table 1 shows that the Compressor Technique contributes the most to turnover. This is followed by Vacuum Technique, Industrial Technique, and Power Technique. Most of the turnover comes from Europe and Asia / Oceania area. (AC annual report, © 2022)

The annual report also discussed the commitment to employees' safety, health, and well-being. Every two years, there is a questionnaire in which employees rate with points 0-100 (100 means 100% agree) how much they agree with the statement that the company is interested in their mental comfort. In 2019, the result was 69 points; in 2021, the score increased to 73. Atlas Copco has safety as its top priority and pursues a policy involving everyone in risk elimination. One of the criteria is the questionnaire; another method that Atlas Copco uses is the safety pyramid. This safety pyramid must be balanced so that the risk observation creates the base of the pyramid, followed by fewer minor injuries and even fewer serious injuries. The safety pyramid system has been established in Atlas Copco since 2019, and so far, every year, the safety pyramid ended balanced. (AC annual report, © 2022)



Figure 7: Safety Pyramid 2021 (AC annual report, © 2022)

3.4 Characteristics of selected branches

For a project of OSH Management comparison two branches of Atlas Copco company have been selected. The first branch is the service and distribution center in Brno, the second branch is the service and distribution center in Belgian Antwerp. As mentioned in the previous chapter, Atlas Copco cares about the safety and health of its employees, which confirms also a well-developed occupational health and safety management system. Atlas Copco ensures that all branches of the company are ISO 45001:2018 certified. (AC annual report, © 2022)

All numerical data used in this thesis are recalculated by the selected coefficient.

The following chapters will summarize the status of both branches, the OSH management system, and statistics of work accidents in 2020 and 2021.

4 OSH MANAGEMENT - BRNO

The first branch selected for the project is the branch in Brno. This chapter will describe the basic activities of this branch and OSH documentation. In the next part, the primary process, Pick-to-Ship, will be analyzed by the SIPOC method, and the risk activities will be analyzed and rated with the LCO method (likelihood, consequences, and opinions). The last part will be focused on the statistics of reported incidents and accidents in the previous two years.

4.1 Basic information

This branch operates as a service center with an average of 105 employees. The branch belongs under the Vacuum Technique area. One of the main areas of business is the refurbishment of vacuum pumps. Therefore, the primary process of this operation includes these activities:

- disassembly of the vacuum pump,
- cleaning,
- repair,
- replacement of the parts so that the product is as new,
- testing and storage,
- packaging,
- shipping.

The products are then used for space simulations, solar panels, semiconductors, food processing, packaging, drying, heat treatment, etc. (Internal documents, 2022)



Figure 8: Atlas Copco Vacuum pump (Directindustry, © 2022)

The fact that occupational safety and health, including environmental protection, is one of the main priorities is proved by the high standards in the company. The OSH management is as important to society as production management. Everyone in the company cooperates with the OSH management, no matter which position in the company they have. The management system in this branch is certified by the ISO 45001:2018 standard.

Effective OSH management does not only lead to the elimination of accidents at work, which is one of the main goals. It also brings the company a lower absence; employees are happier with their work and more involved in the OSH area.

One of the management tools is an electronic reporting system through which employees can report incidents from various inaccuracies to the accidents. Each reported incident is further examined by a responsible person and is then used to establish new directions and trends in this company area. There is also an internal audit every year. (Edwards Vacuum, © 2022)

All situations are reported, from risk observations to fatal accidents. In the report, It is distinguished whether the reported incident is:

- Unsafe condition, unsafe act, risk observations,
- Near miss (nobody was injured but it could happen),
- First aid (need to treat a minor injury, after that, the employee could continue working),
- Medical treatment (the injured employee needed medical treatment, he could continue working the next day),
- Lost time accident (a more serious injury that did not allow the employee to work the next day),
- Fatalities.

Each record has its SHERS ID in the accident book. All mandatory fields are:

- Name and surname of the affected employee,
- Date, time, and place of the accident,
- The activity in which the accident occurred,
- Description,
- Type of injury and injured body part,
- Source of injury,
- Cause of injury,
- Type of accident,
- number of hours worked before the accident,
- Total number of injured persons,
- Witnesses,
- Contact details of the person who reported the accident.

strana číslo: 5

Poradové číslo úrazu	Jméno a příjmení úrazem postiženého zaměstnance	Datum a hodina (čas vzniku úrazu)	Místo, kde k úrazu došlo	Zaměst. při místě úrazu	Popis úrazového děje (popis výše úrazu)	První zranění a měřící údaje (podle přílohy č. 3 přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Zranění (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Zdroj úrazu (co bylo příčinou vzniku úrazu?)	Příčina úrazu (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Druh úrazu (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Podřídnost (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Podřídnost (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Podřídnost (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Podřídnost (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Podřídnost (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Podřídnost (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)	Podřídnost (podle přílohy č. 3 IVZ 201/2010 Sb. - viz úvod knihy úrazů - příloha č. 2)
BRN-6902	[redacted]	[redacted]	Bojov STP	Bojov STP	Při vyvádění rotoru USEM SI POSTUŽIL RUKOU.	032	55	VÁHA ROTORU	SPRÁVA GAZOVON IG	E	5	1	/	[redacted]	[redacted]	[redacted]	[redacted]
BRN-9271	[redacted]	[redacted]	GR	GR	hláček správně kliknut dle manu a ruka si do prstu	044	54	stima	napraveno	E	7	1	/	[redacted]	[redacted]	[redacted]	[redacted]
BRN-3233	[redacted]	[redacted]	Decan	Promančí, oko	Protáhl si oko pastou pro vlny	006	13	Zamrzl v ruce, ruce si protáhl	2	E	10	1	/	[redacted]	[redacted]	[redacted]	[redacted]
BRN-4948	[redacted]	[redacted]	Decan	Príp	Osobně "sting" na pumpě rozepkla kolo a spadla do koly ruky	010	55	klávesy	napraveno	E	9			[redacted]	[redacted]	[redacted]	[redacted]

Figure 9: Work accidents book (Internal documents, 2022)

All employees can report all situations that could lead to injury. A responsible person checks each situation, and then if needed, the new measures are applied. First, the relevant report indicates the situation, what the hazard is, and the risk of this incident. Then the responsible person adds the result of the investigation (e.g., whether the danger has been eliminated and how) and if any new measures are needed.

BRU-8673

Safety Conversation Report

Name / Jméno:	[REDACTED]	Location:	sklad
Observation / Pozorování:	Při procházení bezpečnostními dveřmi jsem si roztrhl tričko o háček umístěný mezi futrama. Hrozí pořezání ruky.		
Results / Výsledky:	Element odstraněn 26.9.19 ✓ oprava → ENG 28.9.19 ✓		
	<input type="checkbox"/> To reinforce safe Behavior / Posílit bezpečné chování <input type="checkbox"/> To improve Unsafe Behavior / Napravit nebezpečné jednání		

Risk / Riziko	<input type="checkbox"/>	Hit/Struck by Object / Náráz / zasažení objektem	<input type="checkbox"/>	Chemical Exposure /vystavení se chemickým látkám
	<input type="checkbox"/>	Fall / Pád	<input type="checkbox"/>	Fire/Burn /požár
	<input type="checkbox"/>	Electrical Shock / úraz el. proudem	<input type="checkbox"/>	Noise/Hearing Loss /hluk - poškození sluchu
	<input checked="" type="checkbox"/>	Others / Jiné: (napíšte) pořezání		

PPE / OOPP	<input type="checkbox"/>	Head / Hlava	<input type="checkbox"/>	Feet / Nohy (chodidla)
	<input type="checkbox"/>	Eyes / Oči	<input type="checkbox"/>	Ears / Uši
	<input type="checkbox"/>	Hands / Ruce	<input type="checkbox"/>	Other PPE / Jiné OOPP

Ergonomics / Ergonomie	<input type="checkbox"/>	Posture / Pracovní pozice	<input type="checkbox"/>	Manual Handling / Ruční manipulace
	<input type="checkbox"/>	Repeated Strains / Opakované zatížení		

Equipment & Tools / Zařízení a nř.	<input checked="" type="checkbox"/>	Incorrect for the job / nevhodné ✓	<input type="checkbox"/>	Poor condition / Špatný stav
	<input type="checkbox"/>	Used Incorrectly /Nesprávné použití		

Housekeeping / Úklid	<input type="checkbox"/>	Not up to standard / Neodpovídá normě (zvyklostem podniku)
-------------------------	--------------------------	--

Procedures & Stds / Procedure	<input type="checkbox"/>	Not complying / neodpovídá proced.	<input type="checkbox"/>	Not communicated / chybi proškolenost
	<input type="checkbox"/>	Not understood / nepochopeno		

Figure 10: Safety Conversation Report (Interní dokumenty, 2022)

4.2 OSH documentation

The entire Atlas Copco group follows guidelines issued by the top management. These are the basic procedures of "The Way We Do Things." Subsequently, based on these guidelines, the directives of individual areas (VT, CT, IT, PT) are created according to which the branches in each area are governed. All guidelines in the entire group are based on ISO 45001:2018 standard.

The main OSH directive in Brno's branch is the "SHE: Strategy and Management System" (referred to as SHE: SMS) directive. It defines the basic requirements for safety and health, and environmental protection for the Vacuum Technique area. This directive is updated annually and contains objectives for the current year, safety, health, and environmental management system (policy, planning, standards, tools, and programs, communication, etc.), and a monitoring system and measures.

The SHE: SMS directive is followed by many others, which discuss individual topics in more detail. These include f. e., risk assessment, health and hygiene, communication, accident investigation, internal audit, etc. (Internal documents, 2022)

4.2.1 Training

This directive describes the training rules for all stakeholders of the company in more detail. Right at the beginning, it emphasizes the training for all, including the company's visitors. The main principle is that every employee has the right to refuse an activity or task if he or she has not been properly trained for that. The line manager is responsible for the employee to be properly trained. The employee is obliged to regularly visit the internal e-learning portal and complete all assigned training.

In addition to the basic training, every Atlas Copco business area must provide the training based on the job positions and activities and in a language understandable for every employee. All training must also follow the results of risk analysis, accident analysis, valid legislation, or the requirements from the Atlas Copco group. All training must be reviewed every time the new employee joins the company or changes the positions. And at least once a year or when there is a change in the internal processes and activities.

For job positions or work tasks/activities that involve a high risk of hazard, the employee will be assigned suitable formal training, which may include practical training and verification of knowledge in the form of a test. The training may end with the appropriate certification, confirming that the employee has undergone the appropriate training and is ready to perform the assigned activity or tasks, e.g., the transport of dangerous goods, risk assessors and security technicians' positions, etc. (Internal documents, 2022)

4.2.2 Risk assessment

This directive specifies the risk assessment of the companies in the Vacuum Technique area. It is the responsibility of each Atlas Copco subsidiary to identify risks and perform risk analysis and risk assessment. Regular and irregular activities must be included in the risk assessment, not only the activities within the processes in the company but also activities related to all persons who have access to the company, including visitors, contractors, etc. The company must also evaluate the risks for activities where employees work outside the company (during business trips or when performing activities in another organization). The risk analysis must consider the human factor, infrastructure, equipment, and materials in the workplace and indirect factors that may affect work activities, such as when employees do some sport during a lunch break.

Regarding the risk management, this directive sets out the hierarchy to be followed:

- Risk elimination
- Risk reduction
- Isolations (such as barriers...)
- Checks (warning signals, work rotation...)
- PPE
- Discipline (according to SHE:SMS)

The basic requirements of this directive include the obligation to assess the risks of all activities. This must be reviewed at least every three years, earlier in the case of some change or new legislation and must be done by a competent and responsible person. All identified risks must be communicated to those who may be affected. After the risk is treated, there must be inspections and monitoring. (Internal documents, 2022)

4.2.3 Communication

Communication plays a big role in health management. For the OSH management system to work properly, communication must happen at all levels in the organization. The Communication Directive lists the requirements in this area. A SHE commission must be established if the branch has more than five employees. It consists of employees who represent all disciplines in the company. The list of commission members is posted on the

noticeboard to clear to other employees who represent them at SHE. The commission meets at least once a quarter and keeps a proper report of these meetings. (Internal documents, 2022)

4.3 Risk analysis

One of the components for comparison in the analysis part is the risk analysis. For this purpose, the SIPOC method will be processed, analyzing the "Pick-to-Ship" process, and identifying possible hazards arising from the individual activities. The SIPOC method will be used to identify risks; for the risk assessment and determining the risk acceptability, the LCO method will be used.

4.3.1 SIPOC

Methods of brainstorming, observation, and interviews with responsible persons who know the whole process in detail were used to complete the SIPOC method. The result of the SIPOC method is depicted in Figure 11. First, the focus was on the category "Suppliers." Here, it was important to answer the question of "what we expect from the supplier and what requirements we have for those inputs to achieve the best output." Then, the output of the process was needed. Finally, it was necessary to determine what output the customer expected from us. To get the best output, there are certain needs that need to be included in this process, and those are resources, men, methods, and measurements.

Then, together with the team, we evaluated the individual areas to determine which areas pose a risk and need more detailed analysis. These lines are marked red in Figure 11.

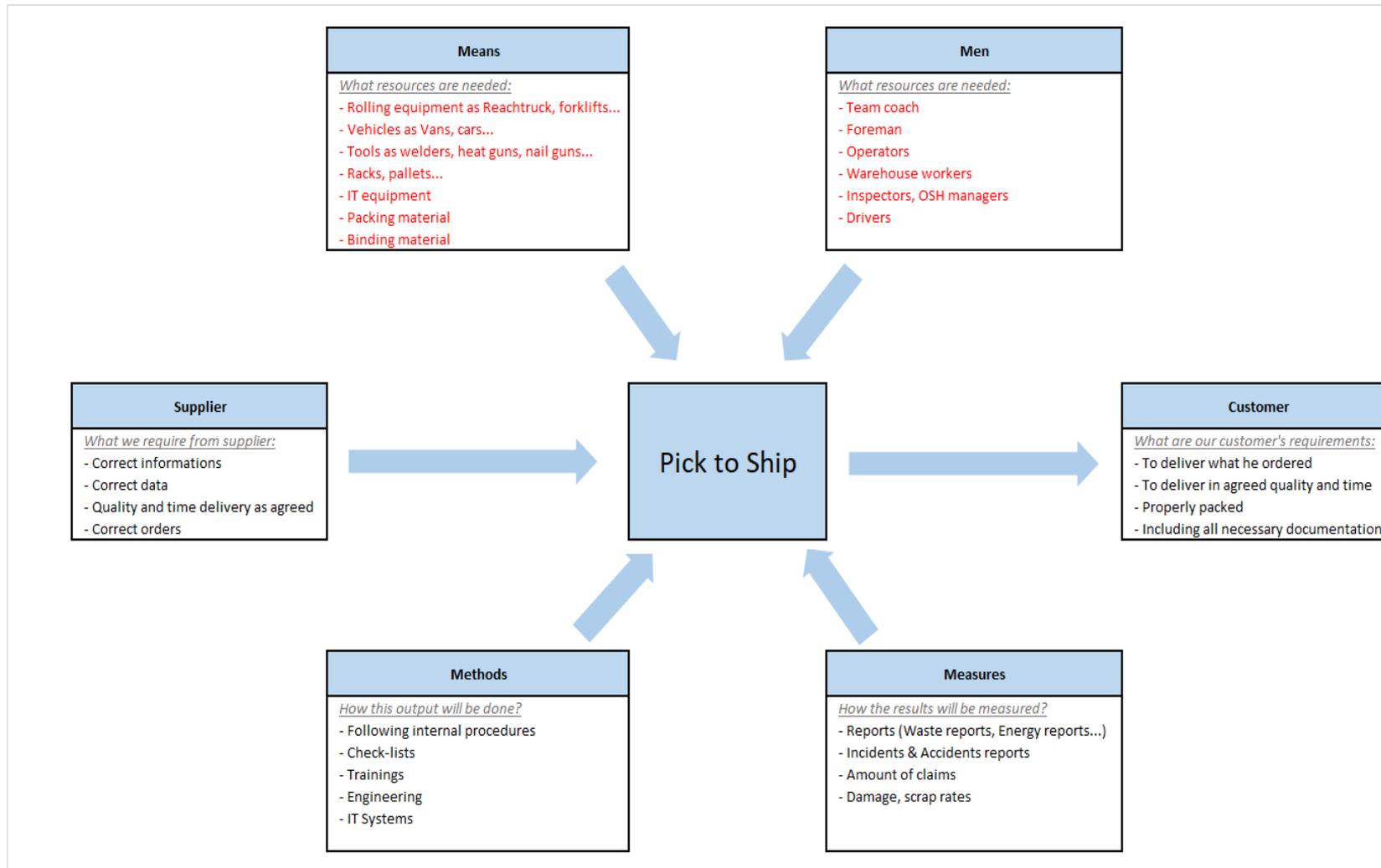


Figure 11: SIPOC method – Brno (own processing)

4.3.2 LCO method

Figure 11 shows that different risks may arise from the category of resources and the category of men. Therefore, the next step was to do a detailed analysis. First, each line determined which risks were posed by individual activities, then these risks were assessed based on the likelihood, consequences, and opinion values. Then based on the table, it was decided whether the risk was acceptable for the company.

For this risk assessment, the following tables of the likelihood, consequences, and opinion were created:

Table 2: Likelihood ranking (own processing)

Likelihood ranking	
Nr.	Description
1	Rare
2	Unlikely
3	Possible
4	Likely
5	Almost certain

Table 3: Consequence ranking (own processing)

Consequence ranking	
Nr.	Description
1	Work accident without incapacity for work
2	Work accident with incapacity for work
3	Serious injury requiring hospitalization
4	Serious injury and injury with permanent consequences
5	Fatality

Table 4: Opinion ranking (own processing)

Opinion of the evaluators ranking	
Nr.	Description
1	Negligible impact on the hazard and threat rate
2	Small impact on the hazard and threat rate
3	Greater, non-negligible impact on the hazard and threat rate
4	Large and significant impact on the hazard and threat rate
5	More significant and adverse impacts on the hazard and threat rate

Table 5: Risk rating (own processing)

Nr.	Risk rating	
1	< 3	Insignificant risk
2	3 - 10	Acceptable risk
3	11 - 50	Moderate risk
4	51 - 100	Undesirable risk
5	> 100	Unacceptable risk

Figure 12 shows the risk assessment based on the Pick-to-Ship process, covering the Equipment and Machinery category. Most dangerous situations arise from working with forklifts, cranes, cars, and similar equipment. For each hazardous situation, the likelihood (L), consequences (C), and opinion (O) were evaluated, and based on the formula $R = L \times C \times O$, the risk rate and acceptability of the risk were determined. All hazardous situations were assessed as insignificant or acceptable risks in this category. This is based on well-applied measures in the company and regular training and inspections.

Another category for risk assessment was the "racks, pallets." As shown in Figure 13, nine hazardous situations were assessed; mainly, there were risks of tripping and injury caused by the pallets left beyond the reserved area. Four risks were assessed as insignificant, another four were assessed as acceptable, and one risk was rated as moderate. The moderate risk comes from the hazardous situation of falling material stored in the higher places. Employees are familiar with the risk and regularly trained. They have been provided with the appropriate

PPE. The number of people in this warehouse area is limited - only authorized persons can be there.

These two categories were followed by the risk assessment for the "tools and material" category (Figure 14). Employees work with many tools, which can be a source of various hazards. Hazardous situations were identified as electric shock, burns from a manual plastic welder, injuries from work with compressed air, fall of pneumatic nail guns which could cause injuries or damage to property, injuries from the nail guns, power tools, or the risk of burns from the hot air gun. All employees who work with these tools are regularly trained and provided with the PPE. These measures help to keep these risk ratings at an acceptable level.

The last analyzed category was IT equipment. Employees work with computer technology. Therefore, It was important to identify and evaluate also risks arising from these activities. There is a risk of health damage (eyesight, carpal tunnels, back pain, etc.). Therefore, it is important to follow the principles of ergonomics for healthy and safe work on computers. Employees are trained on this topic and work with the equipment that meets ergonomic requirements. Another hazardous situation is tripping over loose cables from computers. As a measure here, it is necessary to fasten all cables, so they are not in the areas where the employees move. All risks were rated as acceptable. The results are shown in Figure 15.

Process	Means	Men	Hazard	Current measures	L	C	O	Rating	Acceptability based on the Table 5
Pick - to - Ship	Equipment, Machinery	All	Risk of charging cable of different machines replacement.	Informing employees about this risk, visible description of the cables.	1	2	2	4	Acceptable risk
			Risk of the cooling system damage from the forklift.	Informing employees about this risk, visible area marking, trainings	2	2	2	8	Acceptable risk
			Risk of a collision of the forklift with the workers due to the fast speed.	Informing employees about the risk, regular trainings, practical trainings	2	2	2	8	Acceptable risk
			Risk of a collision of the forklift and the crane if the boom is extended too much.	Informing employees about the risk, emphasize caution, regular trainings	2	2	2	8	Acceptable risk
			Risk of shifting, slamping or falling of the entire rack during handling and storing of goods on a rack that does not have a full bottom.	Warehouse locations equipped with transverse beams that prevent stored goods from falling. Regular trainings, regular inspections and revisions	2	2	2	8	Acceptable risk
			Risk of a collision of the forklift with people or material when leaving the aisle.	Informing employees about the risk, emphasize caution, reduction of the maximum speed of forklifts, signalization when the forklift moves, warning signs, restriction of movement - only authorized persons	2	2	2	8	Acceptable risk
			Risk of acid splashes while adding distilled water to the truck battery.	Provided PPE, regular trainings	2	2	2	8	Acceptable risk
			Risk of a health or property damage if the automatic brakes of the crane fail.	Regular maintenance and inspection	2	1	1	2	Insignificant risk
			Risk of a collision of the worker or forklift with the crane control or hook that has been left in the communication.	Informing employees about the risk, regular trainings	2	2	2	8	Acceptable risk
			Risk of a collision of the car that is entering the warehouse with the crane or suspended load.	Informing employees about the risk, regular trainings, internal traffic regulations	2	1	2	4	Acceptable risk
			Overloading of crane or slings.	Informing employees about the risk, regular trainings, inspections, weight checks	2	1	1	2	Insignificant risk

Figure 12: LCO method Brno – Equipment, Machinery (own processing)

Process	Means	Men	Hazard	Current measures	L	C	O	Rating	Acceptability based on the Table 5
Pick - to - Ship	Racks, pallets	All	Pallet trucks and pallets that have been left beyond the reserved area. The risk of tripping and injury.	Informing employees about this risk, pallet trucks have to be parked in the reserved area, regular trainings	2	2	2	8	Acceptable risk
			Hitting the foot with the pallet truck, overturning, pinching during handling of the pallet truck.	Regular trainings, PPE	2	1	2	4	Acceptable risk
			The risk of falling of the entire stand or damage of the stand in the case of a collision of the fork and the stand.	Regular inspections of stands, to Informing employees about the risk	4	1	2	8	Acceptable risk
			Risk of falling of the material stored in higher places.	Informing employees about the risk, limited movement in the warehouse, PPE, regular trainings	4	2	2	16	Moderate risk
			Risk of injury from slings.	Informing employees about the risk, regular inspections, PPE	2	1	1	2	Insignificant risk
			Risk of tripping, falling, pinching or tipping over goods in the loading and unloading ramp area.	Informing employees about the risk, regular trainings	2	1	1	2	Insignificant risk
			Risk of health or property damage by the vans entering to the warehouse area.	Informing employees about the risk, regular trainings	2	1	1	2	Insignificant risk
			Risk of health or property damage by the collision of the manipulating trucks and the goods which is left beyond the reserved area.	Informing employees about the risk and warehouse layout, marking the related area	3	1	2	6	Acceptable risk
			Risk of health or property damage resulting from leaving the hook and crane control lowered in the area with the forklifts movement.	Informing employees about the suitable location for parking of the crane, regular trainings	2	1	1	2	Insignificant risk

Figure 13: LCO method Brno – Racks, pallets (own processing)

Process	Means	Men	Hazard	Current measures	L	C	O	Rating	Acceptability based on the Table 5
Pick - to - Ship	Tools, Material	All	Electric shock	Regular revisions and maintenance, regular trainings, PPE	3	1	2	6	Acceptable risk
			Burn injury from the manual plastic packaging welder	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Injury from work with the compressed air	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Pneumatic nailgun fall - hazard of health and property damage	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Nailgun injury	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Burn injury from the sealing pliers	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Injury from hand-held power tools	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Burn injury from a hot air gun	Regular trainings, PPE	2	2	2	8	Acceptable risk

Figure 14: LCO method Brno – Tools, Material (own processing)

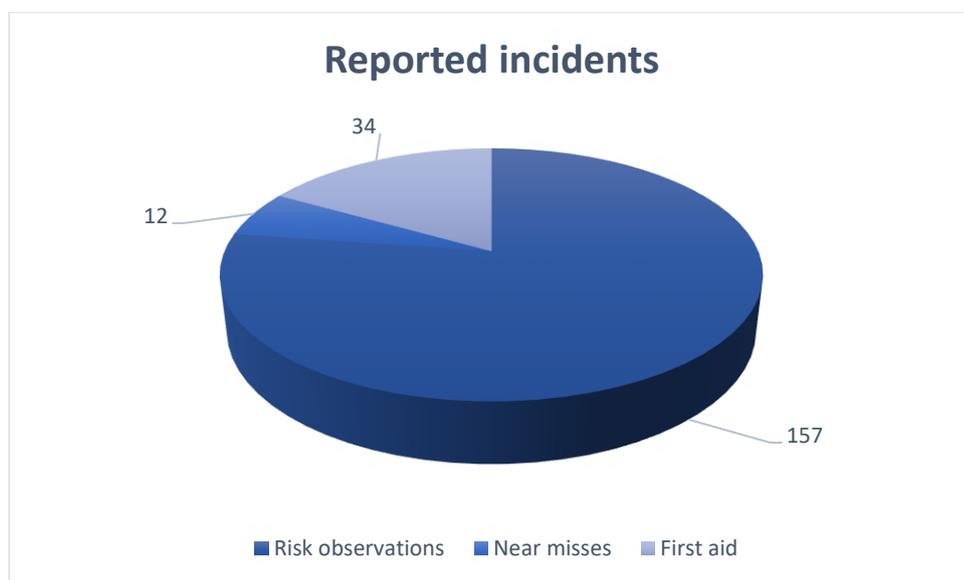
Process	Means	Men	Hazard	Current measures	L	C	O	Rating	Acceptability based on the Table 5
Pick - to - Ship	IT equipment	All	Risk of eye damage from long-term work on a PC	Informing employees about the risk, correctly installed equipment, regular trainings	2	2	2	8	Acceptable risk
			Risk of health damage from long-term work on a PC	Informing employees about the risk, correctly installed equipment, regular trainings	2	2	2	8	Acceptable risk
			Risk of tripping over poorly secured cables from IT equipment	Informing employees about the risk, correctly installed equipment, regular trainings	2	2	2	8	Acceptable risk

Figure 15: LCO method Brno – IT equipment (own processing)

4.4 Work accidents

In Atlas Copco, the emphasis is on involving all employees on all levels in the OSH management system. The company is aware that involving everyone in the OSH makes the OSH management system more effective. One of the examples is that employees observe the workplace and report situations that could lead to an accident or another incident.

203 incidents were reported in the Brno branch in 2020 and 2021. In 157 cases, the risk observation incidents were reported, in 12 cases, it was a near-miss incident, and 34 reported incidents were related to a first aid injury.



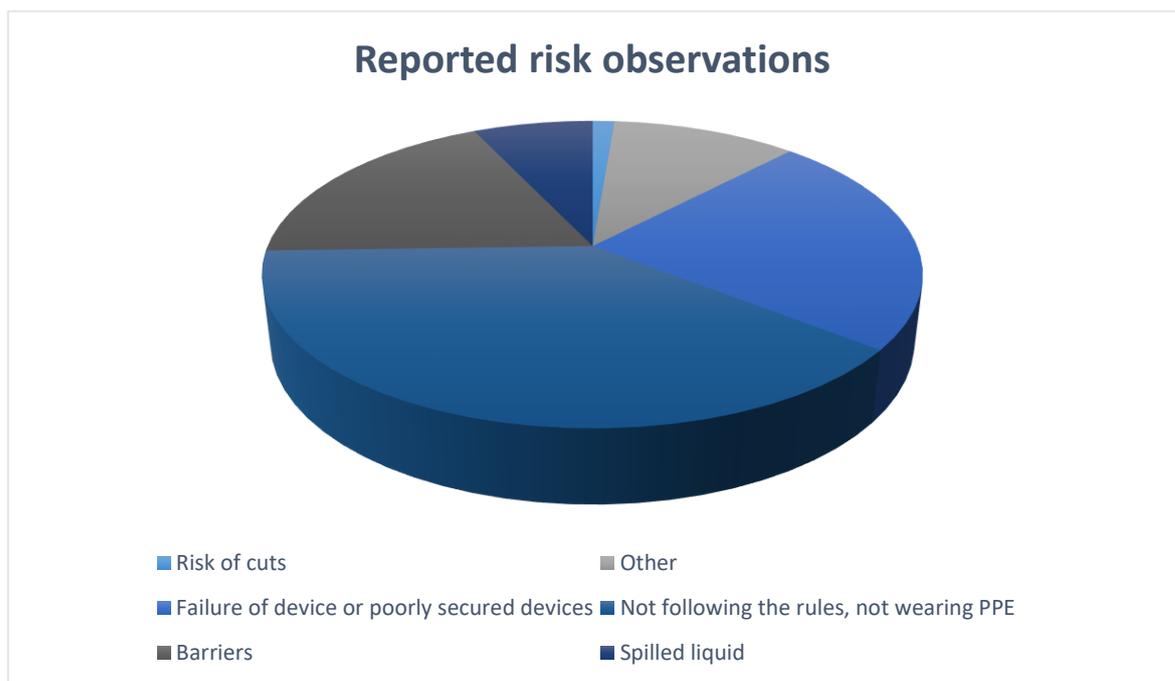
Graph 3: Reported incidents – Brno (Internal documents, 2022)

4.4.1 Risk observations

In 2020 and 2021, employees in Brno reported over 140 situations in which the safety of employees or the company property was endangered. Every reported incident is reviewed and, if necessary, remedied. By being careful and reporting such situations, it is possible to prevent possible work accidents. Not following the internal rules or not using the PPE were the most often reported incidents in the risk observation category (40 %). As mentioned in the chapter [LCO method](#), the applied measure was related to providing PPE for most of the hazards. These protect employees from a work accident. Many of these reported incidents also include external persons.

Another frequently reported situation was a failure of the device or poorly secured device, e.g., a wheel failure in the truck which created a risk of a collision with the rack, the product falling from the heights, a pallet placed vertically, and thus the risk of its falling or the suspended load on the crane without supervision. This was around 24 % of all reported risk observations in this category.

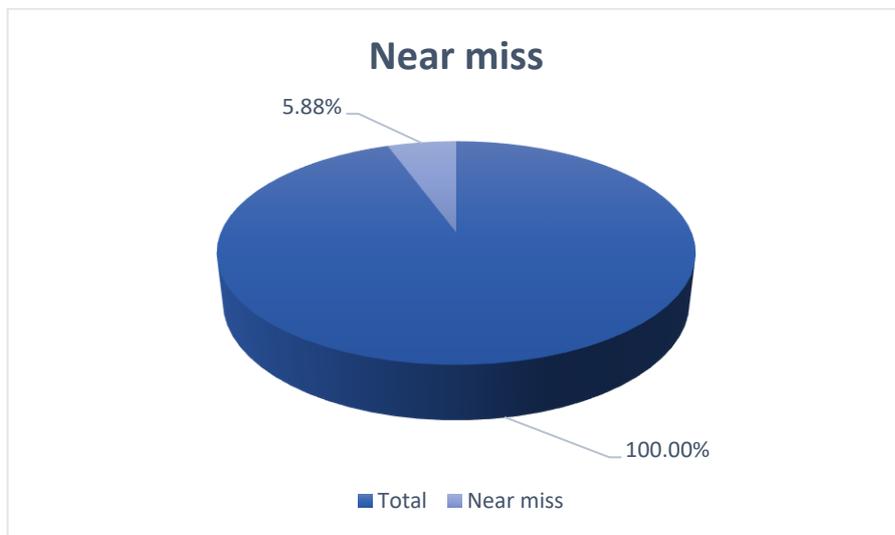
Less than 20 % were barriers in the workplace. These were often pallets placed outside the reserved area, impassable aisles, or left trucks outside the reserved area. Approximately 7 % of the reports concerned spilled liquid like oil, water, etc. After receiving these reports, the area was immediately cleaned, and possible slipping or another accident was prevented. The remaining reports in the risk observations category concerned the possible danger of cuts, increased noise, overloading the capacity of the equipment, etc.



Graph 4: Reported risk observations – Brno (Internal documents, 2022)

4.4.2 Near misses

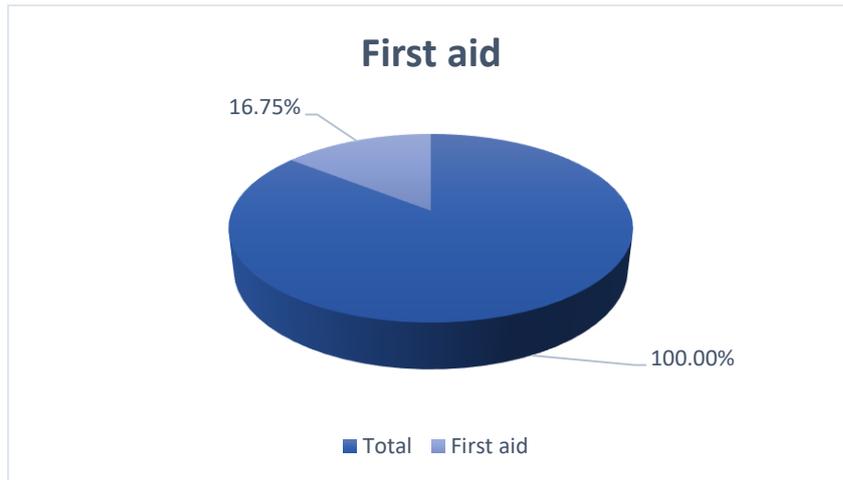
Another reported incident group belongs to the near misses. In the reported incidents, there were, for example, a malfunctioning safety flap on the crane, which could cause the load to fall, missing bolts on the car's wheel, loosening of the drawer full of parts that could have injured a worker or overloading the bar with load and its fall. Fortunately, these incidents did not injure anybody, and the situations have been rectified. In total, near misses were reported in 6 % of cases of all incidents.



Graph 5: Reported near misses – Brno (Internal documents, 2022)

4.4.3 First aid

The rest of the reported incidents belong to the first aid injuries. These injuries were treated, and the workers could continue working soon. Out of all reported incidents, 17 % belong to first aid injuries.



Graph 6: Reported first aid – Brno (Internal documents, 2022)

4.4.4 Safety pyramid

As already mentioned in this thesis, Atlas Copco uses the Safety pyramid, which should be balanced at the end of the period. That means that the lowest layer of the pyramid (risk observations) should be bigger than the reported near misses and injuries. For this chapter, the Safety pyramid in Figure includes data for 2020 and 2021. (Internal documents, 2022)

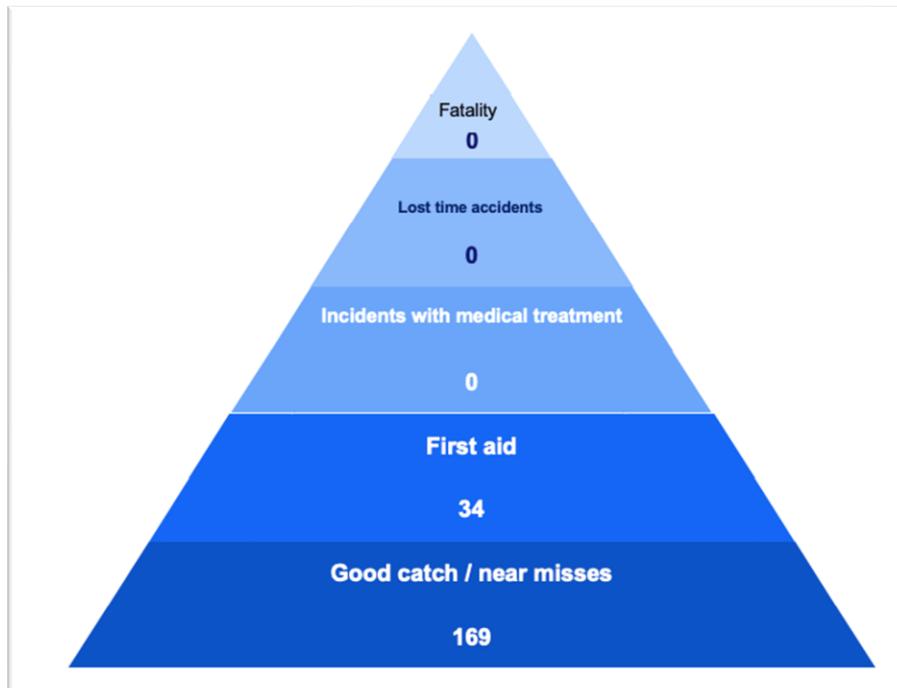


Figure 16: Safety pyramid – Brno (own processing)

4.5 Summary – Brno

In this chapter, the OSH management system in the Brno branch was introduced. It is an Atlas Copco service center with an average of 105 employees. This branch has a certification of the international standard ISO 45001:2018, which is a requirement of Atlas Copco for all the branches. The main directives and documentation in OSH in Atlas Copco are based on this certification. Each Atlas Copco branch then adopts or extends these directives to their management system. The Brno branch has well-prepared documentation for OSH. For the risk assessment, firstly, the SIPOC method analyzed the main process in the organization from which the risk activities were identified. These risk activities were then analyzed and evaluated from the point of acceptability with the LCO method.

The company also has great cooperation of all employees at all levels. All employees report hazardous incidents that could lead to more serious accidents (health hazards, occupational injury, damage to property, etc.), which makes it possible to prevent these accidents. The risk observations were reported in 77 % of all reported incidents, 6 % were near misses, i.e., situations that could have caused some harm to the worker or property, but fortunately, this was prevented by reporting these near-misses incidents. The rest of the reported incidents involved minor injuries that required just some minor treatment, and the employees could return to work.

Due to the well-established OSH management system at the Brno branch, and especially the mindfulness and training of the Brno employees, no serious injuries have occurred in the last two years. Encouraging employees to participate in OSH management is a clear example of how to create a safe working environment for all.

5 OSH MANAGEMENT ANTWERP

The second Atlas Copco branch chosen for the OSH comparison is the distribution center in Belgian Antwerp. In this chapter, the basic activities of this branch will be described as well as the OSH documentation, risk assessment and the incidents and work accidents statistics.

5.1 Basic information

The selected branch is the distribution center in Belgian Antwerp and belongs to the area of compressor technique. The average number of employees is 225. The main process consists of these activities:

- Inbound
- Inventory
- Warehouse
- Customer service
- Shipping and transport

The field of compressor technique deals with industrial compressors, gas compressors, air and gas treatment equipment, and air control systems. This area has a global presence. The distribution center is responsible for delivering products to customers in the most efficient way. The company has customers in textiles, assembly, healthcare, chemical industry, electronics, wood, etc.

The Belgian branch follows an established management system that supports the understanding and fulfillment of OSH requirements required by the Atlas Copco group and requirements based on international standards. The goal is to continuously improve and streamline activities in all company processes. The branch is certified by the international ISO standard 45001, ISO 9001, and ISO 14001. This management system seeks to guide the branch to increase efficiency, reduce the impact of activities on the environment, promote health and safety and at the same time, satisfy its customers.

Same as with the Brno branch, employees pay attention to their situation and report hazardous behavior or situations to the responsible persons. This effectively prevents work

accidents or other health or property damage. Everybody in this branch follows the simple STOP-THINK-ACT rule. (Internal documents, 2022)

5.2 OSH documentation

The branch in Antwerp also follows the directives system of "The Way We Do Things." As mentioned in previous chapters, The Way provides basic principles and rules; all branches can adapt these directives to their system or even extend it. The Belgian branch follows the directives of the Compressor technique area.

The main directive that summarizes the OSH management system at this branch is the "Occupational Safety and Health Management System" directive. It covers the OSH in several areas.

5.2.1 Employer, Employees

This directive states how the field of OSH affects employers and employees. For example, Atlas Copco Group has one of the main goals to ensure a safe and healthy working environment for its employees. Therefore, it constantly strives to streamline all processes to reduce the risk of work accidents or other threats to the employees' health.

Employees are expected to contribute to this by participating in workplace safety. The company also emphasizes preventing harassment, discrimination, or offensive behavior against employees. All employees can report any situation where they do not feel safe or danger. There are several ways in which employees can report incidents:

- **The internal application** that is used to report incidents and accidents and allows their investigation,
- **Team** with superiors take place at regular intervals, and there is always a chance to talk about issues related to safety and health, well-being, or other situations that may adversely affect employees,
- **Employee representatives** who regularly inspect the company's premises and look for possible risks that may endanger the safety and health of employees,
- **Atlas Copco Hotline.**

This directive also introduces the concept of well-being, which the company emphasizes as well as other aspects of health and safety. (Internal documents, 2022)

5.2.2 Responsibilities

The next part of the directive refers to the various stakeholders in the OSH area and specifies their responsibilities. In the company, the direct superior is responsible for properly managing the accident or incident. There is always a health and safety consultant with him who is responsible for investigating and concluding the whole reported incident or accident. (Internal documents, 2022)

5.2.3 Analysis of health and safety aspects

The directive instructs the company to review safety and health aspects at least once a year and take corrective actions. The company performs analysis in all areas that may affect the safety and health of all employees, including external employees, suppliers, and subcontractors, and the neighborhood and society. (Internal documents, 2022)

5.2.4 Objective

The company's goal is, of course, growth. And not only financially but also in matters of safety and health at work. Related to this, there is the annual goal of a balanced safety pyramid and the continuation of the reduction of work accidents. In addition to the balanced safety pyramid, an employee questionnaire is also used to determine whether employees agree that the company takes care of their safety and well-being (see the chapter Evaluation of the year 2021 in the company). (Internal documents, 2022)

5.2.5 Communication

Communication is perceived as an effective element for occupational health and safety management. The main communication of safety and health happens in quarterly meetings, where the ongoing results of safety and health goal, other necessary steps to meet the goals, progress, and other points that require attention are discussed. There are also regular team meetings, where safety and health issues are discussed.

5.2.6 Well-being

The well-being of employees is an often-mentioned topic in the company in the OSH area. The company consults with experts on processes to increase its employees' safety, health, and well-being. The company actively promotes mental and physical health and strives to build a work environment that positively affects employees so that employees actively take care of their mental and physical health. The company provides employees with consulting and support on disease prevention. Top management cooperates with the HR department, creating well-being programs for employees. These programs focus on four areas:

- **Emotional resilience** - in this area, the company offers its employees guides and consultations related to stress affecting employees' professional lives.
- **Nutrition** - the company also thinks about prevention in the form of healthy nutrition, and therefore, when corporate catering is available, a healthier option is always available. This area is also part of employee programs, where they are provided with information and advice for healthier and more balanced diets.
- **Physical activity** - another supported area within the well-being program is employees' physical activity. The company supports employees and their physical activity by cooperating with local sports facilities and gyms, actively promotes the opportunity to participate in the running events and tries to motivate employees to take the initiative in this area. Employees are physically active in the workplace too.
- **Quitting smoking** - another component of the well-being program is promoting the health effects of smoking. The company tries to motivate employees to quit smoking and thus improve their health. The company also strives to promote a non-smoking work environment.

5.2.7 Last Minute Risk Assessment

Another of the directives in the OSH field is the directive describing the last-minute risk assessment procedure (from now on, referred to as LMRA). This procedure aims to eliminate the possible risks from non-recurring activities (e.g., the maintenance team resolving a machine failure) and all services interventions (scheduled customer maintenance or machine failure service). The LMRA applies to all employees, suppliers, and other stakeholders. It is a tool for identifying potential hazards and associated risks and applying measures so that the risk is reduced to an acceptable level and the activity can be performed without endangering the life and health of the worker. To make this method work effectively, all the

people involved must have appropriate training as part of their qualifications. Before any non-routine activity begins, the worker must go through an LMRA checklist (Figure 18). The employee can start with the checklist only once he is at the place of activity. Then the employee goes through the questions and answers them according to the actual situation. If he finds any hazardous situation, he implements appropriate measures to control the hazard, and there is no threat to health or property. The line superior monitors the application of the measures, and the evaluation is then presented at the appropriate meeting. The directive also mentions the fact that any steps to reduce the risk must comply with the legislation, which is superior to the internal directives. (Internal documents, 2022)



Figure 17: LMRA principles (Internal documents, 2022)

Use the checklist and take appropriate actions to eliminate or control the risk to an acceptable level.		SYMBOL	Tick the right box		
			YES	NO	N.A.
Are safety instructions and/or risk assessment available and known?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is an authorized work permit available?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
People: is responsibility defined and clear to all? Are person(s) fit for the work?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are equipment, tools & tackles inspected & safe to use?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are all personal protective equipment(s) available, inspected and safe to use?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is your work site environment illuminated, clean and free from slip, trip & fall hazards?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are other activities in your work area identified, communicated and are actions taken?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Hazardous energy: Did you identify all energy sources and did you follow lock out - tag out procedures?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Chemicals: Did you follow the safety instructions for storage, transport & use?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Fall hazards: Did you take safety precautions for working at height?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Access & Exit: Are you aware of all access, exit and emergency procedures?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are precautions taken to eliminate fire or explosion hazard ?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ergonomics: Do you know the safety instructions for manual handling of material?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Are any other hazards like hot/cold surface, noise, radiation, confined space, sharp edges and extreme weather conditions identified and are actions taken?		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Figure 18: LMRA checklist (Internal documents, 2022)

5.3 Risk analysis

Also, for the Belgian branch, the SIPOC method has been processed for the main internal process, Pick-to-Ship. Subsequently, the risk activities were analyzed by the LCO method and determined the risk level and acceptability. Also, an expert team familiar with the Belgian branch was available for me when preparing the risk analysis.

5.3.1 SIPOC

First, it was important to fill in the inputs and outputs, i.e., suppliers as the input and customers as the output. The same criteria apply here as in the case of SIPOC in Brno; from the suppliers, the Belgian branch expects the right orders to be delivered in agreed quality and in the agreed delivery time. Customers expect the right orders to be delivered to them in the required quality and in the agreed delivery time, properly packed and including all the documentation.

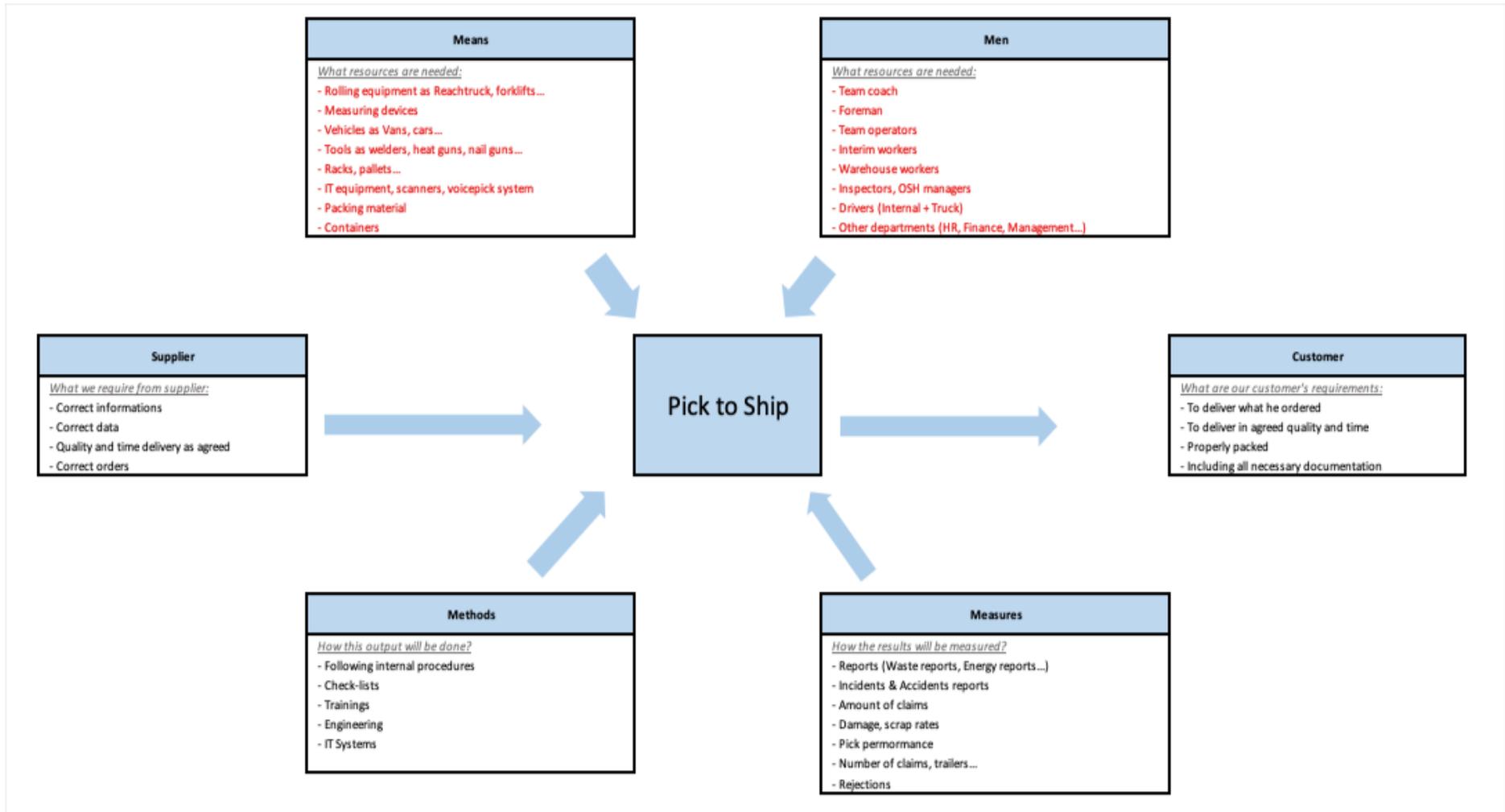


Figure 19: SIPOC method – Antwerp (own processing)

5.3.2 LCO method

For the risk assessment, which is based on the risk activities from the SIPOC method (Figure 19), the same tables as for Brno to assess the likelihood, consequences, and the opinion of the evaluators, were used.

Table 6: Likelihood ranking (own processing)

Likelihood ranking	
Nr.	Description
1	Rare
2	Unlikely
3	Possible
4	Likely
5	Almost certain

Table 7: Consequence ranking (own processing)

Consequence ranking	
Nr.	Description
1	Work accident without incapacity for work
2	Work accident with incapacity for work
3	Serious injury requiring hospitalization
4	Serious injury and injury with permanent consequences
5	Fatality

Table 8: Opinion ranking (own processing)

Opinion of the evaluators ranking	
Nr.	Description
1	Negligible impact on the hazard and threat rate
2	Small impact on the hazard and threat rate
3	Greater, non-negligible impact on the hazard and threat rate
4	Large and significant impact on the hazard and threat rate
5	More significant and adverse impacts on the hazard and threat rate

Table 9: Risk rating (own processing)

Nr.	Risk rating	
1	< 3	Insignificant risk
2	3 - 10	Acceptable risk
3	11 - 50	Moderate risk
4	51 - 100	Undesirable risk
5	> 100	Unacceptable risk

Risks were assessed in four categories:

- Equipment, machinery,
- Racks, pallets, containers,
- Tools, materials,
- IT equipment.

The identified risks in the "*Equipment, machines*" category were mainly related to the activities, including working with forklifts or other similar equipment (Figure 20), which is widely used in the Belgian branch. Due to the frequent movement of these devices, there is a risk of collisions with other workers, pallets placed outside the reserved area, or the fall of goods that are handled with these devices. Also, the risk of collision between the two devices was identified. Most risks were assessed as acceptable, and two risks were assessed as moderate. This mainly concerned the risk of a collision between two devices or a collision with workers or material when leaving the aisle with the forklift. Employees have been informed about these risks and are regularly trained. Areas with the forklifts, or similar devices, movement have limited access. Only the responsible persons can enter the area.

Furthermore, risks arising from activities with "*racks, pallets, and containers*" were identified. The risks identified in this category are shown in Figure 21. Most of the risks were related to a possible collision with the pallets placed outside the reserved area. Other risky activities include handling goods stored in higher places. During such activities, there is a risk of the goods falling on the worker, the worker falling, or the pallet falling if the employee stands on the pallet while trying to reach for the goods. As a measure to reduce these risks, the employees are regularly trained and instructed on the correct procedure for

handling goods placed in higher locations. There are equipment and devices to help pick up goods from the higher locations. Employees are also instructed to store pallets in a reserved area for this. Container risks have been assessed as insignificant, but employees are regularly trained and instructed to follow all principles when using containers. Almost half of the risks were assessed as acceptable and the rest as moderate.

For the risks arising from the handling of *"tools and materials,"* almost all of them were assessed as acceptable. As shown in Figure 22, a moderate risk was assessed for two risks. These were the risks associated with working with power tools and materials containing hazardous chemicals. These risks are reduced by the PPE provided to the employees and regular training.

The last category evaluated was the *"IT equipment"* (Figure 23). Here, the impact of working on a PC on workers' health was mainly evaluated. The branch in Belgium ensures compliance with the principles of ergonomics. All risks were assessed as acceptable.

Process	Means	Men	Hazard	Current measures	L	C	O	Rating	Acceptability based on the Table 5
Pick - to - Ship	Equipment, Machines	All	Risk of collision of the forklift with the workers	Informing employees about the risk, limited entry of people in the area with the forklifts, application of mirrors to risky places, regular trainings.	2	2	2	8	Acceptable risk
			Risk of collision of the forklift with the pallets placed outside the reserved area	Informing employees about the reserved area for pallets storage, emphasis on caution, regular trainings, limited speed of the forklifts.	2	2	2	8	Acceptable risk
			Risk of collision of the forklift with the workers or material when leaving the aisles	Informing employees about the risk, limited entry of people in the area with the forklifts, application of mirrors to risky places, regular trainings.	2	2	3	12	Moderate risk
			Risk of the forklift or similar devices falling	Regular trainings, compliance with the principles of working with the forklifts / reach trucks	2	1	2	4	Acceptable risk
			Risk of collision between two forklifts or other similar devices	Regular trainings, compliance with the principles of working with the forklifts / reach trucks, distance of at least two vehicles.	2	3	3	18	Moderate risk
			Risk of falling when entering or exiting the loading ramp	Regular trainings, compliance with the principles of working with the forklifts / reach trucks	2	2	2	8	Acceptable risk
			Risk of the goods tipping over when passing on a loading ramp	Regular trainings, compliance with the principles of working with the forklifts / reach trucks	2	1	2	4	Acceptable risk

Figure 20: LCO method Antwerp – Equipment, Machines (own processing)

Process	Means	Men	Hazard	Current measures	L	C	O	Rating	Acceptability based on the Table 5
Pick - to - Ship	Racks, Pallets, Containers	All	Risk of the pallet truck hitting the pallet left outside the reserved area.	Informing employees about the layout of the warehouse and reserved areas for pallet storage, regular trainings, visible marking of areas	2	2	2	8	Acceptable risk
			Risk of the entire rack falling, or goods stored in higher places on the racks falling, after the hit from the pallet truck.	Informing employees about the risk, regular inspections and trainings, emphasis on the use of the reachtrucks for getting the goods from higher locations	2	3	2	12	Moderate risk
			Risk of goods falling that are stored in higher locations.	Informing employees about the risk, regular trainings, emphasis on the use of the reachtrucks for getting the goods from higher locations	2	2	3	12	Moderate risk
			Risk of injury after the pallet falling that is not place on the ground but place vertically.	Informing employees about the risk and handling of pallets as well as reserved areas for pallet storage, regular trainings.	2	2	2	8	Acceptable risk
			Risk of the foot injury when being hit by a pallet truck	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Overfilling of containers	Regular trainings and inspections	2	1	1	2	Insignificant risk
			Improper use of containers	Regular trainings and inspections	2	1	1	2	Insignificant risk
			Risk of injury if the pallet slumps	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Risk of tripping over a pallet stored outside the reserved area	Informing employees about the layout of the warehouse and reserved areas for pallet storage, regular trainings, visible marking of areas, PPE	2	2	3	12	Moderate risk
			Risk of injury of employees handling goods placed in higher locations	Informing employees about the risk, regular trainings, emphasis on the use of the reachtrucks for getting the goods from higher locations	2	2	3	12	Moderate risk
Risk of the employee falling when trying to reach for goods place in higher locations.	Informing employees about the risk, regular trainings, emphasis on the use of the reachtrucks for getting the goods from higher locations	2	3	3	18	Moderate risk			

Figure 21: LCO method Antwerp - Racks, Pallets, Containers (own processing)

Process	Means	Men	Hazard	Current measures	L	C	O	Rating	Acceptability based on the Table 5
Pick - to - Ship	Tools, Material	All	Risk of injury when working with cutters	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Risk of injury when working with packaging material	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Risk of injury when working with power tools	Regular trainings, PPE	2	2	3	12	Moderate risk
			Risk of health damage when working with material containing hazardous chemicals	Regular trainings, PPE	2	3	3	18	Moderate risk
			Risk of injury when handling sharp tools	Regular trainings, PPE	2	2	2	8	Acceptable risk
			Risk of falling when tripping over the stored material outside the reserved area	Regular trainings, PPE, visible marking of the reserved area for material storage	2	2	2	8	Acceptable risk
			Risk of material falling from heights	Regular trainings, PPE, visible marking of the reserved area for material storage	2	2	2	8	Acceptable risk
			Risk of burn injury from the hot air gun	Regular trainings, PPE	2	2	2	8	Acceptable risk

Figure 22: LCO method Antwerp – Tools, Material (own processing)

Process	Means	Men	Hazard	Current measures	L	C	O	Rating	Acceptability based on the Table 5
Pick - to - Ship	IT equipment	All	Risk of eye damage from long-term work on a PC	Informing employees about the risk, correctly installed equipment, regular trainings	2	2	2	8	Acceptable risk
			Risk of health damage from long-term work on a PC	Informing employees about the risk, correctly installed equipment, regular trainings	2	2	2	8	Acceptable risk
			Risk of tripping over poorly secured cables from IT equipment	Informing employees about the risk, correctly installed equipment, regular trainings	2	2	2	8	Acceptable risk
			Risk of injury when working with scanners	Regular trainings, following the operating instructions	2	2	2	8	Acceptable risk

Figure 23: LCO method Antwerp – IT Equipment (own processing)

5.4 Work accidents

The Belgian branch also emphasizes the involvement of employees in ensuring a safe working environment. This is being done by reporting potentially hazardous situations that can be eliminated in advance. As a result, there will be no work accidents or other incidents that could endanger the health of employees or company property. The big advantage for the Belgian branch is that there is a doctor and a nurse right in the company. Immediate treatment is available to the employees if needed.

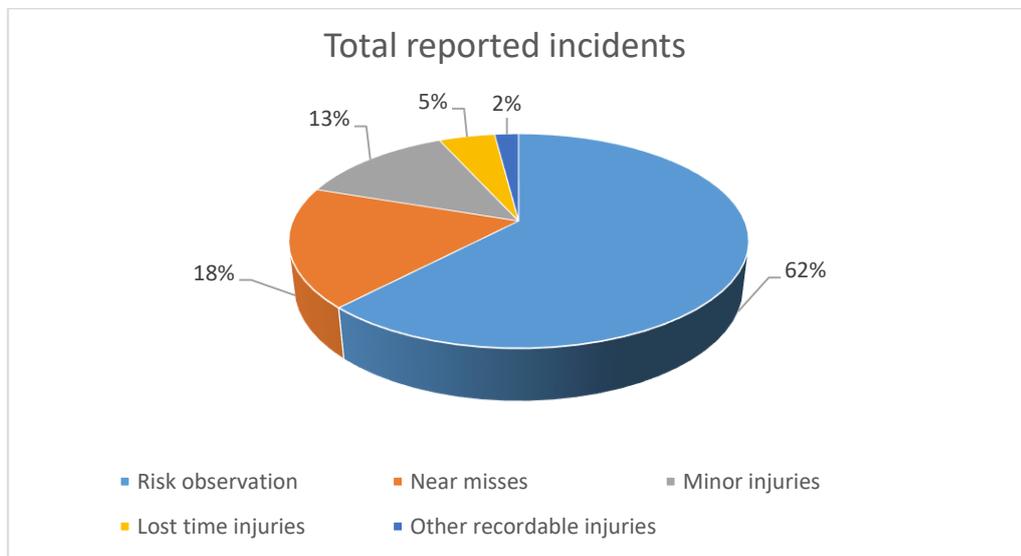
The branch in Antwerp also aims to have a balanced safety pyramid. However, unlike the branch in Brno, they follow an extended version of the safety pyramid. At the bottom of the pyramid are risk observations followed by near misses, minor injuries, other recordable injuries, lost-time injuries, high-consequence injuries, and fatality.



Figure 24: Safety pyramid Antwerp (Internal documents, 2022)

A total of 298 incidents were reported at the Belgian branch in 2020 and 2021. Of all reported incidents, 185 belong to the risk observations, another 18 % of reported incidents were near

misses, and the remaining incidents were injuries, of which 5 % were injuries that required incapacity for work.



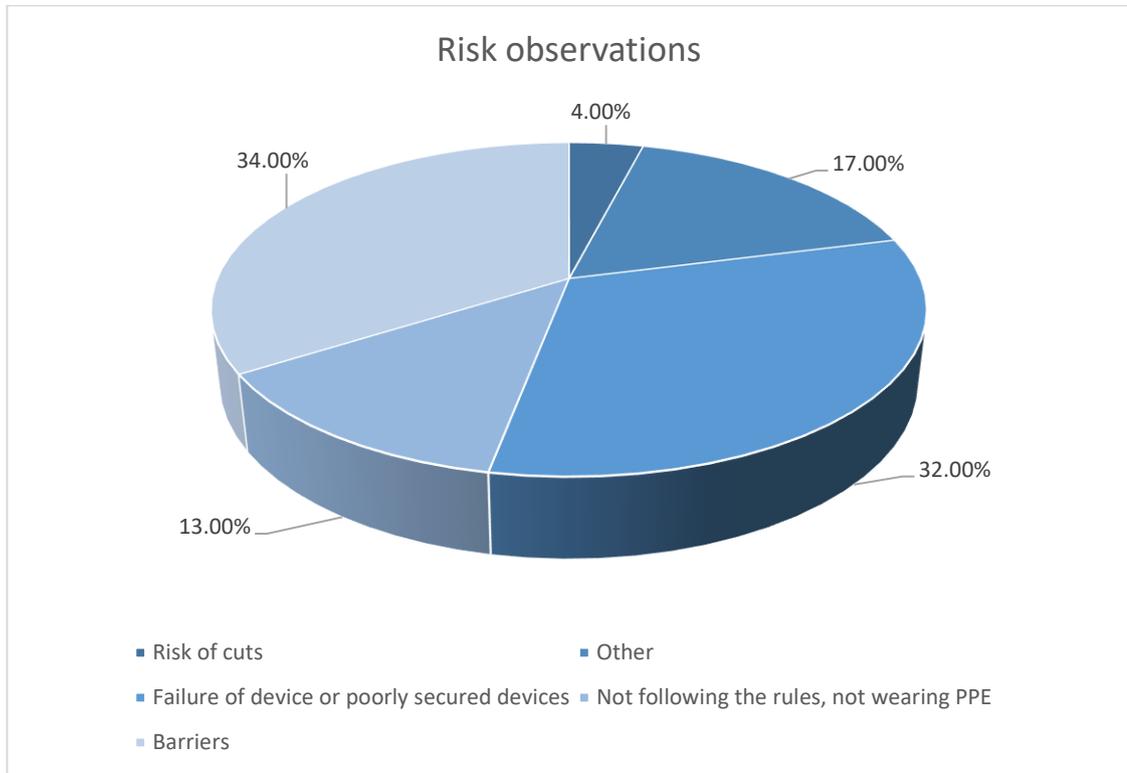
Graph 7: Reported incidents – Antwerp (Internal documents, 2022)

5.4.1 Risk observations

As mentioned above, a total of 185 reported incidents concerned risk observations. The most often reported were obstacles in the workplace (e.g., pallets left outside the reserved area or reduced visibility). Almost the same number of reported incidents involved various failures of devices or poorly secured devices. 13 % involved non-compliance with the rules, such as postponing the equipment and not securing it, opening fire exit, using the wrong containers, etc.). Finally, seven incidents of possible risks of injuries were reported, f. e., screws protruding from the wall.

All reported incidents were checked, and appropriate measures were taken if necessary (e.g., based on reporting an uneven road and the risk of the forklift overturning, the road was repaired immediately after reporting, in case of non-compliance, the employee was informed

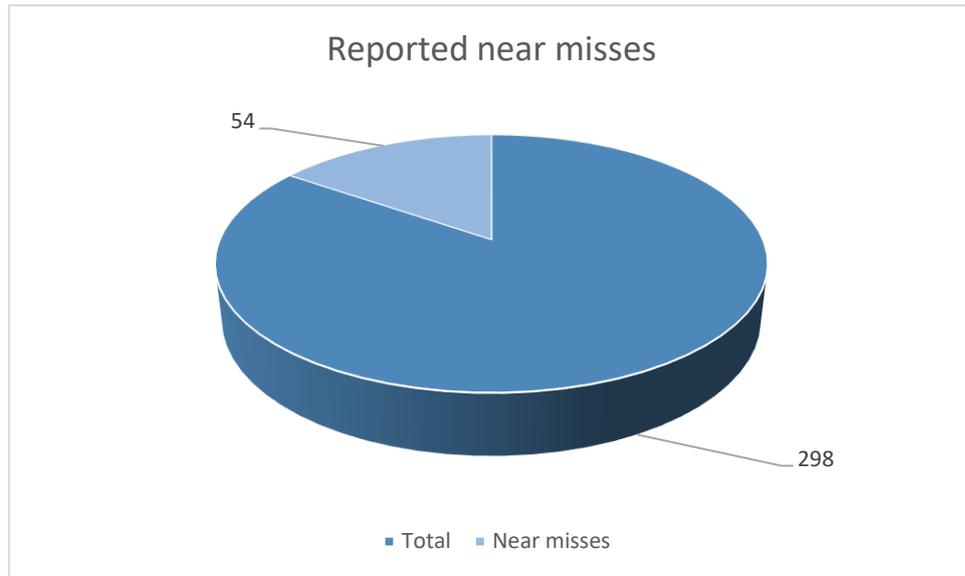
about the correct procedures, etc.). Because of this system, a possible accident or damage was prevented.



Graph 8: Reported risk observations – Antwerp (Internal documents, 2022)

5.4.2 Near-misses

In the case of the Belgian branch, a total of 54 near-misses incidents were reported in 2020 and 2021. Many incidents were related to hazardous situations, specifically concerning left pallets outside the reserved area. This usually happened when driving a forklift, the driver did not have a chance to see the pallet in the area where it should not have been at all. A frequently reported incident was also a situation where there was almost a collision with another forklift or a person due to lack of visibility. Another example of the reported near miss was the overturning of the forklift. Fortunately, no employee was injured. All incidents were investigated and, if necessary, measures were taken. For example, in the above-mentioned incidents, an extra mirror was installed in the area of the forklifts. Drivers of the forklifts were instructed to increase their attention and safety while driving the forklift.

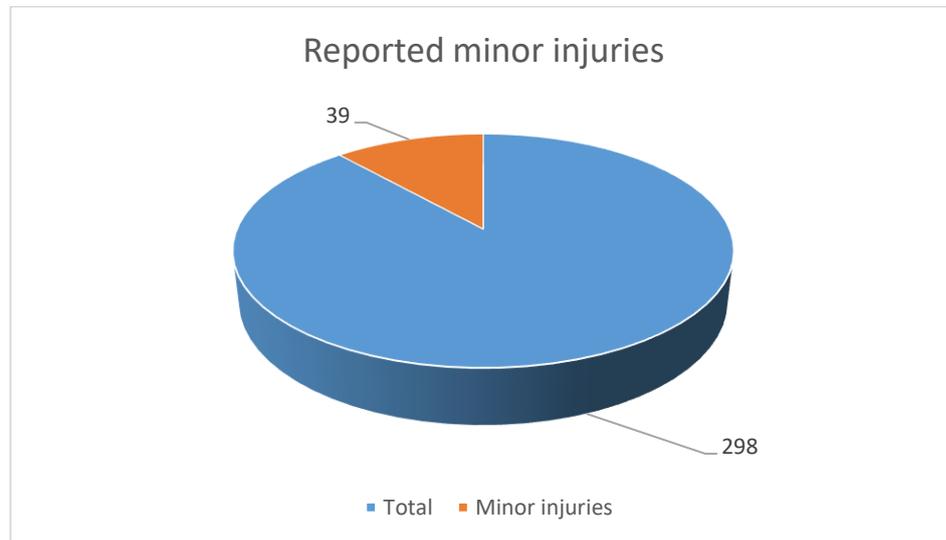


Graph 9: Reported near-misses Antwerp (Internal documents, 2022)

5.4.3 Minor injuries

Another group of reported incidents was minor injuries. This accounted for 13 % of all reported incidents. The employees affected by the incidents were medically treated if necessary, and after that, they could continue working. Every reported incident was checked, and measures were taken to ensure that a similar situation would not happen again. An example of such an accident was the fall of a box when the employee took down four boxes from a height location, and one fell on him. The box hit the worker in his eye. The situation was checked, and the employee was instructed that if it is necessary to take the box from the higher location, it is important to use the reach truck and manipulate the boxes once they are completely down. A similar case was reported from another employee who was injured by a box that fell, again when the employee tried to pick up the box from the high location. The box fell on the worker's shoulder. The same instructions were provided to this work as a

measure. Other injuries included cuts from a sharp edge of the table. This was removed immediately so that a similar injury would not recur.



Graph 10: Reported minor injuries – Antwerp (Internal documents, 2022)

5.4.4 Lost time injuries

Among the reported incidents, several accidents required incapacity for work. All work accidents in which the employee had to interrupt work for more than one day are reported in this category. A total of 14 incidents were reported in 2020 and 2021. The longest absence from work required an incident where the employee was injured by being hit by a forklift. The forklift driver could not see the worker in the area. As a result, the injured worker was unable to work for one month. Another reported injury, which requires incapacity for work for more than a week, occurred while securing two crates. The employee asked the forklift driver to remove the loaded crates and bring new ones, but there was poor communication, and due to the reduced visibility, the hand of the worker operating the crates was crushed. The situation was checked, and a mirror was installed to improve the visibility. Workers were instructed that communication with each other is important in such activities. Other injuries with incapacity for work included:

- hand injuries,
- several eye injuries (e.g., from the fall of a box from a high location - like previous categories),

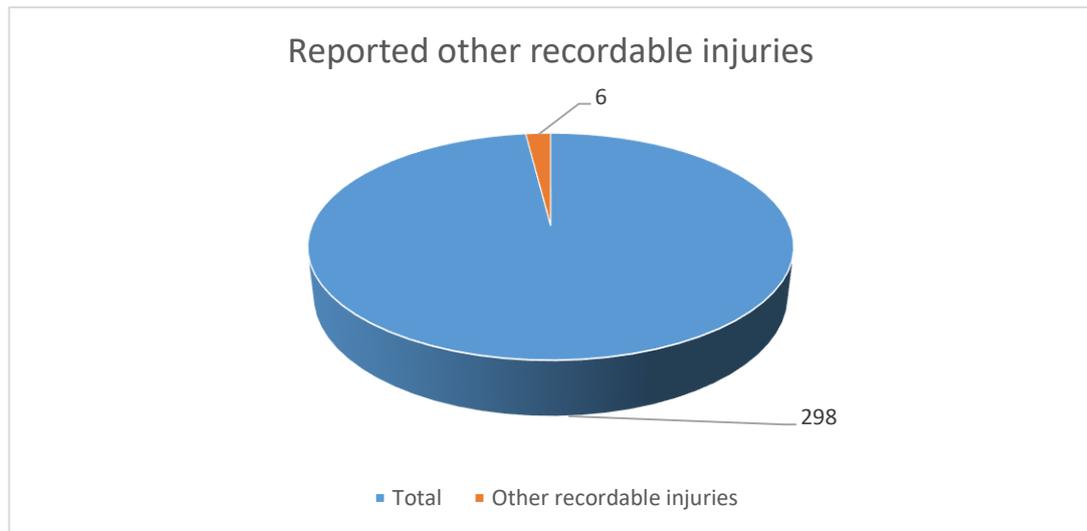
- foot injuries, or
- neck and shoulder injuries caused to an employee by being crushed between a trailer and a loading platform.



Graph 11: Reported lost time injuries – Antwerp (Internal documents, 2022)

5.4.5 Other recordable injuries

Less than two percent of all recorded incidents in 2020 and 2021 were other recordable injuries, including incidents requiring some work restrictions or medical treatment, loss of consciousness, or other injuries diagnosed by a doctor. However, the worker could continue working after the medical treatment. For example, the reported incidents included a heavy box falling on a worker's shoulders, back and shoulder pain after a collision with a pallet or a foot injury after hitting a pallet that the worker could not see. All incidents were investigated, and, if necessary, extra training or measures were taken.



Graph 12: Reported other recordable injuries – Antwerp (Internal documents, 2022)

5.4.6 Safety pyramid

The goal of the Belgian branch and Atlas Copco as a whole group is to have a balanced safety pyramid. Therefore, from the provided 2020 and 2021 data, a safety pyramid was compiled for the project. As shown in Figure 25, the pyramid meets the rule.:

Risk observation > Minor injuries > Lost time injury > Fatality

Therefore, it is confirmed that even in the Antwerp branch, this goal, thanks to the employees reporting all incidents, was fulfilled.



Figure 25: Safety pyramid – Antwerp (own processing)

5.5 Summary - Antwerp

In the sixth chapter of this thesis, the Belgian branch of Atlas Copco in Antwerp was introduced. This branch operates under the compressor technique area as a distribution center with an average number of 225 employees. Same as the Brno branch, also the Belgian one has a certified management system with the international standard ISO 45001:2018 (among others also ISO 9001, ISO 14001, and ISO 50001)

The company has well-processed documentation for the OSH management. All directives follow the instructions by Atlas Copco Group; they are only more elaborate for the area of compressor technique and tailored to this branch. The area of well-being, which the branch has also implemented in internal guidelines, also plays an important role in OSH. The company recognizes that mental health is as important as physical health, as it affects how the employee works in the workplace. That is why there are various projects focused on the well-being of employees; the company also supports employees in a healthy lifestyle. Employees are involved in OSH management by reporting all incidents that may endanger

their safety and health or company property. All employees are guided to follow a simple STOP-THINK-ACT rule.

The SIPOC method was used to identify the risk activities in the Pick-to-Ship process for the risk assessment. This method analyzes the inputs and outputs of this process and includes suppliers, customers, and other means, men, methods, and measures which are part of this process. All risk activities (in Figure 19, marked red) are then assessed by the LCO method to define whether the risk is acceptable or not.

The aim is to have a few work accidents as possible. The branch in Belgium uses a safety pyramid. Compared to Brno one, it has been expanded by more categories, but the goal is the same. It must always be balanced. 298 incidents were reported in 2020 and 2021, of which 62 % were risk observations. There was no serious accident by reporting these incidents and thus immediate action taken. Another 18 % were near-misses, and the remaining incidents were already related to injuries. All reported incidents were investigated, and, if necessary, a new measure was applied to reduce the risk level. Within this chapter, the safety pyramid was built and found to be balanced.

6 PROJECT OF OCCUPATIONAL SAFETY AND HEALTH MANAGEMENT COMPARISON IN ATLAS COPCO

This thesis aims a Project on Occupational Safety and Health Management Comparison in Atlas Copco. Two Atlas Copco branches were selected for this comparison - one in Brno and the second one in Belgian Antwerp. The current OSH management system at both branches was analyzed in the previous chapters. In addition, there was an introduction, OSH documentation, risk assessment, and work accident statistics for each branch.

6.1 A project objective

This project aims to benchmark occupational health and safety management in two selected Atlas Copco branches and based on this comparison, to suggest possible improvements in the OSH area and the implementation of these improvements in practice.

6.2 Data collection methods

Data collection for this project was based on observations, brainstorming, and interviews. To compare health and safety management in both branches, these components will be used for the benchmarking:

- OSH documentation
- Risk assessment
- Work accident statistics
- Safety pyramid

Due to fact that the Belgian branch has more employees than the Brno branch, the conversion to 100 employees will be used for comparison purposes if numerical data is used.

6.3 Benchmarking of OSH management

This chapter will compare the OSH management system at the Brno and Antwerp branches.

- Firstly, the focus will be on the **OSH documentation**,
- Followed by the results of **the risk analysis**,
- The **work accidents statistics** and the related **safety pyramid**.

6.3.1 Comparison - OSH documentation

As mentioned, many times, all Atlas Copco branches must have a certified health and safety management system with the international standard ISO 45001:2018. Both branches meet this criterion. Atlas Copco's guideline collection "The Way We Do Things" is also based on this certification. It determines the basic principles of the management system for individual areas, including OSH. Based on this directive, guidelines are also created for individual areas of the company (CT, VT, etc.). Branches operating in individual areas can implement this directive into their management system or even expand these directives.

The main directive for the Brno branch is the SHE directive: Strategy and Management System for branches in the Vacuum technique area. This directive, which has the main task of briefly describing the OSH management systems and referring to more detailed directives, is very comprehensive and covers all areas of OSH in this branch. Despite the directive's scope, it is very clear and easy to navigate in this directive. The Belgian branch also follows the SHE directive: Strategy and Management System for the Compressor technique area. This is followed by other directives, which discuss the topics in more detail, but the main difference from the Brno branch already occurs in this main directive. It is not nearly as extensive as the one for the Vacuum technique. It also contains links to other individual guidelines, where more detailed instruction can be found. However, the big difference is the clarity of these directives. The Brno branch has a clear table of topics on its internal share point, and under them, all related documents can be found. This is what the Belgian branch is missing, and it is very complicated to orient in this system.

However, what I must emphasize at the Belgian branch is well-being. This topic is often mentioned in connection with OSH, which is an important component of this area. The

orientation towards well-being is more applied at the Belgian branch, which has even a separate directive for this topic.

Table 10: Comparison – OSH documentation (own processing)

Comparison field	Brno	Antwerp
Certification ISO 45001:2018	Yes	Yes
The Way We Do Things guidelines	Yes	Yes
Directives base on the CT x VT area	Yes	Yes
Directives created specifically for the branch	Yes	Yes
A clearer system of the directives	x	
A detailed directive	x	
A bigger emphasis on well-being		x

6.3.2 Comparison – risk analysis

For the risk analysis at both branches, the methods SIPOC and LCO have been used. The main process in both branches "Pick-to-Ship" was analyzed by the SIPOC method. As part of this process, risk activities were identified, which were further assessed with the LCO method. In each risk category, hazardous situations were identified and based on the current measures in the organization, assessed according to the relation $R = L \times C \times O$. The outcome of this step was the risk acceptability.

Table 11: Comparison – Risk analysis (own processing)

Category	Number of identified risks									
	Insignificant risk		Acceptable risk		Moderate risk		Undesirable risk		Unacceptable risk	
	CZ	BE	CZ	BE	CZ	BE	CZ	BE	CZ	BE
Equipment, Machines	2	0	9	5	0	2	0	0	0	0
Racks, Pallets, Containers	4	2	4	4	1	5	0	0	0	0
Tools, Material	0	0	8	6	0	2	0	0	0	0
IT equipment	0	0	3	4	0	0	0	0	0	0

The methods SIPOC and LCO have been used for the risk analysis at both branches. The main process in both branches, "Pick-to-Ship," was analyzed by the SIPOC method. As part

of this process, risk activities were identified, further assessed with the LCO method. In each risk category, hazardous situations were identified and based on the current measures in the organization, assessed according to the relation $R = L \times C \times O$. The outcome of this step was the risk acceptability.

The first assessed category was "Equipment and Machinery for both branches." There is a high usage of forklifts and similar devices in both branches. Therefore, most of the identified risks stemmed from this. One of the most common hazardous situations was the forklift collision with people or pallets that had been left outside the reserved area. In the case of the Brno branch (Figure 12), the risks associated with adding distilled water to the truck's battery were identified. Many of Brno's risks also came from the activities with the crane. Therefore, in the case of the Brno branch, all risks were assessed maximum as acceptable. For the Belgian branch (Figure 20), a risk level higher than ten occurred for some risks, and therefore, those were assessed as moderate. Those moderate risks came from the risk of collision of the forklift with persons or material and danger of collision of two forklifts. Except for these two risks, the rest of the risks were assessed as acceptable for the Belgian branch.

Another category in the risk analysis was a category of racks and pallets, in the case of the Belgian branch, also containers (Figures 13 and 21). The risks arise from the impact of pallets left outside the reserved area or the fall of materials from higher places. The worst-rated risk in the Brno branch was the risk of the falling material from the higher places. The risk level value was 16, which means it is a moderate risk for the branch in Brno. The rest of the assessed risks were evaluated as insignificant or acceptable risks. At the Belgian branch, most of the identified hazards also concerned the collision of the forklifts with pallets or material stored outside the reserved area or the fall of material from higher places. In the Belgian branch, there were several risks assessed as moderate risks. Most of these risks are related to the material stored at heights. The higher level of risks at the Belgian branch is mainly because far more items are stored at heights. Even though employees have at their disposal the forklifts and reach trucks that allow them to reach for these items without endangering their health, this risk is still assessed more seriously than in Brno. However, all risks are acceptable for both branches.

Both branches use a lot of hand tools. Therefore, another category for risk identification and assessment was tools and material. In the case of the Brno branch (Figure 14), it was mainly the risk of injury when working with the electric current, welding machine, compressed air, nail guns, or other electric tools. Due to regular training and providing PPE to employees, all risks were assessed as acceptable. The Belgian branch (Figure 22) uses many power tools, which is why a higher level of risk was assessed here. The acceptability of this risk was assessed as a moderate risk. The moderate risks also arise from working with material containing hazardous chemicals. As in Brno, employees in Belgium have regular training, and PPE is provided for safer work with any tools.

Because both branches use IT equipment, it was necessary to identify and assess risks associated with IT equipment (Figures 15 and 23). This was mainly about the effect of this technology on workers' health. Both branches focus on ergonomics and adherence to the principles of ergonomics when working on a PC. All risks at both branches were assessed as acceptable.

6.3.3 Comparison – work accidents

Both branches rely on reporting not only work accidents but also risk observations. Because of this, hazardous situations are quickly rectified, and no serious accidents happen. At the end of the year, the goal is to have a balanced Safety pyramid (see the chapter Evaluation of the year 2021 in the company). For this comparison, the number of reported incidents was recalculated per 100 employees (see Table 12)

Table 12: Comparison – Reported work accidents (own processing)

Category	Number of reported incidents per 100 employees	
	Brno	Antwerp
Risk observations	62	82
Near misses	5	24
Minor injuries	15	17
Other recordable injuries	0	3
Lost time accidents	0	6
High-consequence injuries	0	0
Fatality	0	0
	82	132

Table 12 shows that the Brno branch records fewer reported incidents than the Belgian branch. Although more risk observations were reported at the Belgian branch, which could have prevented damage to the employees' health or the company's property, unfortunately, more work accidents occurred at the Belgian branch.

Table 13: Comparison – Reported risk observations (own processing)

Reported category	Reported risk observations in % (rounded)	
	Brno	Antwerp
Not following the rules, not using PPE	39%	13%
Barriers	18%	35%
Failure of device or poorly secured devices	24%	32%
Risk of cuts	1%	4%
Spilled liquids	7%	0%
Other	11%	16%

Table 13 shows that the largest percentage of reported risk observations in the Brno branch is non-compliance with the rules or work procedures or not using provided PPE. Obstacles (e.g., pallets outside the reserved area, discarded material, etc.) are more frequently reported in the Belgian branch. Almost the same number of reports in both branches concerned reports of a machine or equipment failure or a poorly secured device. The comparison of these statistical data shows that the employees of the Brno branch pay more attention to the little things that could lead to something more serious. Employees report more technical matters at the Belgian branch, such as obstacles and failures.

Other reported categories include near misses. In the case of Brno, it was 6 % of all reported incidents. Near misses reported in Brno included, for example, a hooked load, missing bolts at the car's wheel, or overloading the bar and its fall. The near misses reporting accounted for almost 20 % of all reported incidents in the Belgian branch. Here, as in the case of risk observations, most of the incidents concerned obstacles in the workplace. There was often a collision between the forklift or other equipment with the pallet placed outside the reserved area. Often reported incidents were also that the forklift almost collided with workers in areas with the low visibility.

The rest of the reported incidents were work accidents. The Brno branch distinguishes between categories of work accidents - first aid injuries, injuries requiring medical treatment,

injuries with incapacity for work, and fatalities. The Belgian branch has more work accident categories - minor injuries, other recordable injuries, lost time injuries, high-consequences injuries, and fatal injuries.

Table 14: Comparison – reported work accidents (own processing)

Work accident category	Number of reported injuries in % (rounded)	
	Brno	Antwerp
Minor injuries	100%	65%
Other recordable injuries	0%	12%
Lost time injuries	0%	23%
High-consequences injuries	0%	0%
Fatal injuries	0%	0%

The Brno branch registered 15 injuries per 100 employees in 2020 and 2021. Table 14 shows that all 15 incidents were minor injuries treated, and the employee continued to work. The Belgian branch has registered more serious injuries. A total of 26 work accidents were reported per 100 employees, of which more than 65 % were minor injuries, 23 % were injuries that required the injured employee's incapacity for work, and the remaining 12 % concerning injuries that somehow limited the employee at work, but those did not require the employee's incapacity for work. Minor injuries in Brno included various scratches or cuts. Frequent injuries in the Belgian branch included injuries to different parts of the body of workers who were trying to pick up material or goods from the heights. This was often a cause of work accidents also in the category of other reportable injuries. Here, too, it was a fall of the object from a height, when later the worker began to complain of back and shoulder pain. Another injury in this category was tripping over a pallet outside the reserved area. As for the injuries that eventually required the employee's incapacity for work, there was a frequent cause of manipulation with the forklifts or the fall of the box from heights. In the last part of the comparison, the Safety pyramid for both branches for 2020 and 2021 was created, both were balanced:

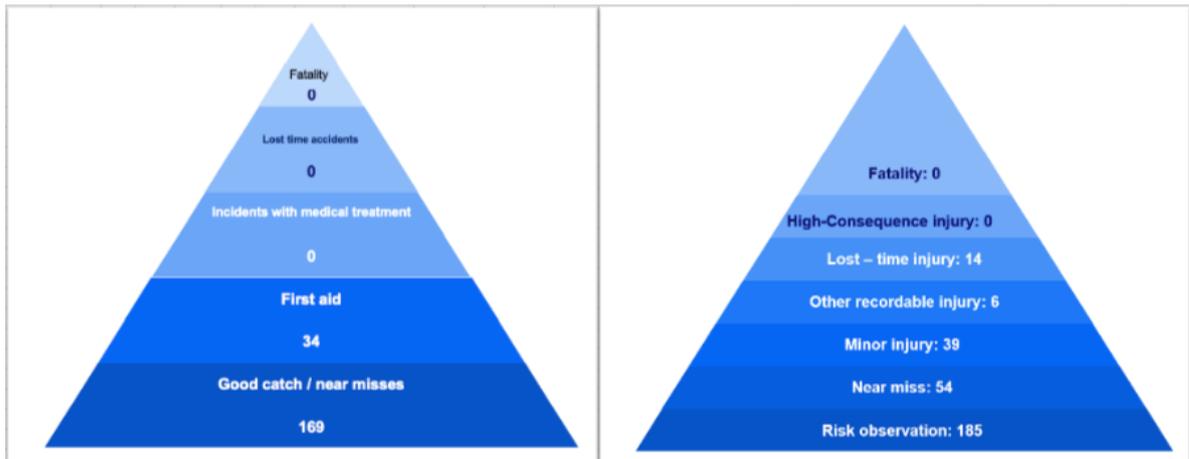


Figure 26: Comparison – Safety pyramids (own processing)

6.3.4 Suggested improvements

The OSH management system between two selected branches of Atlas Copco - in Brno and Antwerp, was compared in the previous chapters. Specifically in the areas of the documentation, risk analysis - which was based on the SIPOC and LCO methods and statistics of the work accidents and its related safety pyramids. Because the Belgian branch was once as large as the Brno branch, all numeric figures have been recalculated to 100 employees for a more accurate comparison.

The outcome of comparing occupational health and safety documentation is that the Brno branch has a much clearer system of the OSH guidelines. When visiting the internal SharePoint, it is immediately clear where to find the guidelines, and then all the documents are clearly in one place. This allows everyone who needs to access this documentation very quick access to the documents. Therefore, I would recommend the Belgian branch introduce **a clearer system of the OSH directives** so that, if necessary, it is immediately clear where the directives can be found. I would recommend promoting well-being more than so far for the Brno branch, as this is currently a frequently mentioned topic in the OSH area. I would suggest **including the well-being in the system of guidelines** and thus not only be one step ahead of the competition but also slightly improve the company's name on the market and show employees that the company also cares about their mental health.

From the comparison of the risk analysis and work accidents of both branches is clear that the Brno branch has a great system of reporting the risk observation and near misses. At the time of reporting any of these incidents, the incident is investigated, and, if possible, action

is taken immediately. Thanks to this established system and careful employees, there has been no serious work accident in the Brno branch in two years. The identified risks from the risk analysis are treated with the appropriate measures, the observance of which and, if necessary, the reporting of non-compliance with these measures protect Brno employees from the occurrence of work accidents. The risk analysis at the Belgian branch largely identified similar risks as in Brno. This is because these are (in terms of business activity) very similar branches. At the Belgian branch, as in the risk analysis then also in the reporting of the work incidents, there were very often situations concerning handling goods at heights and placing pallets outside the reserved areas. The risk of a work accident caused by a fall of material stored at heights or the risk of an employee falling when trying to pick up the material or goods from the heights was also assessed as a part of the risk analysis. Other assessed risks for the Belgian branch included the risk of injury when colliding with a pallet placed outside the reserved area or the forklift collision with a pallet placed outside the reserved area. Appropriate measures have been put in place to reduce these risks. Unfortunately, these incidents have also been reported very often as risk observations and near misses and as work accidents. Therefore, based on this comparison, I would recommend the Belgian branch **organize an extended training for employees**, including the practical part. If this step is successful, the Belgian branch could implement this training frequently into the training system for employees.

Table 15: Proposals of improvements (own processing)

Proposals	Branch	Project nr.
Proposal of the directive on well-being	Brno	2022001
Proposal to modify the internal sharepoing for a better overview of OSH documentation	Antwerp	2022002
Project of extended training for employees	Antwerp	2022002

6.4 Proposal of the directive on well-being

Project nr. 2022001

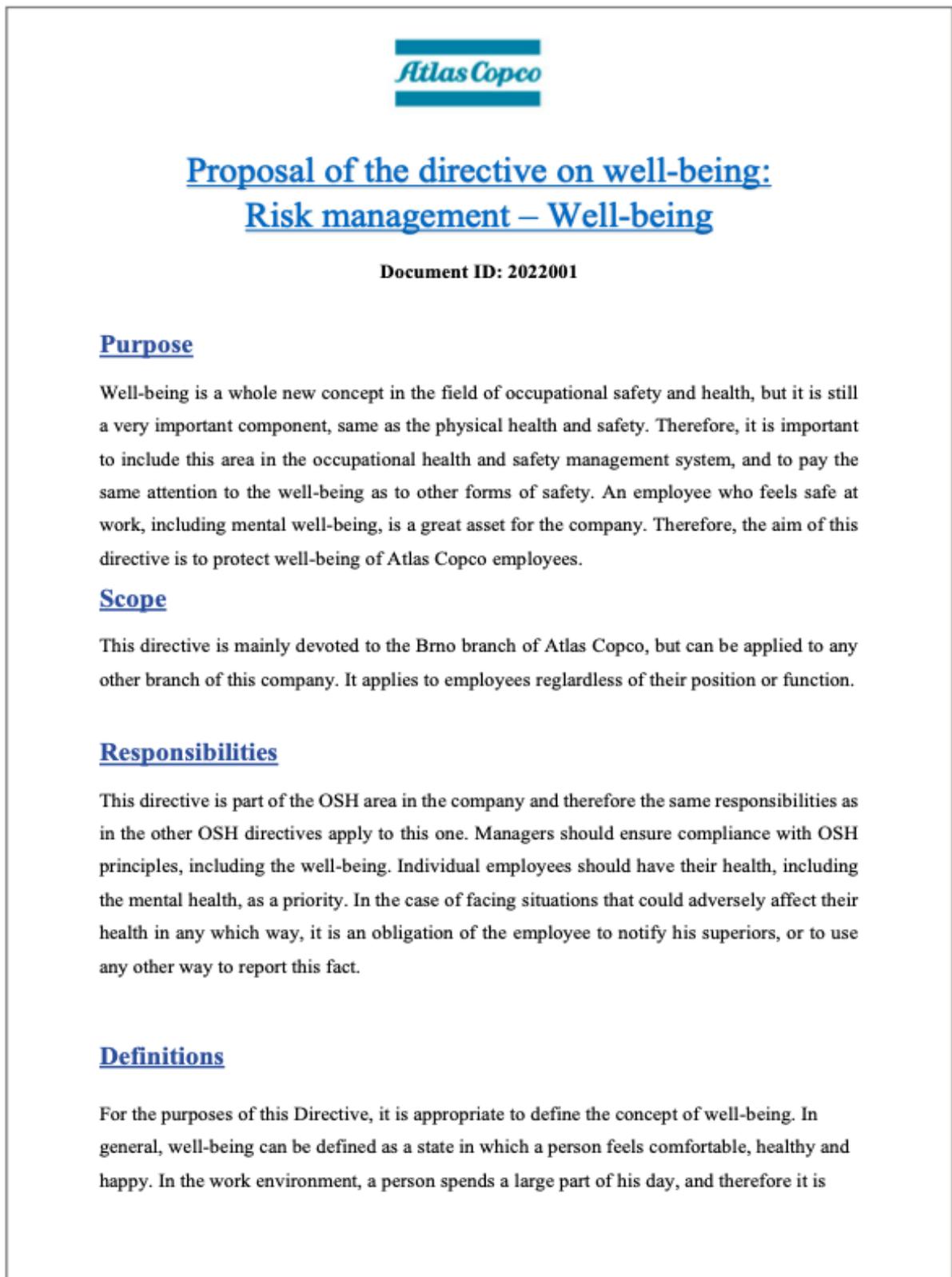


Figure 27: Proposal of the directive – well-being
(own processing, logo Atlas Copco © 2022)

Project nr. 2022001



important to find balance, security and well-being at all levels of his life. It is therefore very important for the employer to help employees to be satisfied, healthy and happy even in the workplace. Such employees are then a great, and long-term benefit to the company for the functioning and fulfilment of the set goals. (Hands on at Work, © 2018)

Procedures

The employer should provide workers with a working environment in which the worker has safe conditions for carrying out his work that do not endanger his health (physical or mental). In addition, employees should be provided with various training programs and projects to raise awareness of the importance of mental health. It is important that employees understand that talking about their mental health is important and perfectly fine.

The employer should also establish some programs to facilitate the employee's return to working life after an accident or other adverse event. It is important to promote a healthy lifestyle and impact of a healthy lifestyle on all areas of employee health. Employees are advised to follow the "Work smarter, not harder" rule. (Hands on at Work, © 2018)

Review

At least once in 2 years or earlier if needed.

Figure 28: Proposal of the directive – well-being
(own processing, logo Atlas Copco © 2022)

6.5 Proposal of the SharePoint adjustment

Another recommendation resulting from the comparison of the OSH management system in Atlas Copco was the adjustment of the internal SharePoint with the OSH documentation for the Belgian branch. The current system is unclear, and it is harder to find individual directives. Therefore, to simplify the overview of the directives, I recommend to the Belgian branch a graphical breakdown of the directives by topic and, after opening the link, to have all relevant documents available:

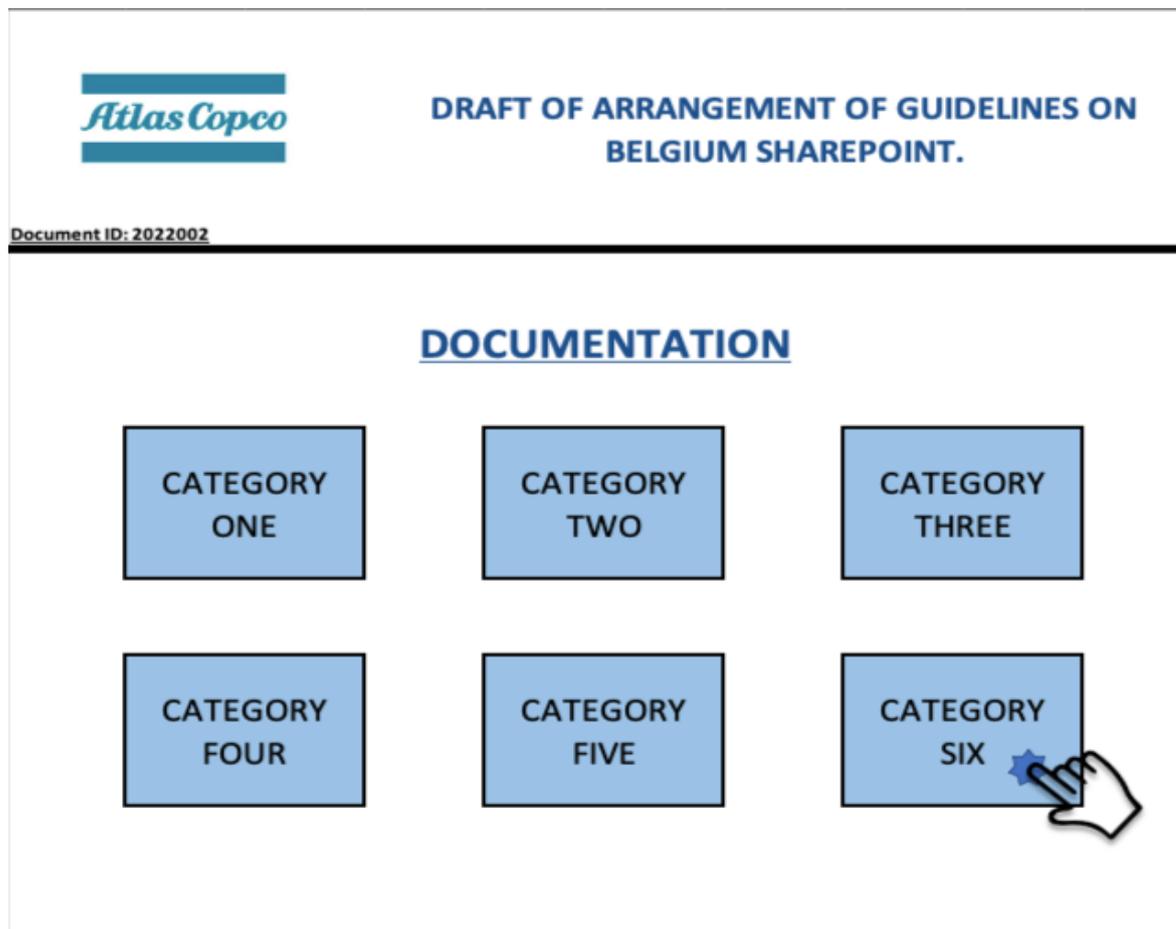


Figure 29: Proposal of the sharepoint adjustment
(own processing, logo Atlas Copco © 2022)

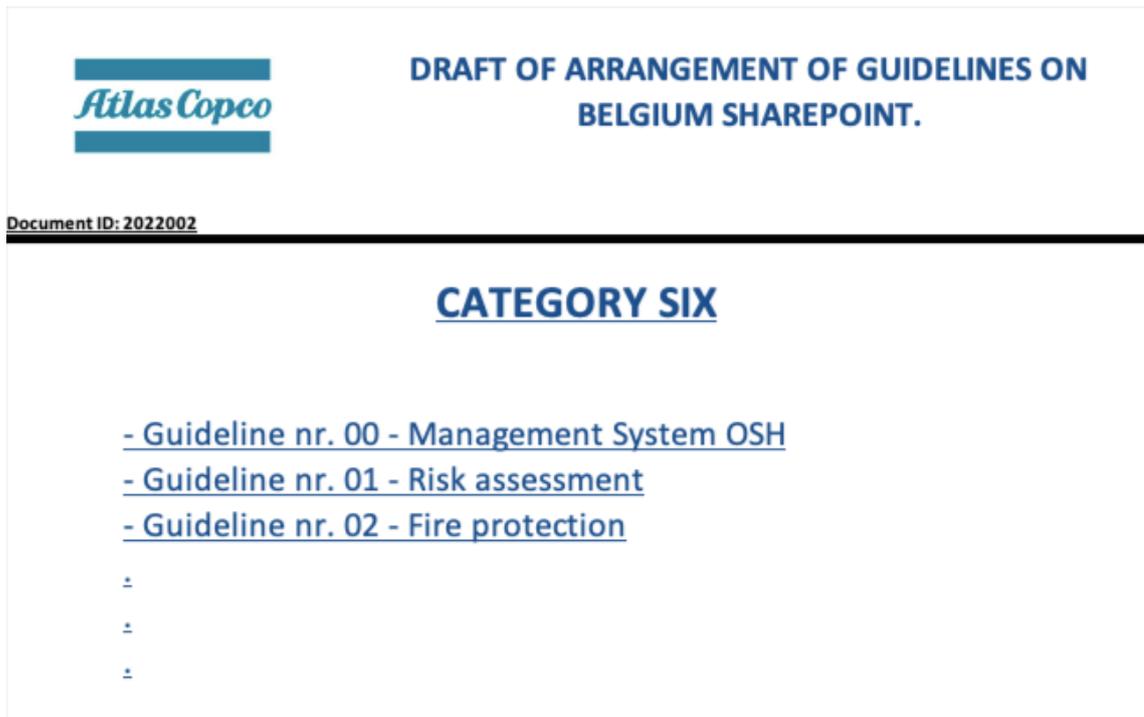


Figure 30: Proposal of the SharePoint adjustment
(own processing, logo Atlas Copco © 2022)

6.6 Project nr. 2022003 - Extended training for employees

The last recommendation from the project of the OSH management comparison was a proposal for extended training for Belgian workers. This should help to reduce the risk of work accidents.

6.6.1 The objective and characteristics of the project

This project aims to extend training for employees in the Belgian branch, especially for workers in the warehouse. The training will also include practical training in working with the forklifts or other similar equipment and a model situation of the hazardous events. Extending this training of this branch's employees aims to reduce the risk level and reduce the number of work accidents arising from these activities. Therefore, it is important to see this training as an interesting activity for employees rather than mandatory training.

6.6.2 Stakeholders

This extended training will apply to all employees working in the warehouse, including their managers.

6.6.3 Project lead time

The training will take place in the second half of the year, more precisely from 1.9 to 30.9.2022, in several workshops and seminars. Therefore, the preparation activities will begin on August 1, 2022.

6.6.4 Work Breakdown Structure – WBS

This project will be divided into two parts - the preparation part (1) and the training part (2). The second part of the project will take place in September 2022. Preparatory work will begin on 1.8.2022. First, a team will be set up to manage this project. The team should look like this:

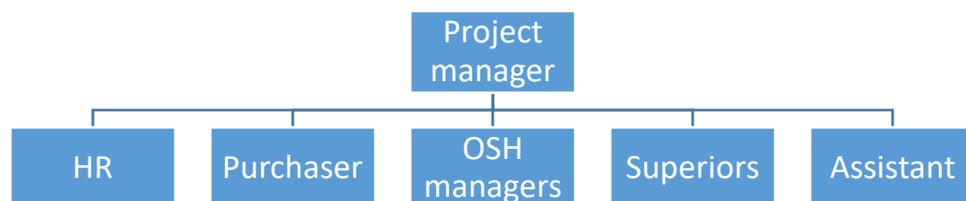


Figure 31: Project team (own processing)

After building the team, tasks will be given according to the WBS structure (Figure 31). Within this project, its promotion itself is important. Therefore, it will be necessary to create promotional materials (leaflets, newsletter emails, etc.). As all employees can't participate in the training simultaneously, HR must divide them into teams according to their shifts, holidays, etc. A total of 6 teams will take part in the extended training. Subsequently, invitations will be sent by email. The theoretical part will end with a quiz test, where a motivational reward will be prepared for the winning teams with the fastest correct solution. It is important to get a practice dummy and prepare an area for a model situation for the practical part.

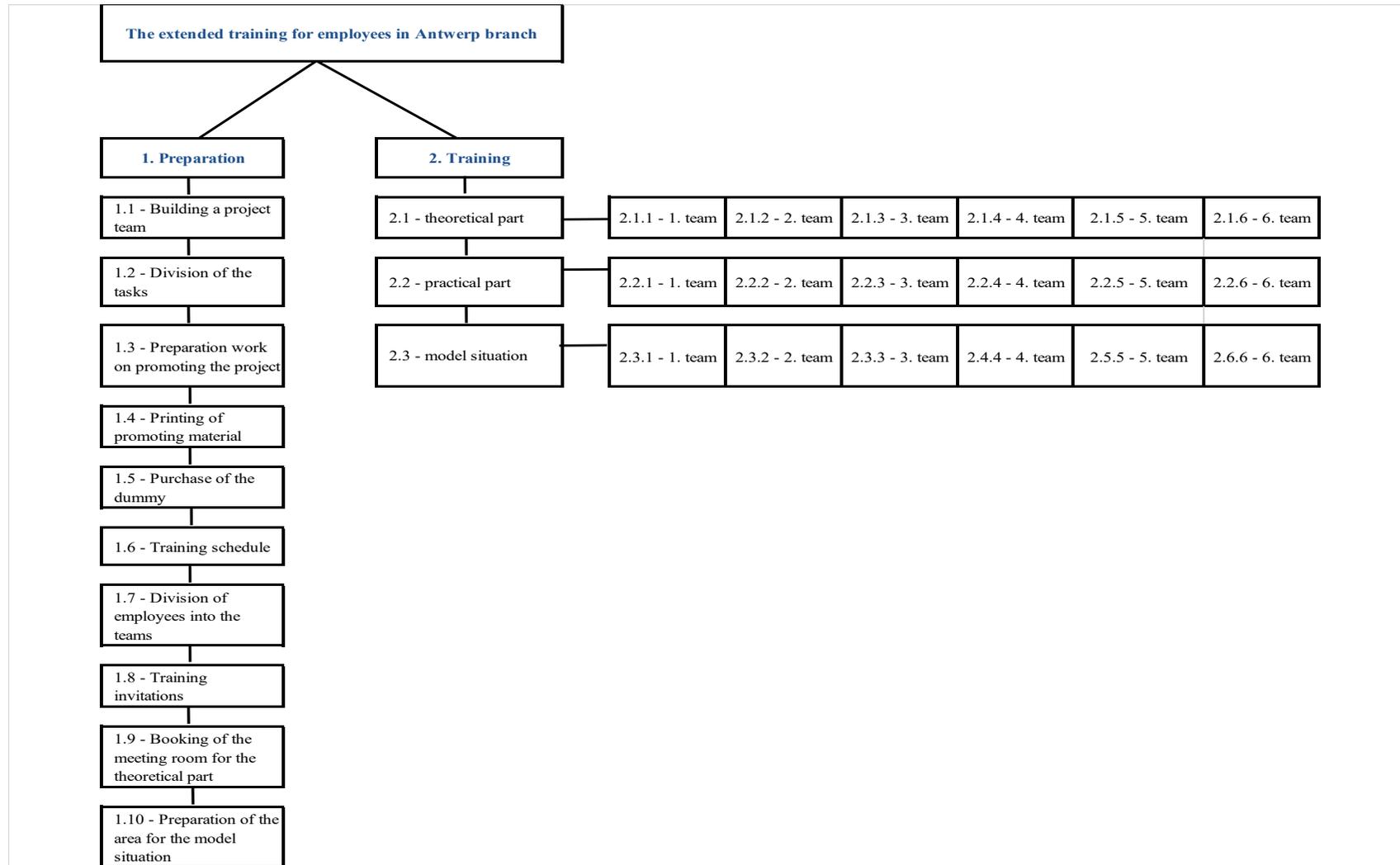


Figure 32: WBS – extended training for employees (own processing)

6.6.5 Gantt diagram

Figure 33 shows a Gantt diagram for extended training for the warehouse employees in the Belgian branch. All project activities (Figure 32) were divided into the timeline within this diagram - the blue part for the preparation work and the orange part for the training itself.

6.6.6 Project costs

Since all the staff for this project will be internal, the company will save more money than if the external staff was needed. Nevertheless, the costs include the salaries of the individual team members for this project. Other costs of this project include the promotional material. The company will distribute leaflets informing about safety at work and the rule "Work smarter, not harder." Furthermore, employees will receive a handbook at the training, which will interestingly explain this topic so that employees are tempted to read it. The design will be processed by an internal team and printed externally. It is necessary to borrow two dummies to simulate different hazardous situations for the model situation. The borrowing cost of one dummy is 5 EUR/hour. The next item in the cost is then a voucher for a quiz. Due to the effort to do the whole training more like an interesting workshop than a mandatory training, the theoretical part will be followed by a quiz. The employee with the fastest and correct solution will then receive a voucher for various sports activities as a part of a well-being promotion.

Table 16: Project costs – extended training for employees (own processing)

Item	Qty	Unit	Unit price	Total cost
Salaries cost	260	EUR	18,1	4706
Promoting material	400	Pcs	1,5	600
Borrowing cost of 2 dummies	60	Hour	5	300
Vouchers	6	pcs	15	90
				5696

6.6.7 The evaluation of the project

The evaluation of the project will take place in the third and fourth quarters of 2022 based on reported incidents and the questionnaire sent to employees after the training. In the case of positive responses and reduced risk, it will be appropriate to include this interactive training in the branch's training system regularly.

CONCLUSION

The topic and primary goal of this master's thesis was the Project of Occupational Safety and Health Management Comparison in Atlas Copco. This company has branches almost all over the World, but only two branches were selected in Brno and Belgian Antwerp for this thesis.

The first part of this thesis included research of the professional literature and other resources related to safety and health at work. This research aimed to introduce the OSH as well as the OSH history. The following chapters dealt with the legislation of the EU, the Czech Republic, and Belgium, also including the OSH institutions. The first part of the theoretical part was closed with the employer's obligations, the employees' rights and obligations, and the work accident statistics. The second part of the theory focused on the current safety and health issues, such as Covid-19, well-being, and the European Working Conditions Survey results. Finally, the theoretical part was concluded with a chapter on health and safety management systems and appropriate risk analysis methods used in the OSH area.

In the practical part, the company Atlas Copco was introduced. This Swedish company was founded in 1873 and currently employs over 43 000 employees. Its products can be found almost everywhere, such as compressors, vacuum solutions, power tools, etc. After a brief history of Atlas Copco, both selected branches for the comparison were introduced. The OSH directive system was described, then risk analysis was performed. Firstly, through the SIPOC method, the primary process "Pick-to-Ship" in both branches was analyzed. The output of this method was the list of risk activities arising from this process, which were then rated by the principle of the likelihood, consequences, and opinion. Based on this, the risk level and the risk acceptability were assessed. The next part of the branch analysis included the work accident statistics from 2020 and 2021. Based on the results, the safety pyramids were built and balanced, so both branches are meeting the Atlas Copco goal to have the safety pyramid balanced at the end of the year.

These outputs were subsequently used in the final part of this thesis and for the project of comparison. From the comparison, three improvements were suggested. First, the directive of well-being was proposed for the Brno branch, as this was missing in the OSH directives' system. For the Belgian branch, the proposal of the internal SharePoint adjustment was recommended to make the orientation in the system of the OSH directives more straightforward. The last recommendation was the project of extended training for the Belgian warehouse employees to reduce the risk of work accidents. If this project is

successful, it would be appropriate to implement this training in the regular training system to keep reducing the risk.

BIBLIOGRAPHY

Atlas Copco Group: Home of Industrial Ideas [online], © 2022. Atlas Copco AB [cit. 2022-03-24]. Dostupné z: <https://www.atlascopcogroup.com/en>

Atlas Copco Annual report 2021, © 2022. Atlas Copco AB. Dostupné také z: <https://www.atlascopcogroup.com/content/dam/atlas-copco/corporate/documents/investors/financial-publications/english/20220321-annual-report-2021.pdf>

BELGIUM. Act of 4 August 1996 on well-being of workers in the performance of their work, 1996. In: . Belgium. Dostupné také z: <https://employment.belgium.be/sites/default/files/content/documents/Welzijn%20op%20het%20werk/EN/Act%20of%204%20August%201996%20on%20well-being%20of%20workers%20in%20the%20performance%20of%20their%20work.pdf>

BEZPEČNÝ PODNIK: Systém řízení bezpečnosti a ochrany zdraví při práci, © 2021. Opava: Státní úřad inspekce práce.

BOZP online – 1a - Co je to BOZP? Bezpečnost a ochrana zdraví při práci, © 2021. *BOZP a PO - bezpečnost práce moderně a efektivně* [online]. Praha [cit. 2021-12-22]. Dostupné z: <https://www.bozp.cz/aktuality/co-je-bozp/>

COCKBURN, William, 2020. COVID-19: NÁVRAT NA PRACOVÍŠTĚ: Přizpůsobení pracovišť a ochrana pracovníků. © Evropská agentura pro bezpečnost a ochranu zdraví při práci. Dostupné také z: https://osha.europa.eu/sites/default/files/EU_guidance_COVID_19_CS.pdf

Co je standard ISO 45001?, © 2021. NQA Globální Certifikační Orgán [online]. NQA [cit. 2022-03-21]. Dostupné z: <https://www.nqa.com/cs-cz/certification/standards/iso-45001>

ČESKO. Zákon č. 262 ze dne 7. června 2006 zákoník práce, 2006. In: . Sběrka zákonů České republiky, ročník 2006, částka 262. Dostupné také z: <https://www.zakonyprolidi.cz/cs/2006-262#p101-1>

ČSN ISO 45001:2018. Systémy managementu bezpečnosti a ochrany zdraví při práci – Požadavky s návodem na použití. Praha: Úřad pro technickou normalizaci, metrologii a státní zkušebnictví, 2018

EU-OSHA: agentura Evropské unie [cit. 2021-12-27]. Dostupné z: <https://osha.europa.eu/cs/safety-and-health-legislation/european-directives>

EUROFOUND AND EU-OSHA, © 2014. Psychosocial risks in Europe Prevalence and strategies for prevention. Luxembourg: Publications Office of the European Union. ISBN 978-92-897-1218-7. Dostupné také z: https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1443en_0.pdf

EUROSTAT, 2021. Possibility of recognising COVID-19 as being of occupational origin at national level in EU and EFTA countries. © European Union. ISBN 978-92-76-41098-0. Dostupné také z: <https://ec.europa.eu/eurostat/documents/7870049/13464590/KS-FT-21-005-EN-N.pdf/d960b3ee-7308-4fe7-125c-f852dd02a7c7?t=1632742856466>

EVROPSKÁ UNIE, 1989. Směrnice Rady 89/391/EHS ze dne 12. června 1989 o zavádění opatření pro zlepšení bezpečnosti a ochrany zdraví zaměstnanců při práci. In: . Evropská Unie, ročník 1989, 89/391/EHS. Dostupné také z: <https://eur-lex.europa.eu/legal-content/CS/TXT/PDF/?uri=CELEX:31989L0391&from=EN>

EVROPSKÁ UNIE, 1991. Směrnice Rady 91/383/EHS ze dne 25. června 1991 kterou se doplňují opatření pro zlepšení bezpečnosti a ochrany zdraví při práci zaměstnanců v pracovním poměru na dobu určitou nebo v dočasném pracovním poměru. In: . Evropská Unie, ročník 1991, 91/383/EHS. Dostupné také z: <https://esipa.cz/sbirka/sbsrv.dll/sb?DR=SB&CP=31991L0383>

EVROPSKÁ UNIE, 2021. Strategický rámec EU pro bezpečnost a ochranu zdraví při práci na období 2021–2027 Bezpečnost a ochrana zdraví při práci v měnícím se světě práce. Dostupné také z: https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1443en_0.pdf

Evropské směrnice o bezpečnosti a ochraně zdraví při práci, © 2021. European Agency for Safety & Health at Work: Information, statistics, legislation and risk assessment tools [online].

FERRETT, Ed, © 2016. Health and Safety at Work Revision Guide: for the NEBOSH National General Certificate in Occupational Health and Safety. 3rd edition. New York: Routledge 2016. ISBN 978-1-315-68943-2.

Historie bezpečnosti a ochrany zdraví při práci, © 2013 - 2020. Portál o bezpečnosti práce a požární ochraně [online]. 2014 [cit. 2021-12-22]. Dostupné z: <https://www.bezpecnostprace.info/bozp/historie-bezpecnosti-a-ochrany-zdravi-pri-praci/>

History of Occupational health and safety(HSE), 2021. Health and Safety Training and Consultancy [online]. 2021 [cit. 2021-12-22]. Dostupné z: <https://www.safecircleglobal.com/post/history-of-occupational-health-and-safety-hse>

Hodnocení rizik pro prevenci onemocnění COVID-19, © 2021. Dokumentace BOZP a PO [online]. CRDR spol. s r.o. [cit. 2021-12-30]. Dostupné z: <https://www.dokumentacebozp.cz/aktuality/hodnoceni-rizik-covid-19/>

Informace o orgánu ochrany veřejného zdraví, 2021. Krajská hygienická stanice Jihomoravského kraje se sídlem v Brně [online]. Brno [cit. 2021-12-30]. Dostupné z: https://www.khsbrno.cz/index.php?stav_menu=informace

Instituce, © 2002 - 2021. BOZPinfo [online]. Výzkumný ústav bezpečnosti práce [cit. 2021-12-30]. Dostupné z: <https://www.bozpinfo.cz/instituce>

ISO 45001, ©2022. CQS - Certifikace systémů managementu [online]. CQS [cit. 2022-03-21]. Dostupné z: <https://www.cqs.cz/Nase-sluzby/ISO-45001.html>

Interní dokumenty společnosti, 2022.

Kompetence v oblasti bezpečnosti práce, 2021. Státní úřad inspekce práce [online]. © Státní úřad inspekce práce [cit. 2021-12-30]. Dostupné z: <https://www.suip.cz/web/suip/kompetence-v-oblasti-bezpecnosti-prace>

Mental health at work, 2020. OSH WIKI: Networking knowledge [online]. [cit. 2022-02-11]. Dostupné z: https://oshwiki.eu/wiki/Mental_health_at_work

NEUGEBAUER, Tomáš, 2016. Bezpečnost a ochrana zdraví při práci v kostce neboli o čem je současná BOZP [online]. 2. vydání. Praha: Wolters Kluwer [cit. 2021-12-27]. ISBN 978-80-7552-107-1.

NEUGEBAUER, Tomáš, 2018. Školení bezpečnosti práce, požární ochrany a motivační školení k prevenci rizik. 2. vydání. Praha: Wolters Kluwer. ISBN 978-80-7552-957-2.

OSH system at national level - Belgium, 2020. OSHwiki [online]. [cit. 2021-12-30]. Dostupné z: https://oshwiki.eu/wiki/OSH_system_at_national_level_-_Belgium

PARENT-THIRION, Agnès et al., 2017. 6th European Working Conditions Survey. © European Foundation for the Improvement of Living and Working Conditions. ISBN 978-92-897-1597-3. Dostupné také z: https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef1634en.pdf

Poslání ústavu, 2021. SZÚ [online]. [cit. 2021-12-30]. Dostupné z: <http://www.szu.cz/poslani-ustavu>

Povinnosti zaměstnavatelů, © 2016-2021. Znalostní systém prevence rizik v BOZP [online]. Výzkumný ústav bezpečnosti práce, v. v. i [cit. 2021-12-30]. Dostupné z: <https://zsbozp.vubp.cz/bozp-obecne/povinnosti-zamestnavatelu>

PRACOVNÍ NESCHOPNOST PRO NEMOC A ÚRAZ V ČESKÉ REPUBLICE za rok 2020, © 2021. Praha: Český statistický úřad, (Č. j.: CSU-004713/2021-63). Dostupné také z: <https://www.czso.cz/documents/10180/122362652/26000420p2.pdf/7dae2a7f-7183-4be9-a69e-4ce98b6ecae6?version=1.1>

Pracovní úrazovost v České republice v roce 2020, © 2016 - 2022. <https://zsbozp.vubp.cz/>: Znalostní systém prevence rizik v BOZP [online]. Výzkumný ústav bezpečnosti práce, v. v. i. [cit. 2022-03-21]. Dostupné z: <https://zsbozp.vubp.cz/pracovni-urazovost/722-pracovni-urazovost-v-ceske-republice-v-roce-2020>

Práva a povinnosti BOZP, když jste zaměstnanec, © 2013-2020. Portál o bezpečnosti práce a požární ochraně [online]. [cit. 2021-12-30]. Dostupné z: <https://www.bezpecnostprace.info/bozp/prava-a-povinnosti-bozp-kdyz-jste-zamestnanec/>

Profil VÚBP, v. v. i., 2021. Výzkumný ústav bezpečnosti práce, v. v. i. [online]. [cit. 2021-12-30]. Dostupné z: <https://vubp.cz/o-nas/profil/>

Průzkum pracovních podmínek v Evropě 2021, © 2022. <https://www.eurofound.europa.eu/cs> [online]. EUROFOUND [cit. 2022-03-05]. Dostupné z: <https://www.eurofound.europa.eu/cs/surveys/2021/pruzkum-pracovnich-podminek-v-evrope-2021>

REESE, Charles D., © 2017. *Occupational Safety and Health: Fundamental Principles and Philosophies*. Boca Raton: Taylor & Francis Group. ISBN 978-1-138-74883-5.

Rotary vane vacuum pump GVD series, © 2022. <https://www.directindustry.com> [online]. [cit. 2022-03-27]. Dostupné z: <https://www.directindustry.com/prod/atlas-copco-construction-tools/product-17043-2045857.html>

Řízení bezpečnosti, © 2022. Edwards Vacuum [online]. [cit. 2022-03-30]. Dostupné z: <https://www.edwardsvacuum.com/cs/about-us/corporate-responsibility/managing-safety>

SIPOC analýza, © 2017 - 2022. Certifikace Manažerských Systémů [online]. CeMS.sk [cit. 2022-04-10]. Dostupné z: <https://www.cems-cz.com/blog/232-sipoc-analyza>

SÚIP, 2021. Zpráva o pracovní úrazovosti v České Republice v roce 2020. Opava: Státní úřad inspekce práce.

Systém BOZP v Evropské unii, 2020–2022. Český Focal Point pro bezpečnost a ochranu zdraví při práci [online]. [cit. 2021-12-27]. Dostupné z: http://www.ceskyfocalpoint.cz/?page_id=4385

The Belgian National Strategy for Wellbeing at Work 2016-2020, 2016. Belgium.

Usnesení Evropského parlamentu ze dne 17. prosince 2020 o silné sociální Evropě pro spravedlivou transformaci (2020/2084(INI))' (2020) Official Journal C 445, 75-93. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020IP0371>

VALA, Jiří, 2016. Systémové řízení bezpečnosti a ochrany zdraví v organizacích. Praha: Wolters Kluwer. ISBN 978-80-7552-109-5.

VEBER, Jaromír a Eva PINCOVÁ, 2008. Management bezpečnosti a ochrany zdraví při práci. Praha: Professional Publishing. ISBN 978-80-86946-46-7.

Výkladový slovník - PDCA cyklus, © 2015-2021. European Lean Six Sigma Community [online]. European Lean Six Sigma Community [cit. 2022-03-21]. Dostupné z: <https://elssc.eu/dictionary/pdca-cyklus>

What does well-being mean to you?, © 2018. Hands On At Work: Supporting a Healthy Workplace [online]. [cit. 2022-04-17]. Dostupné z: <https://www.handsonatwork.co.uk/what-does-wellbeing-mean-to-you/>

LIST OF ABBREVIATIONS

DGs	Directorates-general
EU	The European Union
ISO	International Organization for Standardization
LCO	Likelihood, Consequences, Opinion method
LMRA	Last-minute risk assessment
OSHA	The European Agency for Safety and Health at Work
OSH	Occupational Health and Safety
PPE	Personal protective equipment
SHE	Safety, Health, and Environment
SHE:SMS	Strategy and Management System
WHO	World Health Organization

LIST OF FIGURES

Figure 1: Covid-19 as an occupational disease (Eurostat, 2021).....	29
Figure 2: PDCA cycle (ELSSC, © 2015-2021).....	34
Figure 3: Atlas Copco logo (Atlas Copco Group, © 2022).....	40
Figure 4: Company history (Atlas Copco Group, © 2022).....	41
Figure 5: AC Compressor – history (Atlas Copco Group, © 2022).....	42
Figure 6: AC Compressor – now (Atlas Copco Group, © 2022).....	42
Figure 7: Safety Pyramid 2021 (AC annual report, © 2022).....	44
Figure 8: Atlas Copco Vacuum pump (Directindustry, © 2022).....	47
Figure 9: Work accidents book (Internal documents, 2022).....	49
Figure 10: Safety Conversation Report (Interní dokumenty, 2022).....	50
Figure 11: SIPOC method – Brno (own processing).....	54
Figure 12: LCO method Brno – Equipment, Machinery (own processing).....	58
Figure 13: LCO method Brno – Racks, pallets (own processing).....	59
Figure 14: LCO method Brno – Tools, Material (own processing).....	60
Figure 15: LCO method Brno – IT equipment (own processing).....	60
Figure 16: Safety pyramid – Brno (own processing).....	64
Figure 17: LMRA principles (Internal documents, 2022).....	70
Figure 18: LMRA checklist (Internal documents, 2022).....	71
Figure 19: SIPOC method – Antwerp (own processing).....	72
Figure 20: LCO method Antwerp – Equipment, Machines (own processing).....	76
Figure 21: LCO method Antwerp - Racks, Pallets, Containers (own processing).....	77
Figure 22: LCO method Antwerp – Tools, Material (own processing).....	78
Figure 23: LCO method Antwerp – IT Equipment (own processing).....	78
Figure 24: Safety pyramid Antwerp (Internal documents, 2022).....	79
Figure 25: Safety pyramid – Antwerp (own processing).....	86
Figure 26: Comparison – Safety pyramids (own processing).....	95
Figure 27: Proposal of the directive – well-being (own processing, logo Atlas Copco © 2022).....	97
Figure 28: Proposal of the directive – well-being (own processing, logo Atlas Copco © 2022).....	98
Figure 29: Proposal of the sharepoint adjustment (own processing, logo Atlas Copco © 2022).....	99
Figure 30: Proposal of the SharePoint adjustment (own processing, logo Atlas Copco © 2022).....	100
Figure 31: Project team (own processing).....	101

Figure 32: WBS – extended training for employees (own processing)..... 102
Figure 33: Gantt diagram – Extended training for employees (own processing)..... 104

LIST OF TABLES

Table 1: Orders received and revenues 2021 (AC annual report, © 2022)	43
Table 2: Likelihood ranking (own processing).....	55
Table 3: Consequence ranking (own processing).....	55
Table 4: Opinion ranking (own processing)	56
Table 5: Risk rating (own processing).....	56
Table 6: Likelihood ranking (own processing).....	73
Table 7: Consequence ranking (own processing).....	73
Table 8: Opinion ranking (own processing)	73
Table 9: Risk rating (own processing).....	74
Table 10: Comparison – OSH documentation (own processing)	90
Table 11: Comparison – Risk analysis (own processing).....	90
Table 12: Comparison – Reported work accidents (own processing)	92
Table 13: Comparison – Reported risk observations (own processing).....	93
Table 14: Comparison – reported work accidents (own processing).....	94
Table 15: Proposals of improvements (own processing).....	96
Table 16: Project costs – extended training for employees (own processing).....	103

