

SILESIA UNIVERSITY OF TECHNOLOGY
FACULTY OF MINING AND GEOLOGY
Field of study: Safety Engineering
Programme: Industrial Safety Organization and Engineering
Mode and level of studies: intramural studies,
MSc programme

Rafael GONZALEZ GONZALEZ

OCCUPATIONAL RISK
ASSESSMENT AND PREVENTIVE
ACTIONS IN AN ALUMINIUM
CARPENTRY AND PVC COMPANY

MASTER THESIS PREPARED AT THE DEPARTMENT
OF MINING MANAGEMENT AND SAFETY ENGINEERING

Master Thesis Supervisor:

Joanna HERCZAKOWSKA, PhD, Eng.

Gliwice, March, 2015

Title of Master thesis

for Rafael GONZALEZ GONZALEZ

OCCUPATIONAL RISK ASSESSMENT AND PREVENTIVE
ACTIONS IN AN ALUMINIUM CARPENTRY AND PVC
COMPANY

Scope of the Thesis:

- Introduction to occupational health and safety.
- Establish objectives and scope of the thesis.
- Define the background of the research and company's description.
- Definitions and general information about OH&S.
- Analysis of work environment factors.
- Define risk assessment and all its components.
- Carry out the risk assessment in the studied company.
- Establish conclusions and preventive actions to be taken.

Master Thesis Supervisor:

Joanna HERCZAKOWSKA, PhD, Eng.

Gliwice, March 2015

INDEX

1. Introduction.....	1
2. Objective and scope of the thesis.....	3
3. Background of the research	5
3.1 Statistical data about accidents at work in industry in Spain and in Poland	5
3.2 Description of the company	5
4. Definitions and general information about OHS	7
4.1 What is occupational health and safety?	7
4.2 Risk and OH&S regulations and standards	10
4.3 Definitions.....	11
5. Work environment factors	15
5.1 Hazardous agents/factors	15
5.2 Harmful agents	16
5.2.1 Biological hazards	16
5.2.2 Physical hazards	16
5.2.3 Chemical hazards	17
5.3 Burdensome agents	17
5.3.1 Physical or ergonomics factors	17
5.3.2 Psychological and working organization hazards	18
6. Risk assessment	21
6.1 Employer obligations	21
6.2 Who can do the risk assessment?	23

6.2.1	Competence of persons who make risk assessments.....	23
6.3	When the risk assessment should be carried out?	24
6.4	The main goals and benefits of OSHAS 18001 risk assessment.....	25
6.5	Risk assessment stages	26
6.5.1	Identifying hazards and those at risk.....	26
6.5.2	Evaluating risks and prioritizing risks.....	27
6.5.3	Deciding on preventive action.....	28
6.5.4	Taking action.....	29
6.5.5	Monitoring and reviewing.....	29
6.6	Information needed to carried out the risk assessment.....	30
6.6.1	Sources of information	30
6.7	Risk assessment methods	31
6.7.1	Polish Standard Method (PN-N-18001:2004).....	31
6.7.2	Risk score method	34
6.7.3	Silesian University of Technology Method.....	36
7.	Risk assessment in the studied company	39
7.1	Description of professions assessed	39
7.1.1	Activities during the whole day.....	39
7.1.2	Equipment and used machinery	41
7.2	Sensitive workers	42
7.3	Hazards identification.....	43
7.4	Characteristics of Risk Assessment Methods.....	47
7.4.1	Polish Standard Method (PN-N-18002/2000).....	47

7.4.2 Risk score method risk assessment	50
7.4.3 Silesian University Method risk assessment	53
7.5 Analysis and comparison of methods and results	57
7.5.1 Technical director.....	57
7.5.2 Workshop operator (First group)	58
7.5.3 Workshop operator (Second group)	60
8.Preventive actions proposal	63
8.1 Technical director preventive actions and measures:.....	63
8.2 Workshop operator preventive actions and measures:.....	67
9.Conclusions.....	83
Bibliography and references	87
Abstract	89

1. Introduction

Nowadays organizations of every kind are more concerned with their Occupational Health and Safety at work, by controlling their risks and improving their Occupational Health and Safety policy and trying to achieve higher objectives in this field. Many companies, especially the biggest ones, realized that a good OH&S system has plenty of benefits for them such as: A decrease in personal, productive and material losses, avoid penalties and problems with the law, improvement of the company's image, improve profitability, etc.

The Council Directive 89/391/EEC of 12 June 1989, established a number of fundamental principles that each member of the European Union must comply with [4]:

- Avoid risks.
- Assess the risks that cannot be avoided.
- Combat the risks at source.
- Adapt the work to the individual.
- Take into account the evolution of technology.
- Replace the dangerous by involving little or no danger.
- Planning prevention.
- Adopt measures that put collective protection to the individual.
- Give appropriate training to the workers.

The duty of any enterprise is to prevent risks instead of repairing damage, however, the Law recognizes that there are certain risks that, despite being known, are not avoidable; for which exists the need of carrying out risk assessments.

The risk assessment in a workplace is the process to estimate the magnitude of the risks that can not be avoided, obtaining the information necessary for the employer to take the appropriate preventive measures and the type of measures to be taken.

2. Objective and scope of the thesis

The general objective of the thesis is a risk assessment in an aluminum carpentry and PVC company in a given worksites. In the thesis was described the procedure for general risk assessment in an aluminum carpentry company to identify the hazards in order to eliminate or minimize them, prioritizing and establishing preventive actions and control measures.

This document aims to assess, in compliance with the Occupational Health and Safety Assessment Series (OHSAS 18001) the occupational risks, accidents, hygiene, ergonomics and social psychology risks to which workers are exposed in the workplace.

The risk assessment covers all the company's worksites and the common areas, the risks and deficiencies that affect all workers. The assessment is based on the information provided by the company and on the observation of tasks and existing facilities at the time of the visit to the company. Therefore, valuations and recommendations contained in this thesis are valid while the information and conditions at this workplace do not vary significantly.

Scope of the thesis:

- Introduction to occupational health and safety.
- Establish objectives and scope of the thesis.
- Define the background of the research and company's description.
- Definitions and general information about OH&S.
- Analysis of work environment factors.
- Define risk assessment and all its components.
- Carry out the risk assessment in the studied company.
- Establish conclusions and preventive actions to be taken.

3. Background of the research

3.1 Statistical data about accidents at work in industry in Spain and in Poland

To show how important is risk assessment and setting preventive actions at the metal manufacture the comparison of accidents in Spain and Poland in 2010 and 2013 was made.

Table 3.1

Comparison of accidents between Spain and Poland.

	POLAND		SPAIN	
	2010	2013	2010	2013
ACCIDENTS IN METAL MANUFACTURE (PER 1000 WORKERS EMPLOYED)	4.075 (15.22)	4.050 (13.81)	22.105 (9.43)	13.868 (6.83)
TOTAL NUMBER OF ACCIDENTS	94.207	88.267	645.968	468.030

source: Central statistical office of Poland and Spain[6, 7].

As we can see the number of accidents between these years has decreased in both countries, in Poland a 6.3% and a 27.5% in Spain. Regarding to metal manufacture the decrease is 0.6% in Poland and 37.2% in Spain [6, 7].

3.2 Description of the company

NUEVAS TECNOLOGIAS DE LA VENTANA, S.L.U., is a business project that integrates in its outstanding team of professionals in the activity of the aluminum and PVC, culminating a long career in the field of carpentry, with the aim of providing the best service customer.

In NUEVAS TECNOLOGÍAS DE LA VENTANA, S.L.U., they study, design, manufacture and install a wide range of quality products with the highest technological and aesthetic classifications.

Directing their effort and willingness towards a business management model that applies innovation and excellence in execution of all activities taking place in the company.

NUEVAS TECNOLOGIAS DE LA VENTANA, S.L.U., operates throughout the Principado de Asturias and neighboring communities.

Features of the workplace:

The company facilities are located on two floors of an industrial workshop. Upstairs is the office of management and boardroom. The ground floor is divided into two areas:

- Reception, administration and sales materials exposure.
- Workshop production.

Number of workers:

- Business manager- 1 person.
- Technical director- 1 person.
- Workshop operators- 10 persons.

Organizational structure:

The organizational structure of Nuevas Tecnologías de la Ventana, S.L.U. is defined in the following chart [1]:

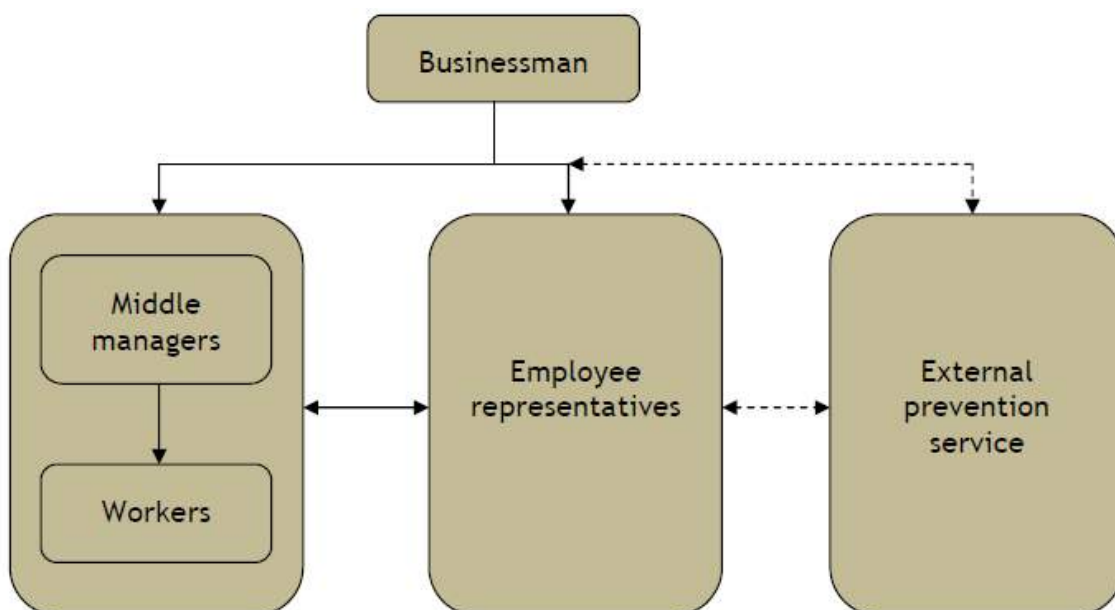


Figure 1. Organizational structure of the company.

4. Definitions and general information about OHS

4.1 What is occupational health and safety?

Occupational Health and Safety is based on:

- Hazard identification: The process of recognizing that a hazard exists (source or situation with the potential to cause harm in terms of human injury or ill-health).
- Risk assessment: The process of evaluating the risk arising from the hazard (combination of the likelihood of a hazardous event or exposure and the severity of injury or ill health that can be caused by the event of exposure).
- Determination of applicable controls: Measures relevant to eliminate or reduce risk to an acceptable level. Measures are based on the hierarchy of control measures.

In order to achieve health system and effective security is vital for organizations to handle these more meaningful. The three aspects above provide increasingly important for the implementation of a good OH&S system and without basis, the overall system will surely fail. They are, in theory, considered part of the stage of "plan", but most of auditors and consultants agree that these issues must be addressed before designing the system as a whole.

OHSAS 18001 Occupational Health and Safety Standard uses a tool management approach called the PDCA cycle. PDCA is an ongoing process that allows an organization to establish, implement and maintain their health and security policy based on the top management leadership and commitment to the system security management. Is as follows:

Plan: establish the objectives and processes necessary to deliver results in accordance with the organization's OH&S policy.

Do: implement the process.

Check: monitor and measure performance against OH&S policy, objectives, legal and other requirements, and report results.

Act: take actions to continually improve OH&S performance.



Figure 2. Stages of OSHAS process[16]

The standard can be deployed to any organization or only part of it. The best results are obtained when despite all the organization is working on the same system and OSH policy is integrated into other management systems and culture of the organization [16].

Plan

The planning stage of the process requires the organization to:

- Devise an OH&S policy.
- Plan for hazard identification, risk assessment and determination of controls.
- Identify relevant legal requirements.
- Plan for emergencies and responses.
- Manage change effectively.
- Devise procedures for performance measuring, monitoring and improvement.
- Provide and ensure the appropriate use of safety equipment.
- Train in order to introduce an OH&S culture and establish the importance of organization's safety statement, policies and objectives.
- Consult employees and communicate.

At first, management should be consulted in order to feel confident in supporting the new system and constantly driving forward. Then the workforce has to be consulted. It is likely to have lower-level employees valuable information, ideas and opinions on the new system. Since they are going to be most affected by it, it makes sense to ensure that they believe and understand the need for change. If you do not realize this could result in much resistance across the organization and thus only result in a system that is not practical to operate.

Do

The implementation stage should be the easiest part of this process. If the planning stage is done the right way, then it's just a matter of following the documentation and procedures that have been created. In order to ensure uniform application lead a senior manager should be in charge of the new WHS system while each element of the process must have an "owner" or a person who takes care of the system. This ensures the appropriate structure for your organization and effectively minimizes the risk.

It is advisable to start the application by breaking the system into specific elements in place to address it as a whole. Focus on specific elements in a logical order creates a solid foundation for the entire system to work efficiently.

Another important aspect of health and safety is to have employees doing the jobs that suit their skills. A matrix must be created showing all groups of staff, their required skills, training and status of each. These formal procedures should instill awareness required within your organization.

Check

The third step of the PDCA cycle consists of the following:

- Conducting internal audits.
- Evaluation of legal compliance.
- Identifying non-conformities and addressing them.
- Thorough analysis of incidents and incidental data.
- Measuring performance and monitoring

The failure to conduct internal audits periodically most likely result in the breakdown of the system as a whole. It often happens that where there is no control, risks tend to arise particularly quickly.

Any derivatives nonconformities should be addressed instantly using corrective measures devised. The most effective and robust systems ensure that this process runs smoothly at all times. This means that the performance of this process should be measured as well.

It is not only derivatives nonconformities that the organization needs to think. It is crucial for the organization to identify potential emergencies and develop procedures relevant response, this is called preventive action.

Act

The last step is the management review, which is a vital part of the process of continuous improvement and therefore the standard itself sums up what should be included in the review.

Management review is conducted by senior management and is the review of the suitability, adequacy and effectiveness of the system. It should also include assessing opportunities for improvement and the need to change the OSH policy and the OSH objectives. Changes are necessary, top management must also provide the necessary resources for implementation. Provide resources is a way to present commitment to the new system of health and safety. [16]

4.2 Risk and OH&S regulations and standards

When considering OHSAS 18001 or any similar rule, an organization must be aware that the rules do not supersede or negate international, national or local regulations regarding health and safety issues at work. OHSAS 18001 has been developed to provide organizations internationally accepted system for managing activities and processes of the organization in order to reduce or eliminate the risks of occupational health and safety for employees. In general, the goal of any standard, if it relates to the manufacture of automobiles, airplanes and machinery, or petrochemical process industry or the provision of services - transport, hospitals, etc. - is the same. Standards are designed to promote, facilitate and enable the coherence of activities and processes and to provide assurance that the processes (for quality reasons, the production of products) will be eligible to provide a uniform and predictable results every Once a series of procedures are executed. It is important to understand that the rules themselves, not necessarily produce, in this case the behavior "safe" or safe workplace, or process.

Occupational Health and Safety Assessment Series (OHSAS 18001) standard was first published in April 1999 and revised in July 2007 to improve alignment with ISO 14001: 2004 throughout the standard. Support for ISO 9001: 2000 is also improved in the revision of 2007. This was done to facilitate the integration of quality, environmental and occupational health and safety management systems of organizations if they wish to do so. Today, OHSAS 18001 is an International Organization for Standardization (ISO) or ANSI standard but is internationally recognized. OHSAS 18001 was developed specifically to enable organizations to systematically control OSH risks and improve performance.

The OHSAS 18001 is applicable within any organization that wishes:

1. Establish and implement a management system & S in order to eliminate or minimize the hazards and risks to employees and those working on their behalf.

2. implement, maintain and continually improve its system of OSH management and specific performance objectives S & SO.

3. Provide a mechanism to facilitate compliance with OSHA.

4. Demonstrate to customers, employees and other stakeholders that the organization complies with an internationally recognized standard.

OHSAS 18001 is compatible with ISO 9001 and ISO 14001 series of standards and their underlying principles and processes such as the Plan-Do-Check-Act. If there are any differences either, OHSAS 18001 is also compatible with ANSI / AIHA Z10-2005, American National Standard - Occupational Health and Management Systems Security, which was released on September 5, 2005 to the American Industrial Hygiene Association (AIHA) [5].

4.3 Definitions

Definitions that must be known for the correct understanding of this document [4],18]:

Acceptable risk: risk that has been reduced to a level that can be tolerated by the organization having regard to its legal obligations and its own OH&S policy.

Accident at work: Accident at work is understood as a sudden event, caused by external reason which leads to injury or death, which happened in connection with work.

Audit: Systematic, independent and documented process for obtaining “audit evidence” and evaluating it objectively to determine the extent to which “audit criteria” are fulfilled.

Collective accident: A collective accident at work means accident, which as a result of the same event suffered at least two people.

Collective protection: Collective protective equipment are designed for the simultaneous protection of a group of people, including and individuals from dangerous and harmful factors, occurring singly or in combination in the work environment, which technical solutions used in the production premises, machines and equipment.

Continual improvement: recurring process of enhancing the OH&S management system in order to achieve improvements in overall OH&S performance consistent with the organization's OH&S policy.

Corrective action: action to eliminate the cause of a detected nonconformity or other undesirable situation.

Document: information and its supporting medium.

Employer: any natural or legal person who has an employment relationship with the worker and has responsibility for the undertaking and/ or establishment.

Exposure: Every harmful factor in a work environment, which as a result of long-term effects on humans can cause smaller or larger health problems including occupational disease.

Fatal accident: Fatal accident is understood as an accident which resulted in the death of a period not exceeding six months from the date of the accident.

Hazard: source, situation, or act with a potential for harm in terms of human injury or ill health, or a combination of these.

Hazard identification: process of recognizing that a hazard exists and defining its characteristics.

Ill health: identifiable, adverse physical or mental condition arising from and/or made worse by a work activity and/or work-related situation.

Incident: work-related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred. An accident is an incident which has given rise to injury, ill health or fatality.

Interested party: person or group, inside or outside the workplace, concerned with or affected by the OH&S performance of an organization.

Maximal permissive concentration (NDS): value of weighted average concentration for which the impact on the employee during the 8-hour, daily and average weekly working time defined in the Labour Code, through the period of its activity should not cause negative changes in his condition and state of health of the future generations.

Maximal permissive intensity (NDN): Average intensity value, for which impact on the employee during the 8-hour, daily and average weekly working time defined in the Labour Code, through the period of its activity should not cause negative changes in his condition and state of health of his future generations.

Nonconformity: non-fulfilment of a requirement.

Occupational disease: Occupational disease is a disease listed in the occupational diseases list, if it was caused by the action of harmful factors in the working environment or was caused by the work method.

Occupational health and safety (OH&S): conditions and factors that affect, or could affect, the health and safety of employees or other workers (including temporary workers and contractor personnel), visitors, or any other person in the workplace.

Occupational risk: The probability of occurring undesired events associated with the work, resulting in losses, particularly among workers of adverse health effects due to occupational hazards in the working environment.

OH&S management system: part of an organization's management system used to develop and implement its OH&S policy and manage its OH&S risks.

OH&S objective: OH&S goal, in terms of OH&S performance, that an organization sets itself to achieve. Objectives should be quantified wherever practicable.

OH&S performance: measurable results of an organization's management of its OH&S risks.

OH&S policy: overall intentions and direction of an organization related to its OH&S performance as formally expressed by top management.

Organization: company, corporation, firm, enterprise, authority or institution, or part or combination thereof, whether incorporated or not, public or private, that has its own functions and administration.

Personal protective equipment: Personal protective equipment are designed to protect human from dangerous and harmful factors, acting individually or collectively in the work environment, constituting his personal equipment.

Prevention: all the steps or measures taken or planned at all stages of work in the undertaking to prevent or reduce occupational risks.

Preventive action: action to eliminate the cause of a potential nonconformity or other undesirable potential situation.

Procedure: specified way to carry out an activity or a process. Procedures can be documented or not.

Record: document stating results achieved or providing evidence of activities performed

Risk: combination of the likelihood of an occurrence of a hazardous event or exposure(s) and the severity of injury or ill health that can be caused by the event or exposure(s).

Risk assessment: process of evaluating the risk(s) arising from a hazard(s), taking into account the adequacy of any existing controls, and deciding whether or not the risk(s) is acceptable.

Serious accident: A serious accident at work is an accident which resulted in serious bodily injury, such as loss of vision, hearing, speech, reproductive, or other injury or health disorder, affecting the basic functions of the body, as well as an incurable disease or life-threatening persistent mental illness, total or partial inability to work in the profession or permanent disfigurement or significant distortion of the body.

Worker: any person employed by an employer, including trainees and apprentices but excluding domestic servants.

Workers' representative with specific responsibility for the safety and health of workers: any person elected, chosen or designated in accordance with national laws and/or practices to represent workers where problems arise relating to the safety and health protection of workers at work.

Workplace: any physical location in which work related activities are performed under the control of the organization.

5. Work environment factors

There are aspects in a workplace environment that can have a direct impact on the productivity, health and safety, comfort, concentration, job satisfaction and morale of the people within it. Important factors in the work environment should be considered and assessed.

The main environment hazard factors in a workplace are: Hazardous agents/factors (traumatic), harmful agents (physical, chemical, biological) and burdensome agents [11, 19].

5.1 Hazardous agents/factors

Dangerous factors (traumatic) in the work environment are all factors that act on a man in a sudden and violent way and can cause accidents and other dangerous events.

Dangerous factors include:

- The risk associated with the movement of people.
- Spills on floors or tripping hazards, such as blocked aisles or cords running across the floor.
- Working from heights, including ladders, scaffolds, roofs, or any raised work area
- Unguarded machinery and moving machinery parts; guards removed or moving parts that a worker can accidentally touch.
- Electrical hazards like frayed cords, missing ground pins, improper wiring.
- The risk of a fire, explosion.
- The risk of burns.
- Confined spaces.
- Machinery-related hazards (lockout/tagout, boiler safety, forklifts, etc).

5.2 Harmful agents

Harmful factors to the health of the work environment are all physical, chemical and biological, which intensity or concentration exceeded the maximal permissible concentration (NDS) or maximal permissible intensity (NDN) in Polish or other standards and the long-term effects on the human body has the ability to cause negative changes providing to occupational diseases.

5.2.1 Biological hazards

All hazards associated with working with animals, people, or infectious plant materials. Work in schools, day care facilities, colleges and universities, hospitals, laboratories, emergency response, nursing homes, outdoor occupations, etc. may expose you to biological hazards.

Types of things you may be exposed to include:

- Blood and other body fluids.
- Fungi/mold.
- Bacteria and viruses.
- Plants.
- Insect bites.
- Animal and bird droppings.

5.2.2 Physical hazards

Are factors within the environment that can harm the body without necessarily touching it.

Physical Hazards include:

- Radiation: including ionizing, non ionizing (EMF's, microwaves, radio waves, etc.).
- High exposure to sunlight/ultraviolet rays.
- Temperature extremes – hot and cold.

- Constant loud noise.
- Dust.
- Vibration.
- Electromagnetic field.

5.2.3 Chemical hazards

Are present when a worker is exposed to any chemical preparation in the workplace in any form (solid, liquid or gas). Some are safer than others, but to some workers who are more sensitive to chemicals, even common solutions can cause illness, skin irritation, or breathing problems.

Beware of:

- Liquids like cleaning products, paints, acids, solvents – Especially if chemicals are in an unlabeled container.
- Vapors and fumes that come from welding or exposure to solvents.
- Gases like acetylene, propane, carbon monoxide and helium.
- Flammable materials like gasoline, solvents, and explosive chemicals.
- Pesticides.
- Allergenic substances.
- Toxic, irritants, allergenic, carcinogenic and mutagenic substances.

5.3 Burdensome agents

Burdensome factors of a work environment are all factors that can impede the work or temporarily reduce psychophysical possibilities of a man, but do not cause occupational diseases. There are two groups:

5.3.1 Physical or ergonomics factors

They occur when the type of work, body position and working conditions put stress on your body. They are the most difficult to detect because it is not always immediately notice the tension in your body or damage that these risks arise. The short-term exposure can

result in "muscle pain" the next or the following day exposure days, but long-term exposure can cause serious long term illnesses.

Ergonomic Hazards include:

- Improperly adjusted workstations and chairs.
- Frequent lifting.
- Poor posture.
- Awkward movements, especially if they are repetitive.
- Repeating the same movements over and over.
- Having to use too much force, especially if you have to do it frequently.

5.3.2 Psychological and working organization hazards

Hazards or stressors that cause stress (short-term effects) and voltage (long term effects). These are the risks associated with problems such as workload, lack of control and / or respect, etc.

Examples of work organization hazards include:

- Workload demands.
- Workplace violence.
- Intensity and/or pace.
- Respect (or lack of).
- Flexibility.
- Control or say about things.
- Social support/relations.
- Sexual harassment.



Figure 3. Main hazards [source: www.osha.gov]

6. Risk assessment

A risk assessment is a systematic examination of all aspects of the work undertaken to consider what could cause injury or harm, whether the hazards could be eliminated, and if not what preventive or protective measures are, or should be, in place to control the risks [8].

6.1 *Employer obligations*

1. Within the context of his responsibilities, the employer shall take the measures necessary for the safety and health protection of workers, including prevention of occupational risks and provision of information and training, as well as provision of the necessary organization and means.

The employer shall be alert to the need to adjust these measures to take account of changing circumstances and aim to improve existing situations.

2. The employer shall implement the needed measures following general principles of prevention:

- Avoiding risks.
- Evaluate the risks which cannot be avoided
- Combating the risks at source.
- Adapt the work to the individual, especially as regards the design of work places, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work-rate and to reducing their effect on health.
- Adapt to technical progress.
- Replace the dangerous by the non-dangerous or the less dangerous.
- Developing a coherent overall prevention policy which covers technology, organization of work, working conditions, social relationships and the influence of factors related to the working environment.
- Give collective protective measures priority over individual protective measures.

- Give appropriate instructions to the workers.

3. Without prejudice to the other provisions of the European Directive, the employer shall, taking into account the nature of the activities of the enterprise and/or establishment:

- Evaluate the risks to the safety and health of workers, inter alia in the choice of work equipment, the chemical substances or preparations used, and the fitting-out of work places. Subsequent to this evaluation and as necessary, the preventive measures and the working and production methods implemented by the employer must:

- Assure an improvement in the level of protection afforded to workers with regard to safety and health.

- Be integrated into all the activities of the undertaking and/or establishment and at all hierarchical levels.

- Where he entrusts tasks to a worker, take into consideration the worker's capabilities as regards health and safety.
- Ensure that the planning and introduction of new technologies are the subject of consultation with the workers and/or their representatives, as regards the consequences of the choice of equipment, the working conditions and the working environment for the safety and health of workers;
- Take appropriate steps to ensure that only workers who have received adequate instructions may have access to areas where there is serious and specific danger.

4. Without prejudice to the other provisions of this Directive, where several undertakings share a work place, the employers shall cooperate in implementing the safety, health and occupational hygiene provisions and, taking into account the nature of the activities, shall coordinate their actions in matters of the protection and prevention of occupational risks, and shall inform one another and their respective workers and/or workers' representatives of these risks.

5. Measures related to safety, hygiene and health at work may in no circumstances involve the workers in financial cost [3],[4],[5].

6.2 Who can do the risk assessment?

In any organization, the final decision as to who should carry out risk assessments, it is a decision for the employer. The person conducting risk assessments include [3]:

- The employers themselves.
- Employees, designated by the employers.
- External services.

6.2.1 Competence of persons who make risk assessments

Whoever is to make a risk assessment at work, what is essential is that they should be competent for their task.

It may be that a person designated to make risk assessments is not competent for the whole range of risk assessment tasks which it is necessary to evaluate. For example a qualified electrical engineer might not have the necessary training and knowledge to assess the risks arising from a complex chemical process. It is essential that those making the assessment and employers recognize the limits of their assessment skills so that wherever necessary the need for additional or specialist expertise is identified and brought in to the risk assessment process.

In practice it will often be necessary for risk assessments to be made by a team bringing together different competences.

Persons making risk assessments can demonstrate their competence by showing that they have the following abilities:

- 1) Understand the general approach to risk assessment.
- 2) Have the capacity to apply this to the workplace to be assessed and to the task required. This may require:
 - Identifying the health and safety problems.
 - Assessing and prioritizing the need for action.
 - Suggesting options available to eliminate or reduce risk and their relative merits.
 - Evaluating their effectiveness.

- Promoting and communicating health and safety advances and practice.

3) Be able to identify situations where they would be unable to adequately assess the risk without assistance and be able to advise on the need for further assistance [3].

6.3 When the risk assessment should be carried out?

The risk assessment needs to be relevant at all times. It may be necessary to revise it whenever there are changes, or when the improvements made have an impact on safety and health. Such changes may include changes in work processes, organizational structure, equipment or substances used, technical knowledge, and legislation or standards.

Changes in the workforce may also have an impact; for example by altering the number of workers in a particular process, replacing workers with more experience with participants or as a result of experience gained through training.

An employer should carry out a risk assessment:

- Each time a new job brings significant new dangers. If there is a high turnover, then the way the new personal do their job should be checked against risk assessment and the training in safe work practices when necessary.
- Whenever something strange happens or the presence of a new hazard – for example, a big volume of sickness absence, complaints of stress and bullying, or unusually high staff turnover.
- In response to particular changes in the level of risk for individual employees - for example, when an employee returns to work after a period of absence due to long term illness.
- Where a worker is pregnant or breastfeeding, and her work might mean a risk to her health and safety or that of her unborn child [3,19].

6.4 The main goals and benefits of OSHAS 18001 risk assessment

Table 6.1

The main goals and benefits that OSHAS 18001 risk assessment can contribute [16]

HEALTH AND SAFETY ISSUE	HOW OSHAS 18001 HELPS	GOALS AND BENEFITS
<p>STRIVING “TOWARDS ZERO ACCIDENTS” CAN BE A CHALLENGE FOR ANY ORGANIZATION.</p>	<ul style="list-style-type: none"> ▪ It provides a system to identify OH&S hazards and minimize health and safety risks. ▪ It makes sure that all elements to effectively manage health and safety are clearly defined. ▪ It gives the techniques to identify potential causes of accidents within the workplace. ▪ It helps to improve employee awareness of risks. 	<ul style="list-style-type: none"> ▪ Reduced incident and accident rates. ▪ Improved performance monitoring and accident reporting. ▪ Better control of OH&S risks. ▪ Decrease in overall costs of accidents. ▪ Decrease in insurance premiums.
<p>ORGANIZATIONS NEED TO STAY UP-TO-DATE WITH LEGISLATION AND REMAIN COMPLIANT, AS BREACHES CAN LEAD TO FINES AND PROSECUTIONS.</p>	<ul style="list-style-type: none"> ▪ It makes sure to take account of legal requirements when setting up, implementing and maintaining your OHSAS 18001 system. ▪ It ensures to commit to complying with applicable legal requirements. ▪ It helps you communicate relevant information on legal and other requirements to employees and interested parties. 	<ul style="list-style-type: none"> ▪ Improved levels of compliance to health and safety legislation. ▪ Reduced likelihood of fines and prosecutions, which in turn can lead to less HSE or local regulator visits and lower insurance premiums, providing financial benefit.
<p>A POOR HEALTH AND SAFETY RECORD CAN QUICKLY DAMAGE AN ORGANIZATION’S REPUTATION WITH BOTH CUSTOMERS AND INVESTORS.</p>	<ul style="list-style-type: none"> ▪ It shows that health and safety is a priority. ▪ It makes sure to have appropriate measure to protect your staff. ▪ It reassures stakeholders a best practice system is in place. ▪ It makes continually improves in health and safety performance. 	<ul style="list-style-type: none"> ▪ Improved reputation and stakeholder satisfaction – positively presenting your organization for tenders and investment opportunities. ▪ A competitive advantage to grow the business.
<p>HIGH ABSENTEEISM IS OFTEN AN ISSUE FOR ORGANIZATIONS AND DIFFICULT TO MANAGE WITHOUT A CLEAR PROCESS IN PLACE.</p>	<ul style="list-style-type: none"> ▪ It helps to implement policies and procedures that can help you tackle Absenteeism. ▪ It makes sure to put in place clear processes for everyone to understand and follow. ▪ It shows to employees the company’s commitment to keeping them safe. 	<ul style="list-style-type: none"> ▪ Reduced absenteeism and improved employee morale, leading to increased productivity. ▪ Greater involvement and commitment from employees and the management team, resulting in improved health and safety culture. ▪ Improved communication and training.

6.5 Risk assessment stages

For most companies, especially small and medium enterprises, an approach five easy steps (incorporating elements of risk management) as presented below should work fine.

6.5.1 Identifying hazards and those at risk

The identification of the hazards in all aspects of work should be approached by:

- Walking around the workplace and looking at what could cause harm.
- Consult workers and / or their representatives about the problems found. Often, fastest and safest way to identify the details of what actually happens is ask workers involved in the activity being evaluated form. They will know what steps process followed, if any shortcuts or ways to get over a difficult task, and what precautions you take the systematic examination of all aspects of the work, ie:
 - Looking at what actually happens in the workplace or during the work activity.
 - Thinking about non-routine and intermittent operations (e.g. maintenance operations).
 - Considering unintended but predictable, such as interruptions of work activity events.
- Given the long-term risks to health, such as high levels of noise or exposure to harmful substances, as well as more complex or less obvious risks such as psychosocial factors or work organizational risk.
- Looking at company accident and illness records.
- Seeking information from other sources such as:
 - Manufacturers' and suppliers' instruction manuals or data sheets.
 - Occupational safety and health websites.
 - National bodies, trade associations or trade unions.
 - Legal regulations and technical standards.

The identification of all those who might be exposed to the hazards.

For each risk, it is important to understand that could be harmed; that will help you identify the best way of managing risk.

It should be noted workers who interact with the dangers either directly or indirectly, for example, a worker painting a surface is directly exposed to solvents, while other workers nearby, are engaged in other activities, and indirectly exposed inadvertently.

This does not mean listing everyone by name, but identifying groups of people such as 'people working in the store "or" transients ". Cleaners, contractors and members of the public may also be at risk.

Particular attention should be paid to:

- Gender issues.
- Groups of workers who may be at increased risk or have particular requirements:
 - Workers with disabilities.
 - Migrant workers.
 - Young and old workers.
 - Pregnant women and nursing mothers.
 - Untrained or inexperienced staff.
 - Temporary and part-time workers.

It is important to identify how these people could be harmed what type of injury or illness can occur.

6.5.2 Evaluating risks and prioritizing risks

The next step is to assess the level of risk arising from each hazard. This is done by considering:

- How likely it is that a hazard will cause harm.
- How serious that harm is likely to be.
- How often (and how many) workers are exposed.

A simple process based on common sense, can be enough to assess numerous risks and work activities. Included among these activities with low risks and workplaces where risks are well known or readily identified and where available the appropriate means of control. This is probably what will happen in most companies (especially SMEs).

In other cases, it may not be possible to identify hazards and assess risks without knowledge, support and professional advice. This can happen when it comes to more complex processes and technology, or health hazards that are not so easily recognizable and require analysis and measurements.

6.5.3 Deciding on preventive action

Having evaluated the risks, the next step is to put in place preventive and protective measures. Among the things to be considered at this stage are:

- 1) If the risks are preventable and avoidable. Is it possible to get rid of the risk? This can be done, for example, by:
 - considering whether the task or job is necessary,
 - removing the hazard,
 - using different substances or work processes.
- 2) If the risks are not avoidable and preventable. When determining a strategy to reduce and control risks, employers should be aware of the following additional general principles of prevention:
 - Combating the risk at source.
 - Adapting the work to the individual, especially as regards the design of work places, the choice of work equipment and the choice of working methods.
 - Adapting to technical progress.
 - Substituting the dangerous by the non-dangerous or the less dangerous.
 - Developing a coherent overall prevention policy which covers technology, organization of work, working conditions, social relationships and the influence of factors related to the working environment.
 - Giving collective protective measures priority over individual protective measures.
 - Giving appropriate training to workers.

On controlling risk through these measures employers should be referred to the specifications, in national legislation, national standards, published guidance and other criteria, published by national authorities.

6.5.4 Taking action

After identifying preventive measures and more adequate protection, the next step is to put them in place.

Effective implementation involves the development of a plan specifying:

- The measures to be implemented.
- The means allocated (time, expenses etc).
- Who does what and when.
- When actions are to be completed.
- A date for reviewing the control measures.

It is important to involve workers and their representatives in the process:

- To inform them about the measures implemented.
- To train or instruct them about the measures or procedures.

6.5.5 Monitoring and reviewing

Arrangements for monitoring and reviewing the protective and preventive measures should be introduced after the risk assessment to ensure the effectiveness of these measures is maintained and the risks under control. The information generated by the monitoring activities should be used to perform the review and revision of the risk assessment.

Risk assessment should not be done just once. The assessment needs to be reviewed and revised, as necessary, for a number of reasons, including:

- The degree of change likely in the work activity.
- Changes which might alter the perception of risk in the workplace, such as a new process, new equipment or materials, change of work organization, and new work situations including new workshops or other premises.
- Once the new measures have been introduced following the assessment, the new working conditions should be assessed in order to review the consequences of the change. It is essential that the risk is not transferred, that is to say that in providing a solution to one problem, another problem should not be created.

- The assessment no longer being applicable because the data or information on which it is based is no longer valid.
- As a result of the findings of an accident or “near miss”.

6.6 Information needed to carried out the risk assessment

Persons making risk assessments at work should have knowledge of and/or information on:

- Hazards and risks which are already known to exist and the way they arise.
- The material, equipment and technology used at work.
- Working procedures and organization and interaction of workers with materials used.
- The type, likelihood, frequency, and duration of exposure to the hazards. In some cases this may mean the application of modern, validated techniques of measurement.
- The relation between exposure to a hazard and its effect.
- The legal standards and requirements relevant to the risks present in the workplace.
- What is regarded as good practice for areas where there are no specific legal standards.

Where employees of different companies work in the same workplace, assessors may need to share information about risks and the health and safety measures in that workplace.

6.6.1 Sources of information

Information may be gathered from:

- Analysis of work activity to predict possible incidents.
- Consultation and/or participation of the workers and/or their representatives.
- Manufacturers' and suppliers' data sheets or manuals.
- Repositories of knowledge and experience for the activity.
- Health and safety journals and databases.

- Guidance available from national competent bodies or institutes in the field of health, safety and hygiene at work.
- Accident and incident data (including records of hazardous events, e.g. near misses), epidemiological studies.
- Written site practices, manuals and operating procedures.
- Monitoring data and records of measurements.
- Anonymized data from health surveillance.
- Relevant scientific and technical literature.
- Standards established by European or national standardization bodies[8, 19]

6.7 Risk assessment methods

6.7.1 Polish Standard Method (PN-N-18001:2004)

Estimation of the occupational risks (R) associated with the hazards identified at a workplace consists of determining:

- The probability of harm (P).
- The severity of harm (S).

which can be expressed by the formula:

$$R = f(P, S) \quad (6.1)$$

The recommended method include risk estimation on a three-point risk level estimator:

Table 6.2

Three-point risk level estimator.

PROBABILITY	SEVERITY OF CONSEQUENCES		
	MODERATE (HARM)	MEDIUM (HARM)	EXTREME (HARM)
HIGHLY IMPROBABLE	Small 1	Small 1	Medium 2
PROBABLE	Small 1	Medium 2	High 3
HIGHLY PROBABLE	Medium 2	High 3	High 3

In estimating risk according to Table 6.2, the severity of negative consequences of a hazard and the probability of such consequences may be determined applying the following rules:

- *Moderately harmful consequences* are defined as traumas and illnesses not causing protracted distress and absenteeism; they are temporary worsening of a state of health such as small nicks, eye irritations, symptoms of mild poisoning, headaches, etc.
- *Medium harmful consequences* are defined as traumas and illnesses causing moderate, but protracted or periodically recurring distress and are associated with short absenteeism (such as wounds, simple fractures, 2nd degree burns on a limited body surface, dermal allergy, simple fractures, muscle–skeleton diseases (e.g. tendonitis) etc.
- *Extremely harmful consequences* are defined as traumas and illnesses causing grave and permanent distress and/or death (these include 3rd degree burns or 2nd degree burns on a large body surface, amputations, compound fractures, cancer, toxic damages of internal organs and nervous system resulting from exposure to chemical factors, vibration syndromes, occupational damage of hearing, asthma, cataract etc.).
- *Highly improbable hazard consequences* are defined as those, which should not materialize during the entire working life of an employee.
- *Probable hazard consequences* are defined as those, which may materialize only a few times during the working life of an employee.
- *Highly probable hazard consequences* are defined as those, which may materialize repeatedly during the working life of an employee.

It is recommended that, whenever possible, occupational risk should be estimated on the basis of the value of parameters characterizing exposure. A general guide to estimation of occupational risk on a three-point risk level estimator basing on the value of parameters characterizing exposure has been provided in table 6.4.

Table 6.4

General guidelines for estimating occupational risk on a three-point risk level estimator basing on the value of parameters characterizing exposure.

VALUE OF PARAMETER CHARACTERISING EXPOSURE	RISK ESTIMATION
$P > P_{max}$.	High
$P_{max} \geq P > 0.5 P_{max}$.	Medium
$P \leq 0.5 P_{max}$.	Low
<p>P_{max} – admissible value of parameter characterizing exposure, normally determined on the basis of applicable requirements (this could be the value of MAC – maximum admissible concentration or of MAI – maximum admissible intensities). When there are no set requirements, in determining such a parameter it is possible to use the opinions of experts and/or consider the views of employees.</p>	

Tolerability of occupational risk may be usually defined, as a rule, on the basis of its estimation. Table 6.5 lists the rules for determining the tolerability of occupational risk estimated on a three-point risk level estimator.

Table 6.5

General rules for occupational risk evaluation and recommended action following up assessment of risk [10, 12]

RISK ASSESSMENT	RISK TOLERANCE	ACTION REQUIRED
HIGH	INTOLERABLE	When risk is connected with work currently performed, actions to reduce risk need to be taken at once (e.g. by applying protective equipment). Planned work cannot commence until risk is reduced to a tolerable level.
MEDIUM	TOLERABLE	Planned actions to reduce occupational risk level are recommended.
LOW	TOLERABLE	Assurance that risk will remain at most on the same level is necessary.

6.7.2 Risk score method

Risk Score is a variation of the classic method of occupational risk assessment, in which the risk (R) is described as the product of parameters such as:

$$R = P \cdot E \cdot S \quad (6.2)$$

- The probability of hazard activation (P),
- Exposure to hazards (E)
- Likely effects of the risk (S)

The probability of hazard occurrence (P):

Probability of the occurrence of a particular adverse event during the execution of the single task (during a one-exposure).

Table 6.6

The probability of hazards occurrence (P)

CATEGORY OF PROBABILITY	SIZE OF PROBABILITY	RANK OF PROBABILITY
VERY LIKELY	(0,5)	10
QUITE LIKELY	(0,1)	6
NOT LIKELY, BUT POSSIBLE	(0,01)	3
ONLY OCCASIONALLY POSSIBLE	(0,001)	1
POSSIBLE TO THINK	(0,0001)	0,5
PRACTICALLY IMPOSSIBLE	(0,00001)	0,2
ONLY THEORETICALLY POSSIBLE	(0,000001)	0,1

Exposure to risk (E):

Table 6.7

Exposure to risk classification

CATEGORY OF EXPOSURE	EXPOSURE DESCRIPTION	RANK OF EXPOSURE
PERMANENT	All the time	10
FREQUENT	Almost every day	6
SPORADIC	Once a week	3
OCCASIONAL	Once a month	2
MINIMAL	Several times a year	1
NEGLIGIBLE	Once a year	0,5

The potential impact of hazards (S):

Table 6.8

Impact of hazards classification.

CATEGORY OF LOSSES	LOSSES DESCRIPTION	RANK OF LOSSES
SERIOUS DISASTER	Many fatalities	100
DISASTER	Several deaths	40
VERY LARGE	One fatality	15
LARGE	Serious injury	7
MEDIUM	Absenteeism	3
SMALL	First aid	1

Interpretation of the risk index:

Table 6.9

Risk index interpretation [10, 20]

INDEX VALUE	RISK CATEGORY	RISK ZONE	RECOMMENDATIONS
UNTIL 1,5	MINIMAL	SAFE	No need to take any additional corrective actions beyond the periodic control.
1,5 - 48	ACCEPTABLE	ALMOST SAFE	Should be made periodic preventive security actions and carried out continuous monitoring.
49 – 270	SIGNIFICANT	DANGEROUS	Should be taken preventive actions and sought to reduce the risk to an acceptable level. The inspection should be increased and insightful.
271 – 1440	UNDESIRABLE	ESPECIALLY DANGEROUS	Reduce the number of people to a minimum. In this situation work should not be started, and if the need for the work should be pursued immediately to reduce the risk.
ABOVE 1440	UNACCEPTABLE	CRITICAL	People should be immediately withdrawn from the risk places. Work can not be continued until the risk is not reduced accordingly.

6.7.3 Silesian University of Technology Method

Is a method of occupational risk assessment, in which the risk is described as the product of four parameters which are:

- The probability of hazard occurrence (P).
- Exposure to hazards (E).
- The risk of the number of people at risk (L).
- The risk of losses resulting from hazards (S).

$$R = P \cdot E \cdot L \cdot S \quad (6.3)$$

To ensure broad participation of employees in the risk assessment, it is proposed to use a simplified and better adapted to Polish conditions the risk assessment procedure based on the evaluation of two parameters characterizing occupational risk, i.e. the probability of the risks and potential consequences of threats, where the third parameter characterizing exposure threat is a time of doing a specific task.

Occupational risk assessment:

- 1) Risk size is determined by the index from the formula:

$$WR_{cz} = \frac{1}{n} \cdot \sum_{i=1}^n P \cdot S \quad (6.4)$$

where n - number of experts.

- 2) Calculation of generalized intensity risk index of working activities by the formula:

$$WNR_{cz} = \frac{\sum_{i=1}^n WR_{cz} \cdot t_{cz}}{\sum_{i=1}^n t_{cz}} \quad (6.5)$$

- 3) Interpretation of the intensity risk rate of working activities [10], [20]:

Table 6.10

Likelihood of a hazardous event

PROBABILITY	FREQUENCY	RANK
HIGH	A few times a month	4
SIGNIFICANT	Several times a year	3
SMALL	Once in a several years	2
MINIMAL	Theoretical impossible	1

Table 6.11

Effects of hazardous events

EFFECTS/ CONSEQUENCES	FREQUENCY	RANK
CRITICAL	Fatal or collective accident	4
SERIOUS	Serious accident	3
SLIGHT	Lightweight accident	2
NEGLIGIBLE	Micro- trauma	1

Table 6.12

Interpretation of the risk indicator

WORK ACTIVITY	RISK CATEGORY	UPDATE
SAFE	Minimal 1 ÷ 2	Every 6 months
ALMOST SAFE	Acceptable 2,01 ÷ 3	Every 3 months
DANGEROUS	Significant 3,01 ÷ 6	Every 2 months
ESPECIALLY DANGEROUS	Undesirable 6,01 ÷ 9	Every month
CRITICAL	Unacceptable 9,01 ÷ 16	Each time before starting work

7. Risk assessment in the studied company

7.1 Description of professions assessed

This company has 11 workers, one technical director and ten workshop operators.

Technical director is responsible for the completion of the technical study. Visit the works for the performance measurement and data collection.

Workshop operators are divided in two groups. The first operators group (7 workers) at the workshop is dedicated to the manufacture and assembly of aluminum windows. Used machinery such as saws, cutting machine, milling machines (copier), machining center and various hand tools such as screwdrivers and drills for assembly of different products manufactured. To mount and use pneumatic material moving tables have mobile carts with wheel sand crane. The chemicals used are polyurethane foam, silicone and polish. The second group (3 workers) task is to package and distribute the product as well as perform its final installation. In the section of machinery and tools used, the degree of compliance of the equipment with legislation that applies to them is indicated [1].

7.1.1 Activities during the whole day

Table 7.1

Technical director activities

TASK	COMPONENTS OF WORKING OPERATIONS	TIME OF EXECUTION (MIN)
1.VISIT THE WORKS FOR CARRYING OUT THE MEASUREMENT AND DATA COLLECTION.	Drive to the place where will be placed the product and meet with the client.	40
	Do necessary measures and data collection.	90
2.PERFORM TECHNICAL STUDY AND DESIGN TECHNICAL DRAWINGS.	Perform the technical study to know exactly how everything should be done and design the technical drawings of the products and send them to the workshop.	350

Table 7.2

First group of workers activities.

TASK	COMPONENTS OF WORKING OPERATIONS	TIME OF EXECUTION (MIN)
1. PREPARE THE RAW MATERIAL TO BE MANUFACTURED. I'd correct the time according to the table that you send me, please check if everything is ok	Bring the product from the warehouse the workstation.	20
	Inspection to the aluminum extrusion material.	15
	Prepare the product to be cut according to the needed measures.	15
2. MANUFACTURE THE PRODUCT.	Prepare and turn on the machinery and tools.	10
	Cut aluminum shape to required length and shape of the frame and sash.	100
	Form holes at window frame and sash section.	80
3.ASEMBLY THE PRODUCT	Install and fix reinforcing bars to the frame and sash.	40
	Insert weather strip, fittings and accessories to the window frame and sash.	60
	Apply small gap sealant in all miter joints and assembly the different parts of the sash and frame.	70
	Check that the miters are properly aligned and sealed.	10
	Assembly the sash into the frame of the window.	30
	According to the order it can be included blinds, mosquito nets and crystals.	20
	Check that the product works properly.	10

Table 7.3

Second group of workers activities.

TASK	COMPONENTS OF WORKING OPERATIONS	TIME OF EXECUTION (MIN)
1.PACK THE FINAL PRODUCT	Bring the product to the packaging machine.	20
	Pack the product correctly with the packaging machine.	60
2. BRING THE PRODUCT TO ITS DESTINATION	Load it into the truck.	30
	Drive the truck to the destination.	60
	Download it from truck.	30
3.INSTALL THE PRODUCT.	Perform the installation on customer premises.	280

7.1.2 Equipment and used machinery

In order to comply with the Law and ensure the safety and health of workers using work equipment, it is necessary that the company can demonstrate to the Labour Authority that each machine, tool or equipment available to workers complies with current legislation.

The overall risk assessment per job includes, among others, risks generated by machines and tools that are detected by direct observation, without the need for specific tests or measurements.

To complete this overall risk assessment and establish the status or condition of work equipment in accordance with legal requirements to be met, below there is a list of them indicating their compliance status.

This conformity must be accredited with documents and the requirements are different depending on whether work equipment subject to the CE marking (CE mark, declaration of conformity and instruction manual) or work equipment not subject to it. Equipment or facilities subject to specific regulations that have to be justified by the corresponding periodic reviews or inspections by authorized installers, inspectors entities or bodies authorized.

Table 7.4

Tools, machinery and vehicles used [1]

GENERAL REGULATION MACHINES OR TOOLS	MODEL	MEETS REGULATIONS
1 Packing machine	ROCHMAN	Yes
1 Double head cutting machine	MECAL SW 543	Yes
1 Machining center	MECAL four axes MC 304 ARIEL	Yes
1 Milling machine	FR 706 MECAL	Yes
1 Cutting machine	MECAL AS400M	Yes
1 Milling copier machine	FR810P	Yes
4 Pneumatic workbench		Yes
2 Pneumatic screwdrivers		Yes
2 Pneumatic drills		Yes
4 Manual drills		Yes
SPECIFIC REGULATION MACHINES OR TOOLS	MODEL	MEETS REGULATIONS
1 Overhead Crane	GH N°76828 3.2 TN	Yes
1 Compressor	KAESER AIRTOWER 19	Yes
1 Boiler	DOMUSA with 1000 litres diesel	Yes
VEHICLE	MODEL	
1 Truck	Iveco Daily 35C14 136 CV	
1 Van	Fiat	

7.2 Sensitive workers

According to information provided by the company has not been detected particularly sensitive staff.

In the case of joining the staff workers particularly sensitive (pregnant women, recent childbirth or breastfeeding, children and workers with disabilities or sensitivity) we remind the need to reassess that post considering its special characteristics [1].

7.3 Hazards identification

The evaluation process begins with the identification of risks in every job and facilities. The risks identified are of different nature depending on the originating cause and its health consequences.

- **Accident risks:** caused by an unsafe working condition and materialize suddenly.
- **Hygiene risks:** from the presence in the workplace of environmental agents that may affect employees as a result of prolonged exposure over time.
- **Ergonomic risks:** derived from the physical requirements of the task and the work environment to which is subjected the worker.
- **Psychosocial risks:** factors associated with work organization, task requirements psychic and interpersonal relationships.
- **Deficiencies:** breaches of regulations that do not generate any risk but that's hold be remedied.

The different risks, along with their description are listed.

Accidents:

- Fall of people at different levels: Includes both falls from heights and depths.
- Fall of people at the same level: Includes falls in walkways or work surfaces and objects falling on or against.
- Falling objects by collapse or collapse: Includes falls from buildings, walls, scaffolding, ladders, stacks of goods, etc., and landslides landmasses, rocks, avalanches, etc.
- Falling objects manipulation: Includes drop tools, materials, etc., on a worker, provided that the injured person is manipulating the fallen object.
- Fall of detached objects: Includes tools or materials falling on a worker, provided it were not manipulated.
- Stepping on objects: Includes accidents that result in injury from footsteps on sharps.

- Striking against moving objects: Worker suffers shock by moving parts of machines or installations. Entrapments are not included.
- Striking against stationary objects: Consider the worker blows from objects that are not moving is caused.
- Blows or object or tool cuts: Worker by an object or tool is injured during use. Being struck by falling objects are not included.
- Projection fragments or particles: Includes accidents due to the projection onto the worker flying fragments or particles from machines or tools.
- Entrapment by or between objects: In parts of machines, with different materials, etc.
- Entrapment overturning of machinery or vehicles include entrapments due to overturning of trucks, vehicles or other machines that can imprison the worker.
- Overexertion: Accidents caused by specific actions related to the handling of loads or taking extreme positions.
- Exposure to extreme environmental temperatures: Accidents caused by physiological timely to meet the worker exposed to excessively cold or hot environment changes.
- Thermal contacts: Accidents caused by extreme temperatures and having objects that come in contact with any part of the body (liquid or solid).
- Electrical contacts: are all accidents whose cause is electricity.
- Inhalation or ingestion of toxic substances: Accidents caused by a point to a toxic atmosphere or by ingestion of toxic exposure.
- Contacts with aggressive substances: Accidents caused by contact with substances that result in extreme injuries.
- Contamination by biological agents: Infections caused by living organisms such as viruses, bacteria, fungi or parasites.
- Exposure to radiation: Risk caused by a point to both ionizing and non-ionizing radiation exposure.

- Fire and explosion protection: Actions that result in injury from the blast or its side effects, or fire due to handling of chemicals or teams. Anyway just affect the person who is working with this equipment or products.
- Accidents caused by living things: Accidents caused directly by people or animals.
- Abuses or death by vehicle: Includes people per vehicle violations and accidents where the injured worker goes on the damaged vehicle. Traffic accidents are not included.
- Accidents movement: Traffic accidents occurred during working hours, regardless of whether it is normal or not work.
- Other risks not included in other charts.

Hygiene hazards:

- Exposure to chemicals by inhalation: situations in which there are continued presence of chemical agents in the work environment are considered and it is possible that the worker's breathing.
- Exposure to chemical agents contact: situations in which repeated exposure to certain chemical agents from the skin of the workers and as a result may be considered, it can produce dermal absorption or skin conditions.
- Exposure to Noise: Noise exposure is considered in those jobs that may pose a health risk, and not merely a cause of annoyance or discomfort.
- Exposure to vibration: Exposure to vibrations occurs when a body part is transmitted the rocking motion of a structure, whether the ground, a handle or a seat.
- Risk of heat stress: Originated in those jobs under adverse climatic conditions, both cold and heat.
- Exposure to ionizing radiation: Use in the workplace natural radioactive sources (radioisotopes) or ionizing radiation producing devices (X-rays, rays, particle accelerators).
- Exposure to non-ionizing radiation: Use in job specific sources of non-ionizing radiation, such as ultraviolet, infrared, microwave, radio frequency radiation or static fields.

- Exposure to biological agents: situations where there may be contact with microorganisms, animals, plants and / or derivatives thereof that may pose a health risk are considered.

Ergonomic hazards:

- Postural problems: Activities in which the worker must maintain extreme or prolonged fixed postures, causing an overload on the body musculature.

- Repetitive movements: repetitive type activities involving the realization of rapid movements of the upper limbs, combined with efforts postures inadequate and insufficient recovery time job.

- Manual handling of loads: This includes all those activities that represent a lifting, carrying, pushing or towing a load by the employee.

- Data Display screens: Those jobs where the use of data visualization screens to involve a risk of physical, visual and / or mental load.

- Lighting: Situations where lighting conditions may pose a risk of eye fatigue for the worker.

Psychosocial hazards:

- The organization factors: implicit to the organization that may have a psychological impact on workers, as the existing level of participation and communication aspects, organization of work time and personal relationships.

- Task Factors: Aspects related to the task itself and the work to be performed, such as job content, the demands, the degree of autonomy, etc.

Deficiencies:

- Terms of evacuation: the status of evacuation routes and exits are considered, as well as proper signage and lighting.

- Fire protection equipment: It refers to the existence and proper state of extinguishers, BIE, detectors, etc.

- Toilets: Provision of locker rooms, showers, toilets, drinking water, rest rooms, etc.

- First Aid: Provision of local materials and first aid.

7.4 Characteristics of Risk Assessment Methods

7.4.1 Polish Standard Method (PN-N-18002/2000)

Technical director:

Table 7.5

Technical director risk assessment, Polish Standard Method.

HAZARD	PROBABILITY	HARMFULNESS OF CONSEQUENCES	RISK	RISK GRADE	RISK TOLERANCE	NECESSARY ACTIONS
TRAFFIC ACCIDENTS	Improbable	Extreme	Medium	2	Tolerable	Planned actions to reduce occupational risk level are recommended
EYES PROBLEMS	Highly	Medium	Medium	2	Tolerable	
FALL OF PEOPLE AT THE SAME LEVEL	Probable	Moderate	Small	1	Tolerable	Assurance that risk will remain at most on the same level is necessary.
STRIKING AGAINST STATIONARY OBJECTS	Probable	Moderate	Small	1	Tolerable	
POSTURAL PROBLEMS	Probable	Moderate	Small	1	Tolerable	
STEPPING ON OBJECTS	Probable	Moderate	Small	1	Tolerable	

Workshop operator (First group):

Table 7.6

Workshop operator (first group) risk assessment. Polish Standard Method.

RISK	PROBABILITY	HARMFULNESS OF CONSEQUENCES	RISK	RISK GRADE	RISK TOLERANCE	NECESSARY ACTIONS
FALL OF PEOPLE AT THE SAME LEVEL	Probable	Moderate	Small	1	Tolerable	Assurance that risk will remain at most on the same level is necessary.
STRIKING AGAINST OBJECTS	Improbable	Moderate	Small	1	Tolerable	
ELECTRICAL CONTACTS	Improbable	Medium	Small	1	Tolerable	
PROJECTION OF FRAGMENTS OR PARTICLES	Improbable	Medium	Small	1	Tolerable	
ENTRAPMENT BY OR BETWEEN OBJECTS	Improbable	Medium	Small	1	Tolerable	
FALLING OBJECTS FROM CRASH OR COLLAPSE	Improbable	Medium	Small	1	Tolerable	
CONTACT WITH SEALANT SUBSTANCES	Probable	Moderate	Small	1	Tolerable	
REPETITIVE MOTIONS	Probable	Moderate	Small	1	Tolerable	
BLOWS OR CUTS WITH OBJECTS OR TOOLS	Probable	Medium	Medium	2	Tolerable	Planned actions to reduce occupational risk level are recommended
OVEREXERTION	Probable	Medium	Medium	2	Tolerable	
EXPOSURE TO NOISE	Probable	Medium	Medium	2	Tolerable	
FALLING OBJECTS BEING HANDLED	Probable	Medium	Medium	2	Tolerable	

Workshop operator (Second group):

Table 7.7

Workshop operator (second group) risk assessment. Polish Standard Method.

RISK	PROBABILITY	HARMFULNESS OF CONSEQUENCES	RISK	RISK GRADE	RISK TOLERANCE	NECESSARY ACTIONS
FALL OF PEOPLE AT THE SAME LEVEL	Probable	Moderate	Small	1	Tolerable	Assurance that risk will remain at most on the same level is necessary.
STRIKING AGAINST OBJECTS	Improbable	Moderate	Small	1	Tolerable	
ENTRAPMENT BY OR BETWEEN OBJECTS	Improbable	Medium	Small	1	Tolerable	
MANUAL HANDLING OF LOADS	Probable	Moderate	Small	1	Tolerable	
BLOWS OR CUTS WITH OBJECTS OR TOOLS	Probable	Medium	Medium	2	Tolerable	Planned actions to reduce occupational risk level are recommended
OVEREXERTION	Probable	Medium	Medium	2	Tolerable	
FALL OF PEOPLE AT DIFFERENT LEVELS	Improbable	Extreme	Medium	2	Tolerable	
FALLING OBJECTS BEING HANDLED	Probable	Medium	Medium	2	Tolerable	
TRAFFIC ACCIDENTS	Probable	Medium	Medium	2	Tolerable	

7.4.2 Risk score method risk assessment

Technical director:

Table 7.8

Technical director risk assessment. Risk Score Method.

HAZARD	P	E	S	R	RISK CATEGORY	RISK ZONE	PREVENTIVE ACTIONS
TRAFFIC ACCIDENTS	1	6	15	90	Significant	Dangerous	Should be taken preventive actions and sought to reduce the risk to an acceptable level. The inspection should be increased and insightful.
EYES PROBLEMS	3	10	7	210	Significant	Dangerous	
FALL OF PEOPLE AT THE SAME LEVEL	1	6	3	18	Acceptable	Almost safe	Should be made periodic preventive security actions and carried out continuous monitoring.
STRIKING AGAINST STATIONARY OBJECTS	3	6	1	18	Acceptable	Almost safe	
POSTURAL PROBLEMS	1	10	3	30	Acceptable	Almost safe	
STEPPING ON OBJECTS	3	6	1	18	Acceptable	Almost safe	

Workshop operator (First group):

Table 7.9

Workshop operator (first group) risk assessment. Risk Score Method.

HAZARD	P	E	S	R	RISK CATEGORY	RISK ZONE	PREVENTIVE ACTIONS
FALL OF PEOPLE AT THE SAME LEVEL	1	6	3	18	Acceptable	Almost safe	Should be made periodic preventive security actions and carried out continuous monitoring.
STRIKING AGAINST OBJECTS	6	6	1	36	Acceptable	Almost safe	
ELECTRICAL CONTACTS	1	1	15	15	Acceptable	Almost safe	
PROJECTION OF FRAGMENTS OR PARTICLES	3	6	1	18	Acceptable	Almost safe	
ENTRAPMENT BY OR BETWEEN OBJECTS	1	6	7	42	Acceptable	Almost safe	
FALLING OBJECTS FROM CRASH OR COLLAPSE	1	3	15	45	Acceptable	Almost safe	
CONTACT WITH AGGRESSIVE SUBSTANCES	0,5	2	3	3	Acceptable	Almost safe	
REPETITIVE MOTIONS	1	3	3	9	Acceptable	Almost safe	
BLOWS OR CUTS WITH OBJECTS OR TOOLS	6	10	1	60	Significant	Dangerous	Should be taken preventive actions and sought to reduce the risk to an acceptable level. The inspection should be increased and insightful.
OVEREXERTION	3	6	3	54	Significant	Dangerous	
EXPOSURE TO NOISE	6	10	3	180	Significant	Dangerous	
FALLING OBJECTS BEING HANDLED	3	10	3	90	Significant	Dangerous	

Workshop operator (Second group):

Table 7.10

Workshop operator (second group) risk assessment. Risk Score Method.

HAZARD	P	E	S	R	RISK CATEGORY	RISK ZONE	PREVENTIVE ACTIONS
FALL OF PEOPLE AT THE SAME LEVEL	1	6	3	18	Acceptable	Almost safe	Should be made periodic preventive security actions and carried out continuous monitoring.
STRIKING AGAINST OBJECTS	6	6	1	36	Acceptable	Almost safe	
ENTRAPMENT BY OR BETWEEN OBJECTS	1	6	7	42	Acceptable	Almost safe	
MANUAL HANDLING OF LOADS	1	10	3	30	Acceptable	Almost safe	
BLOWS OR CUTS WITH OBJECTS OR TOOLS	3	10	1	30	Acceptable	Almost safe	Should be taken preventive actions and sought to reduce the risk to an acceptable level. The inspection should be increased and insightful.
OVEREXERTION	3	6	3	54	Significant	Dangerous	
FALLOF PEOPLE AT DIFFERENT LEVELS	3	3	7	63	Significant	Dangerous	
FALLING OBJECTS BEING HANDLED	1	10	3	30	Acceptable	Almost safe	
TRAFFIC ACCIDENTS	1	6	15	90	Significant	Dangerous	

7.4.3 Silesian University Method risk assessment

Technical director risk assessment. Silesian University Method.

Table 7.11

TECHNICAL DIRECTOR RISK ASSESSMENT											
WORKING OPERATION	COMPONENTS OF WORKING OPERATIONS	HAZARDS	P	S	RCZ	WR CZ	T CZ (MIN)	WNRCZ	WORK ACTIVITY	RISK CATEGORY	RISK ASSESSMENT UPDATE
1. Visit the clients for carrying out the measurement and data collection.	Drive to the place where will be placed the product and meet with the client.	TRAFFIC ACCIDENTS	1	4	4	4	40	2,35	DANGEROUS	SIGNIFICANT 3,01 ÷ 6	EVERY 2 MONTHS
	Do necessary measures and data collection.	FALL OF PEOPLE AT THE SAME LEVEL	1	3	3	3	30		ALMOST SAFE	ACCEPTABLE 2,01 ÷ 3	EVERY 3 MONTHS
		STRIKING AGAINST STATIONARY OBJECTS	3	1	3	3	30		ALMOST SAFE	ACCEPTABLE 2,01 ÷ 3	EVERY 3 MONTHS
		STEPPING ON OBJECTS	3	1	3	3	30		ALMOST SAFE	ACCEPTABLE 2,01 ÷ 3	EVERY 3 MONTHS
2. Perform and design technical study.	Perform the technical study to know exactly how everything should be done and design the technical drawings of the products and send them to the workshop	EYES PROBLEMS	1	2	2	2	180		SAFE	MINIMAL 1 ÷ 2	EVERY 6 MONTHS
		POSTURAL PROBLEMS	1	2	2	2	170		SAFE	MINIMAL 1 ÷ 2	EVERY 6 MONTHS

Workshop operator (first group) risk assessment. Silesian University Method.

Table 7.12

WORKSHOP OPERATOR FIRST GROUP RISK ASSESSMENT											
WORKING OPERATION	COMPONENTS OF WORKING OPERATIONS	HAZARDS	P	S	RCZ	WRCZ	Tcz(MIN)	WNRCZ	WORK ACTIVITY	RISK CATEGORY	RISK ASSESSMENT UPDATE
1.Prepare the raw material.	Bring the product from the warehouse to the workstation.	FALL OF HANDLING OBJECTS	2	2	4	4	6	3.23	DANGEROUS	SIGNIFICANT 3.01 ÷ 6	EVERY TWO MONTHS
		OVEREXERTION	2	2	4	4	8		DANGEROUS	SIGNIFICANT 3.01 ÷ 6	EVERY TWO MONTHS
		FALLS	1	2	2	2	6		SAFE	MINIMAL 1 ÷ 2.01	EVERY TWO MONTHS
	Inspect and prepare the aluminum to be cut according to the needed measures.	STRIKING AGAINST OBJECTS.	2	1	2	2	15		SAFE	MINIMAL 1 ÷ 2.01	EVERY TWO MONTHS
		FALLING OBJECTS.	1	3	3	3	15		ALMOST SAFE	ACCEPTABLE 2.01 ÷ 3	EVERY THREE MONTHS
2.Manufacture the product.	Prepare and turn on the machinery and tools.	ELECTRICAL CONTACTS.	1	3	3	3	10		ALMOST SAFE	ACCEPTABLE 2.01 ÷ 3	EVERY THREE MONTHS
		Cut aluminum shape to required length and shape of the frame and sash, form holes at window frame and sash section.	BLOWS OR CUTS.	2	3	6	6		45	DANGEROUS	SIGNIFICANT 3.01 ÷ 6
	PROJECTION OF FRAGMENTS.		3	1	3	3	45		ALMOST SAFE	ACCEPTABLE 2.01 ÷ 3	EVERY THREE MONTHS
	EXPOSURE TO NOISE		3	2	6	8	45		DANGEROUS	SIGNIFICANT 3.01 ÷ 6	EVERY TWO MONTHS
	ENTRAPMENT	1	3	3	3	45	ALMOST SAFE		ACCEPTABLE 2.01 ÷ 3	EVERY THREE MONTHS	
3.Assembly the product.	Install and fix reinforcing bars to the frame and sash, insert weather strip, fittings and accessories to the window frame and sash.	REPETITIVE MOTIONS	2	1	2	2	100	SAFE	MINIMAL 1 ÷ 2.01	EVERY SIX MONTHS	
	Apply small gap sealant in all miter joints, assembly the different parts of the sash and frame, and finally assembly the sash into the frame of the window.	CONTACT WITH SEALANT SUBSTANCES	2	1	2	2	140	SAFE	MINIMAL 1 ÷ 2.01	EVERY SIX MONTHS	

Workshop operator (second group) risk assessment. Silesian University Method.

Table 7.13

WORKSHOP OPERATOR SECOND GROUP RISK ASSESSMENT											
WORKING OPERATION	COMPONENTS OF WORKING OPERATIONS	HAZARDS	P	S	RCZ	WR CZ	Tcz (MIN)	WNR CZ	WORK ACTIVITY	RISK CATEGORY	RISK ASSESSMENT UPDATE
1. Pack the final product.	Bring the product to the packaging machine.	MANUAL HANDLING OF OBJECTS	1	3	3	3	10	3.12	ALMOST SAFE	ACCEPTABLE 2.01 ÷ 3	EVERY THREE MONTHS
		STRIKING AGAINST OBJECTS	2	1	2	2	10		SAFE	MINIMAL 1 ÷ 2.01	EVERY TWO MONTHS
	Pack the product correctly with the packaging machine.	ENTRAPMENT	1	3	3	3	60		ALMOST SAFE	ACCEPTABLE 2.01 ÷ 3	EVERY THREE MONTHS
2. Bring the product to its final destination.	Load the product into the truck.	OVEREXERTION	3	2	6	6	30		DANGEROUS	SIGNIFICANT 3.01 ÷ 6	EVERY TWO MONTHS
	Drive the truck to the destination.	TRAFFIC ACCIDENTS	1	4	4	4	60		DANGEROUS	SIGNIFICANT 3.01 ÷ 6	EVERY TWO MONTHS
	Download it from truck.	FALL OF HANDLING OBJECTS	1	3	3	3	30		ALMOST SAFE	ACCEPTABLE 2.01 ÷ 3	EVERY THREE MONTHS
3. Install the product.	Perform the installation on customer premises.	FALL FROM HEIGHT	1	4	4	4	100		DANGEROUS	SIGNIFICANT 3.01 ÷ 6	EVERY TWO MONTHS
		FALL DOWN	1	2	2	2	100		SAFE	MINIMAL 1 ÷ 2.01	EVERY TWO MONTHS
		CUTS AND BLOWS WITH TOOLS	1	3	2	2	80		ALMOST SAFE	ACCEPTABLE 2.01 ÷ 3	EVERY TWO MONTHS

7.5 Analysis and comparison of methods and results

7.5.1 Technical director

The table below (7.14) shows comparison of risk assessment results for the technical director workstation carried out with Risk score method, PN-N 18002:2004 method and Silesian University of Technology method.

Table 7.14

Technical director results comparison.

HAZARD	TIME OF EXECUTION (% OF WORKING JOURNEY)	RISK SCORE METHOD		PN-N 18002:2004		SILESIAN UNIVERSITY METHOD	
		RISK CATEGORY	WORK ACTIVITY CATEGORY	RISK CATEGORY	RISK TOLERANCE	RISK CATEGORY	WORK ACTIVITY CATEGORY
Traffic accident	40 (8.33%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
Eye problems	30 (6.25%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
Fallens	30 (6.25%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
Striking against objects	30 (6.25%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
Postural problems	180 (37.50%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
Stepping on objects	170 (35.42%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe

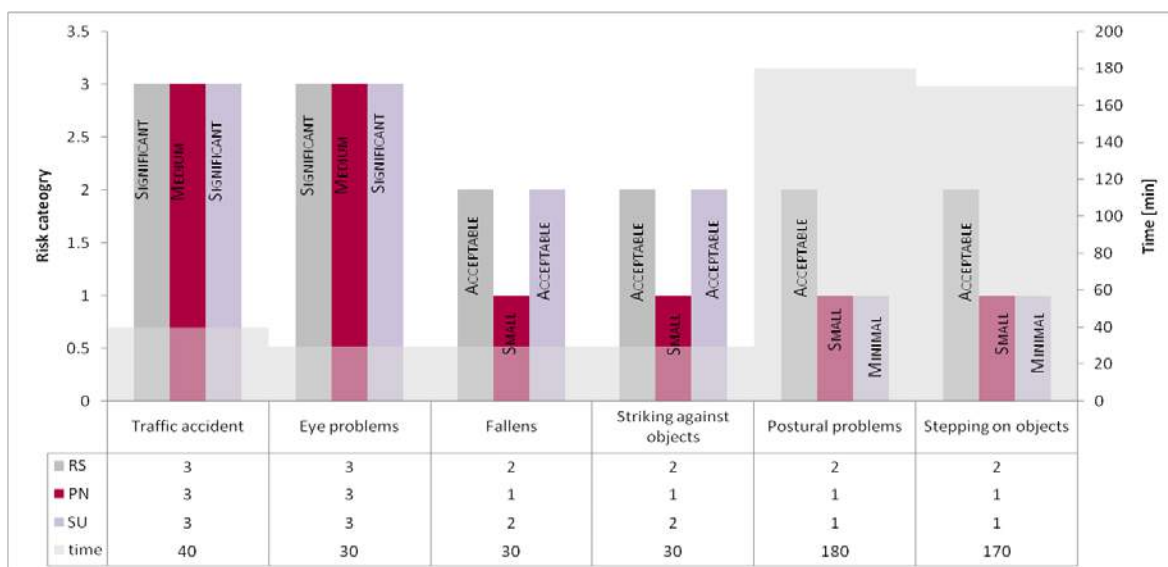


Chart 7.1 Technical director comparison of results

7.5.2 Workshop operator (First group)

The table below (7.16) shows comparison of risk assessment results for the first group of workshop operators carried out with Risk score method, PN-N 18002:2004 method and Silesian University of Technology method.

Table 7.15

Workshop operator (first group) results comparison.

HAZARD	TIME OF EXECUTION (% OF WORKING JOURNEY)	RISK SCORE METHOD		PN-N 18002/2000		SILESIA UNIVERSITY METHOD	
		RISK CATEGORY	WORK ACTIVITY CATEGORY	RISK CATEGORY	RISK TOLERANCE	RISK CATEGORY	WORK ACTIVITY CATEGORY
Fallen at the same level	6 (1.25 %)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
Striking against objects	15 (3.12 %)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
Electrical contacts	10 (2.08 %)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
Projection of fragments or particles	45 (9.37 %)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
Entrapment	45 (9.37 %)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
Falling objects from crash or collapse.	15 (3.12 %)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
Contact with sealant substances	140 (29.1%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
Repetitive motions	100 (20.8%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
Blows or cuts	45 (9.37 %)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
Overexertion	8 (1.66 %)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
Exposure to noise	45 (9.37 %)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
Falling objects being handled	6 (1.25%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous

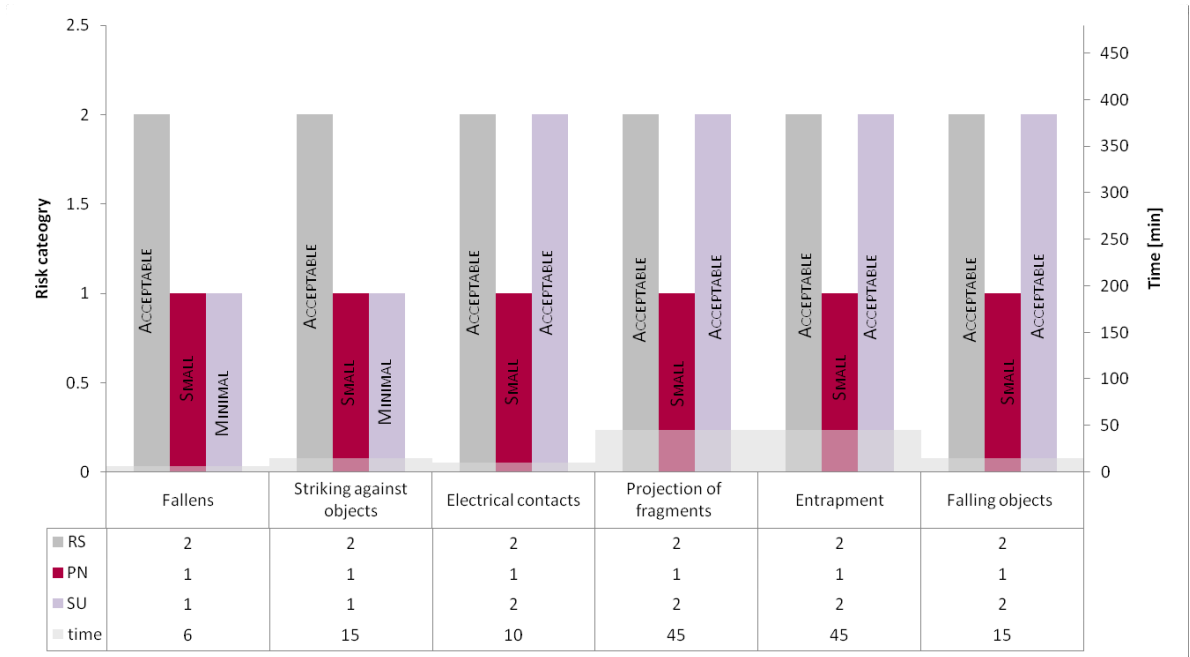


Chart 7.2 Workshop operator (first group) comparison of results

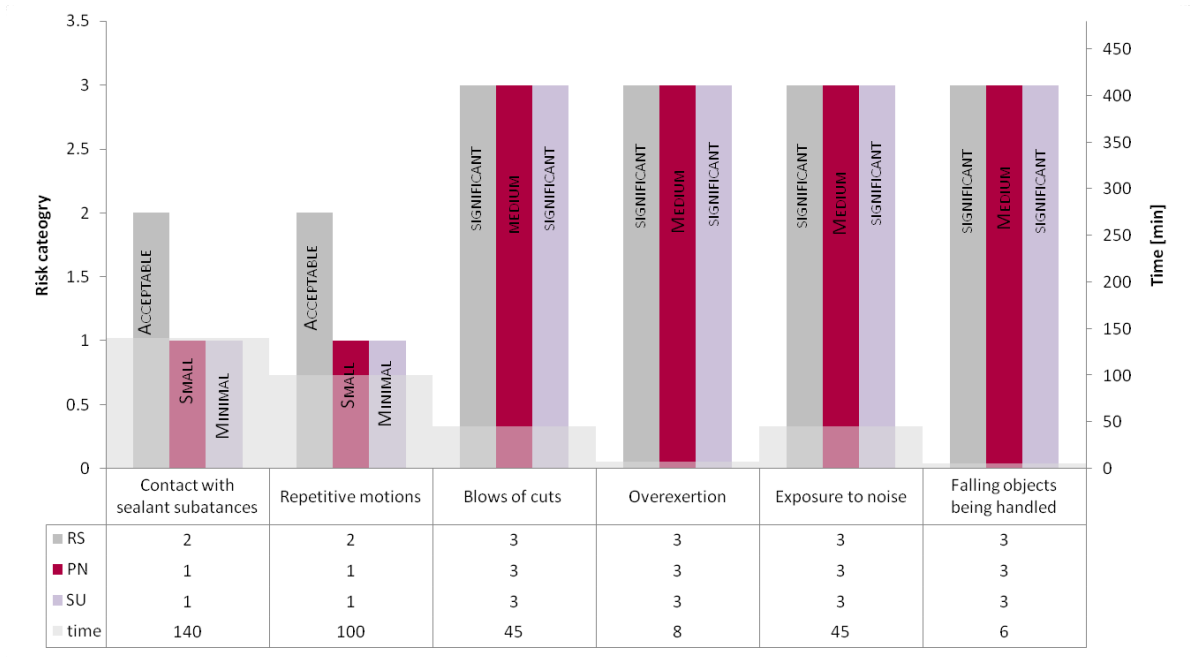


Chart 7.3 Workshop operator (first group) comparison of results

7.5.3 Workshop operator (Second group)

The table below (7.16) shows comparison of risk assessment results for the second group of workshop operators carried out with Risk score method, PN-N 18002:2004 method and Silesian University of Technology method.

Table 7.16

Workshop operator (second group) results comparison. Risk score method and PN-N 18002:2004 method.

HAZARD	TIME OF EXECUTION (% OF WORKING JOURNEY)	RISK SCORE METHOD		PN-N 18002/2000		SILESIA UNIVERSITY METHOD	
		RISK CATEGORY	WORK ACTIVITY CATEGORY	RISK CATEGORY	RISK TOLERANCE	RISK CATEGORY	WORK ACTIVITY CATEGORY
Fallen at the same level	100 (20.83%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
Striking against objects	10 (2.08%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
Entrapment	60 (12.5%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
Manual handling of loads	10 (2.08%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
Blows of cuts with objects or tools	80 (16.67%)	Acceptable	Almost safe	Medium	Tolerable	Acceptable	Almost safe
Overexertion	30 (6.25%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
Fall from heights	100 (20.83%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
Falling objects being handled	30 (6.25%)	Acceptable	Almost safe	Medium	Tolerable	Acceptable	Almost safe
Traffic accidents	60 (12.5%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous

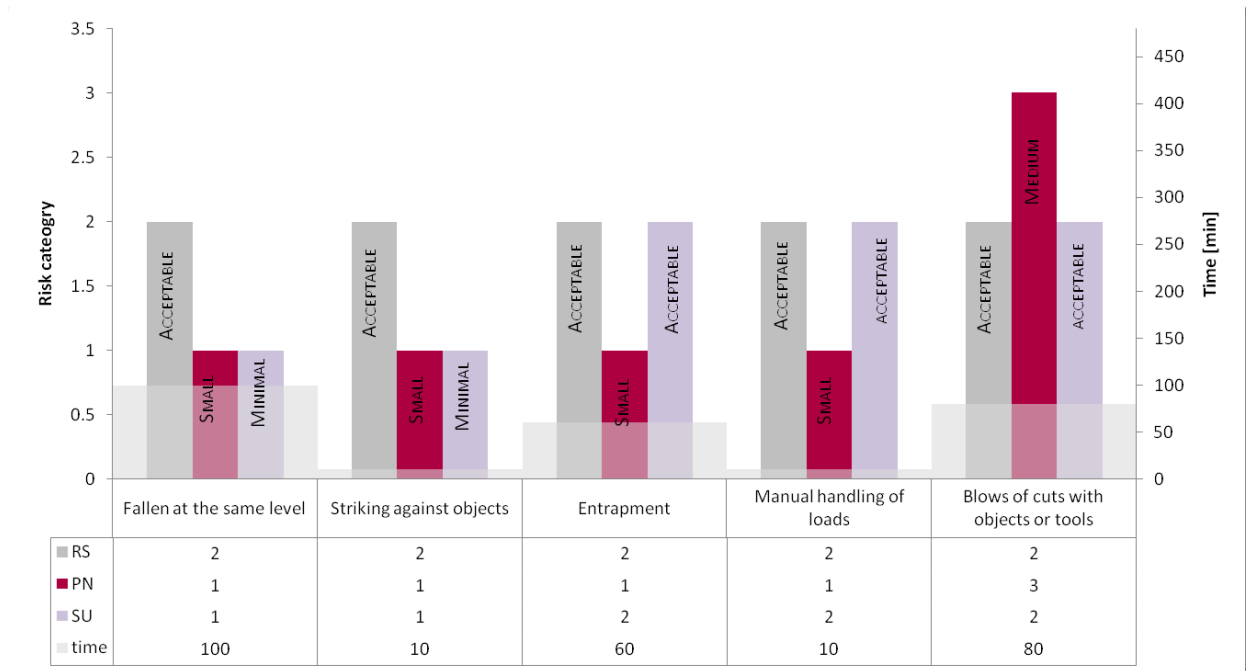


Chart 7.4 Workshop operator (second group) comparison of results

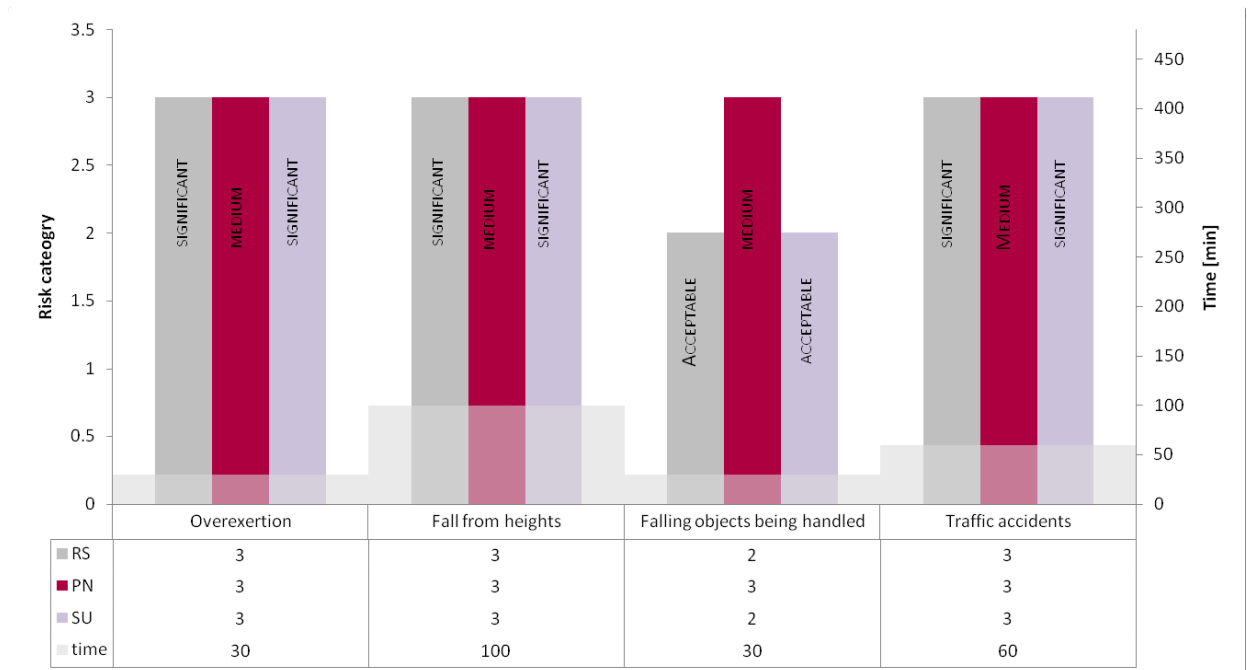


Chart 7.5 Workshop operator (second group) comparison of results

8. Preventive actions proposal

After realizing the analysis and assessment of every working activity at workplace in the company Nuevas Tecnologías de la Ventana, SLU can be proposed appropriate preventive controls to minimize occupational risks.

8.1 *Technical director preventive actions and measures:*

Traffic accidents, Displacements in vehicles:

- Establish a schedule for periodic review and maintenance of all company vehicles. It is also recommended that a procedure written notice of anomalies detected in the vehicles. Repair any damage before what may have occurred in vehicles.
- Comply with the following safety standards for lead:
 - Respect the rules strictly stated in the Highway Code.
 - Anticipating possible maneuvers from other users and dangerous traffic conditions or route.
 - Respect safety distances.
 - Pay particular attention when alighting or walking beside it if stop on the shoulder of a road circulation.
 - Perform all maintenance checks recommended by the manufacturer.
 - When any load is transported must be positioned so that hazardous movements are avoided using suitable fastening means necessary. Check stability and support loads before starting the movement.
 - Do not drive under the influence of alcohol and / or CNS depressant medications or drugs. If drugs that may affect driving are taken, it must be reported to the Company, through the surveillance of health, appropriate measures are taken.
 - Avoid heavy meals or fatty foods when then must lead.
 - Do not drive for prolonged periods; enough rest, taking short, frequent breaks.

- Stop the vehicle immediately in adequate conditions of safety for you and other drivers if you notice symptoms of somnolence.
- In case of breakdown or emergency (relief for injured) in road transfers it is recommended to use the emergency signals and signaling vests before invading the driveway.

Screens Data Visualization: Using PVD

- When working with a computer you should consider the following recommendations:
 - Adjust the seat height so that your elbows are at or slightly below the table.
 - Adjust the backrest of your chair so that your back is supported properly.
 - If the height adjustment of the chair can not keep their feet on the floor, use a footrest.
 - Place the top edge of the screen at eye level or slightly below.
 - Support the forearms on the table in front of the keyboard to relax the muscles of the shoulders.
 - Whenever possible, place the computer in parallel with both natural and artificial light sources, to avoid glare or reflections on the screen.
- As a general rule, your computer should occupy the leading position in the desk, that is, to the user. In addition:
 - Place the bottom of the same slightly closer to the user than the upper portion.
 - Locate the top of the screen at eye level of the user or slightly below.
 - Place the screen at a distance greater than 40 cm from the eyes of the user.
- The use of a briefcase for all those people that must continuously display texts and the computer screen is recommended. The characteristics required of the briefcase are:
 - Being adjustable in height, angle and distance.

- The support rests where the document should be opaque and covering an area of low reflectance.
- Having enough to support the weight of the documents without resistance oscillations.
- The use of the palm rest is optional, and is only recommended in the event that the user has a thin wrist, and otherwise to raise the wrist pad, a strained wrist posture provoked.
- It is recommended to follow these recommendations when sitting:
 - Sit in the chair and bring it to the table. If the armrests prevent access to the table is advisable to remove them unless they are adjustable in height.
 - Adjust the seat height so that your elbows are at table height or slightly below the height of the table.
 - If this height can not comfortably rest your feet on the ground, you must request a footrest.
 - The backrest height should be adjusted to get a comfortable support in the lumbar area of the back.
 - Adjust the depth of the seat to prevent the seat edge press the back of the knees. If not possible, you should request a seat shallower.
 - It is recommended to change posture throughout the workday, using the regulatory mechanisms of the chair and getting up occasionally.
- Between the keyboard and the edge of the table should have a minimum of 10cm in order to support the forearms and wrists on the table. It is also recommended to adjust the height of the keyboard so that during use hands are aligned with forearms. Technically this is not so when using wrist is recommended.

Fall of people at the same level: Slips and trips

- Place the power cords from phones, computers and other electrical equipment and so as not to obstruct traffic areas.
- It must use safety footwear with good traction during visits to the works.

Striking against stationary objects: Bumping into furniture

- Maintain clear and unobstructed all traffic areas, avoiding these items stored in boxes or packages.

Postural: Sitting position continued

- Although it is not subjected to physical exertion, prolonged maintenance of a particular posture leads to fatigue of the muscles. For this reason, avoid the positions of fixed and static work providing the person can rise from time to time or walking takes too long when sitting; or, standing workstations, allow it to sit or lean or shift weight from one foot to another.
- Tips for physical exercises:
 - Relax and focus attention on the muscles that are being stretched.
 - Perform the movements slowly, reaching the final positions without forcing, without pain.
 - Repeat each movement 10 times.
 - Perform full table 2 or 3 times a day, every day.
 - If after a few days of starting the exercises appear muscle aches, reduce the number of repetitions or perform them stop for a few days. Subsequently perform them again with less intensity.

Stepping on objects: Presence of other sharp materials in the works.

- Movement will be defined by the entrances or areas and / or authorized by those responsible for facilities / works not moving through areas where conditions cleanings and order are not appropriate.
- Keep clear and clean walking areas. Remove sharp objects from the floor.
- Request to the address of the work or the safety coordinator to proceed with cleaning access and work area.
- Avoid stepping on debris and boards.
- You must use safety shoes during visits to the works. The shoe must have sole with reinforced material to prevent slippage drawing template.

8.2 Workshop operator preventive actions and measures:

Fall of people at the same level: By tripping over materials or distributed objects work areas.

- We suggest that the shoe soles are patterned material and to avoid slippage.
- Work spaces should be kept clean, dry and free of slippery substances.
- Must be signaled traffic areas and storage and keep them free of obstacles.
- The electrical wiring shall be avoided by installing plugs on the floor next to the place of location of electrical equipment connected points. Also laying electrical cables must be made in discrete locations, so that no risk of snagging or slip is not generated in the first.
- If the cabling is done on the floor of the walkways, should be used protections (angled beams at the side of the cable or cable bundles, with the apex directed outward and touching the ground).
- Do not leave the hose on the floor in traffic areas. Hoses must be transported collected in reels or rolls without drag. Also, when not in use, you have saved or rolled into reels hung from suitable supports.

Falling objects manipulation: When handling materials or hand tools (falling on the worker).

- Operators must indicate the mandatory use of safety-toe footwear in order to avoid injury from falling materials handled. Any equipment purchased must have the "CE" and an information brochure that will be referenced and clearly explain the levels of protection provided by the equipment. Must also issue a statement certifying that the PPE market conforms with the provisions of the Law.
- Hand tools should be placed in appropriate tool or move shelves and in boxes or bags.
- The loads to be handled must be clean and free from slippery substances.

Stepping on objects: By foot injuries with sharp or sharp materials distributed by the workshop floor.

- Cuts excess material should be collected.
- The spaces and workplaces should be cleaned regularly and whenever necessary.
- When on the floor of the workplace exist or may exist sharp objects (nails ,metal shavings, chips, etc.), should be used a shoe with security sole.

Striking against stationary objects: By beating against the machines or objects stored in the vicinity of the working areas.

- The floors, corridors and stairways must remain unobstructed.

Blows or cuts with objects or tools: Blows and cuts produced using hand tools.

- Tools should be kept sharp and piercing and cutting sides should maintain properly insulated. It is convenient to conduct periodic reviews.
- Tools should be in good cleaning and maintenance during use must be free of grease, oil and other slippery substances.
- Must improve work methods and training of workers, giving precise instructions on the use of tools and safety measures to be taken.
- To reduce the risk of shock or cuts with objects or tools, we recommend:
 - Use specific protection gloves when handling materials and / or tools unless they are of the rotary type.
 - Use guards that come with the machines used and not remove them.
- Safety in the use of pneumatic guns
- The nail will be equipped with elements that force the device to connect to the circuit pressure is If the cabling is done on the floor of the walkways, should be used protections (angled beams at the side of the cable or cable bundles, with the apex directed outward and touching the ground).

- Do not leave the hose on the floor in traffic areas. Hoses must be transported collected in reels or rolls without drag. Also, when not in use, you have saved or rolled into reels hung from suitable supports
- Operators must indicate the mandatory use of safety-toe footwear in order to avoid injury from falling materials handled. Any equipment purchased must have the "CE" and an information brochure that will be referenced and clearly explain the levels of protection provided by the equipment. Must also issue a statement certifying that the PPE market conforms with the provisions of the Law.
- Hand tools should be placed in appropriate tool or move shelves and in boxes or bags.
- The loads to be handled must be clean and free from slippery substances.
- Cuts excess material should be collected.
- The spaces and workplaces should be cleaned regularly and whenever necessary.
- When on the floor of the workplace exist or may exist sharp objects (nails, metal shavings, chips, etc.), should be used a shoe with security sole.
- The floors, corridors and stairways must remain unobstructed.

Blows or cuts with objects or tools: Blows and cuts produced using hand tools.

- Tools should be kept sharp and piercing and cutting sides should maintain properly insulated. It is convenient to conduct periodic reviews.
- Tools should be in good cleaning and maintenance during use must be free of grease, oil and other slippery substances.
- Must improve work methods and training of workers, giving precise instructions on the use of tools and safety measures to be taken.
- To reduce the risk of shock or cuts with objects or tools, we recommend:
 - Use specific protection gloves when handling materials and / or tools unless they are of the rotary type.
 - Use guards that come with the machines used and not remove them.

- Safety in the use of pneumatic guns
 - The nail will be equipped with elements that abandoned.
 - It will be periodically check the pressure in the supply circuits is specific to the operation of each device.
 - The guns that are used will be equipped with the probe, as well as the possibility of shooting burst is eliminated. Plus they have the characteristic inability to disable the probe by the operator.
 - Rapid guns plunger will still be removed safely stuck nails or staples.

- Safety rules for the use of nail guns and nailers
 - Before starting work the perfect condition of the gun is checked and not lack any of its constituent elements.
 - All elements are perfectly connecting to tighten pressure circuit as accidental disconnection can cause serious injury.
 - To the apparatus will be given pressure gradually, not all at once, in order to avoid damage and possible injury mechanisms.
 - Will be verified in a safe place (no operators in the vicinity) that the controls are working properly.
 - No parts stapled together subject manually, as the shot may be uncontrolled.
 - No limit will trigger parts as staple or nail can excel the operator and damage during handling.
 - Air pressure will be monitored, since an overpressure can cause violent expulsion of the blades, causing injury.
 - The assistant will be located towards the side opposite to the ejection of fragments retaining wire nails or staples side.
 - Hearing protection is needed.

- Before leaving the tool is disconnected from the circuit under pressure. If the work is temporarily interrupted, the air valve in order to prevent accidents will close. The use or handling of the gun or untrained personnel outside these tasks is not permitted.
- Respect the basic safety rules in the use of pneumatic tools:
 - Check that the fittings, hoses and tools that will be used are appropriate for the equipment used and the working pressure
 - Check that the air supply pressure is recommended for the equipment used or the work performed.
 - Ensure the coupling of the tools to the air hose. Always use safety restraint devices that prevent the tool from being thrown.
 - Lock the trigger safety through your device when you are not working with the tool.
 - Do not eject tool portable pneumatic equipment by pressure; manually disassemble.
 - Before solving any breakdown or accident, stop and depressurize the equipment. Do not attempt to adjust the connections with the team under pressure.
- Cutting or piercing tools will be stored and transported in suitable boxes or covers. In working at heights, scaffolding and ladders tools should be carried in bags or hanging leaving your hands free.

Flying fragments or particles projected performing the machining and assembly operations.

- When operations at risk of flying particles or liquids are carried, not removed by existing safeguards, you should use personal protective equipment (goggles, face shields, gloves, etc.) to protect the exposed body parts.
- Hand tools should be constructed of durable materials, be the most appropriate for its characteristics and size of the operation to be performed and not have defects that can break or wear on hit.
- Respect the rules of safe use of compressed air:
 - Avoid using compressed air for cleaning; the air jet can blow particles in the eye and generate lots of harmful dust.

- If it is essential to use compressed air will be done at low pressure, with (panels, screens ...) necessary protection to prevent flying particles and use face protection and eyewear (goggles, face shields).
- Do not use compressed air to clean clothes.
- Never point the air stream at people; can cause serious injury.
- Replace air cleaning methods by insurance; using a vacuum cleaner, a brush or wet methods.

Entrapment or between objects: By trapping with moving machine parts or handling heavy materials.

- Work equipment must not be used without the elements of protection provided by the manufacturer or safety devices neutralized.
- Must information and training to workers about the risks, preventive measures and working procedures to operate the equipment safely.
- Safety rules for the correct use of work equipment:
 - Before using the work equipment must be checked for their protection and conditions of use are suitable and that connection or startup is not a danger to others. It is forbidden to use their computers without or neutralized protection devices.
 - When teams with accessible hazardous elements that can not be fully protected are used, additional precautions such as pushers, templates, clamps, etc. should be taken, and appropriate measures to reduce the risks to a minimum personal protection used.
 - Do not use work equipment or in conditions contraindicated by the manufacturer.
 - Work teams should be allowed to use if deterioration, failure, or other circumstances that endanger the safety of operation occur.
 - The use of equipment commonly used in hazardous environmental conditions for which they are not designed is prohibited.
 - The maintenance, assembly and disassembly of equipment work performed safely in compliance with the manufacturer's instructions or failing those developed by the employer.

- When handling manually guided teams must respect a safe distance to avoid shock loading, or equipment with other teams, workers or parts of structure itself. You must also have at all times an adequate visibility and control.
- Must devices allowing blocking teams and prevent its implementation installed when cleaning, maintenance or repairs are made. Furthermore, due to signal that such operations are being carried out.
- Keep and maintain equipment in optimal working conditions to ensure the proper operation thereof. It is advisable to follow the manufacturers instructions and record these interventions in daily maintenance. If not available from manuals, procedures should be developed written work indicating how to perform maintenance and what security measures should be taken.
- Safety in the use of the router:
 - Never remove metal chips by hand, always do it with a hook and gloves.
 - Make all cleaning and maintenance with the engine stopped.
 - No work wearing very baggy or loose clothing that can be trapped by moving parts.
 - Check that all guards of the moving parts are installed.
 - Before milling a piece make sure it is securely tightened with clamping claws.
 - Do not carry the machine in motion measurements of the work piece, finished with lime or any maintenance.
- Safety in the use of the cutting:
 - Check that the clamps are tight.
 - When you are cutting up long pieces, fit the material portion projecting from the machine.
 - Make all cleaning and maintenance with the engine stopped.
 - No work wearing very baggy or loose clothing that can be trapped by moving parts.
 - Check that all guards of the moving parts are installed.

Falling objects by collapse or collapse: Elevation windows for installation or placement.

- To improve the safety of the next teams workers lifting loads, you must:
 - Establish roads suspended loads to avoid going over the jobs.
 - Place so that the operator can control both the cargo area and discharge; If not possible, you should get help from another operator using coded gestures.
- Safety rules to be followed in the use of the crane:
 - Rules for the crane operator:
 - Should only be authorized operating the crane by the crane operator.
 - Do not operate the crane if you are not in perfect physical condition. If you are ill, inform the manager.
 - Communicate immediately malfunctions.
 - Remove elements in disrepair as soon as the defects are detected
 - Rules relating to the working environment:
 - Do not move loads over people.
 - Prevent people under the burdens are placed.
 - When lifting or lowering a load, make sure you can save materials or adjacent loads.
 - Never leave a suspended load.
 - Do not leave spacer blocks, tools or other utensils on top of a load.
 - Do not stack or leave the materials so that they can slide or unbalanced.
 - Do not use the crane to tow vehicles or loads.
 - Do not use lifting equipment for transporting people.
- Rules on lanyards.
 - Not drag on the ground slings or chains.
 - Never use a sling has been stretched or a hook that has begun to open.

- Ensure that slings are not kinked or twisted or form kinks.
- Rules for handling methods.
 - The load must engage when it is directly under the car. Do not allow bias shots.
 - Never attach more than the specified maximum allowable load for the crane.
 - Ask the manager if in doubt.
 - Distribute the load evenly among the various branches of a sling. Ensure that the angle between the branches and the vertical is as small as possible. The effort of the sling increases when the angle is greater.
 - Hang the load on the concavity of the hook, never on the point or close to it, unless it has been designed for this purpose.
 - When charging or discharging, keep your hands away from pinch points.
 - Never use limiters limit switch to stop the elements of the crane.
 - Whether to accompany the load, do following her, never preceding it.
- Establish a maintenance program and periodic reviews according to manufacturer instructions. Notwithstanding indicated:
 - Daily, before starting work, the engineer must review all elements under stress.
 - Every three months, at least, should be reviewed thoroughly cables, chains, pulleys, brakes, electrical controls and control systems for all items of equipment to be lifted. Also a register of interventions should be established.
- Working methods and a training plan aimed at operators, should be established on:
 - Management of lifting devices.
 - Directing and signaling maneuvers.
 - Knowledge of gestural signaling lifting maneuvers.

MHL: By manually manipulating pieces of aluminum (doors and windows).

- Before starting any task that required lifting, holding or moving load is very important to note the following preliminary considerations:

- Whenever possible use mechanical aids available: trucks, cars, lifting tables, etc.
- Follow the instructions that appear on the packaging about the potential hazards of the load, such as a center of gravity unstable, corrosive materials, etc.
- If no instructions on package, observe well the load, paying particular attention to its shape and size, possible weight, grip areas, potential danger spots, etc. Try to lift one side first, if not always the size of the load gives an accurate idea of its actual weight.
- Ask for help from others if the weight of the load is excessive and should adopt awkward postures during lifting and can not be resolved through the use of mechanical aids.
- Before moving the load to think about the route to be followed and remove any obstacles that hinder the passage.
- Wear clothing, footwear and adequate equipment.

Overexertion: When manually manipulate the pieces.

- No awkward postures should be taken as they can be as harmful as a poorly executed effort.
- It is necessary to train the operator in correct postures and gestures to avoid back pain, muscle twists, locks, etc.
- As a general indication, the weight of objects handled should not exceed 25kg. However, this limit should be reduced to 15 kg maximum when exposed workers are women, young or old. In special circumstances, physically healthy and trained workers could handle loads up to 40 kg, provided that the task is carried out sporadically and safely.
- Also avoid awkward work postures involving extreme positions or movement of the joints: arms above shoulder level, reach behind the body, pronounced tilt or twist back and neck, shoulders misaligned, etc., especially if they are moving or holding or carrying loads high forces.

Postural: When installing windows.

- To reduce the risk associated with the onset of stress positions, it is recommended that the following recommendations:
 - Avoid enforced or extreme as raising arms above shoulders when working at heights, using a ladder positions.
 - Also should be avoided whenever tilting or twisting of the back and neck as possible, especially when working in areas close to the ground, it is recommended to work with one knee on the ground or use a stool.

Electrical Contacts: For electrical contacts with the installation or use of portable electric tools.

- Respect the basic safety rules in the use of electrical equipment:
 - Before using any electrical equipment should review their status and their connections, and particularly check that conductors and live parts are properly insulated. If any abnormality is detected, it shall immediately notify the responsible for repair.
 - Electrical connections are made through standard plugs and sockets that support and ensure a good connection. No sockets or 'thieves' not to allow grounding of the equipment will be used.
 - When necessary to use extension cords or multi-plug bases, make sure they can handle the power of the equipment connected to them. If these elements are overloaded, they can damage or even burn the insulation.
 - To disconnect a computer from the wall outlet, pull the plug, not the cord.

Contact with aggressive substances: Upon contact with sealants, silicones and rinse

- You must use appropriate gloves and eye protection (goggles or face shields) and duly certified (CE marked) to avoid contact with the chemicals used.
- All hazardous chemicals (toxic, harmful, corrosive, irritant, flammable, etc.) must be properly labeled and have their safety record, so that anyone can use them know the risks and safety measures to consider. It is preferable that the products remain in their

original containers. When necessary perform transfers, the new packaging is adequately labeled, containing the information of the original label.

- When flammable products are used whenever the following rules should be adhered to:
 - Keep away from any source of ignition (flames, sparks, high temperature points)
 - Do not smoke or use any apparatus producing sparks or flames (torches, welding equipment or cutting ...)
 - Do not handle in closed, poorly ventilated places. Maintain good ventilation to prevent dangerous concentrations of vapors; open doors and windows if necessary.

Exposure to Noise: The noise generated by the machines used (machining center, cutting machine, etc.).

- The use of hearing protectors shall be determined as MANDATORY during operation of the machine cutting and machining center in addition to those noisy machines and equipment such as work and was determined after noise measurements made.
- Hearing protection, earplugs or headphones will be right to the spectrum and level of noise to which workers are exposed. The headphones must be kept in perfect condition, thus must be regularly cleaned and replaced the pads when the pressure exerted by the band is reduced over time. After use should be stored in a clean area where they will not be damaged.

Fall of people at different levels: On the use of ladders, scaffolds, etc., for the mounts.

- Establish a plan for inspections and repairs to ensure the correct state of ladders (well assembled crossbars, etc.).
- Ladders will have the strength and support elements and support necessary for its use does not pose a risk of rupture or fall by the same displacement. No ladders more than 5 m should be used. Length without being reinforced at its center and is prohibited from using ladders to heights over 7 m. construction and improvised.
- Safety rules for the correct use of ladders:

- Ensure stability of ladders before use. The base of the ladder be firmly established footings, iron spikes or other slip mechanism. The upper part will be subjected, if necessary, to the wall on which it rests.
- Simple hand ladders are placed at an angle of 75 degrees with the horizontal. When used to access high places their rails shall extend at least 1 m. above it.
- Before accessing the ladder make sure that both the soles of shoes, like the rungs are free of grease, oil or any slippery substance.
- The ascent, descent and work from ladders are made in front of them and hands free grabbing stringers or rungs.
- Keep within the body rails of the ladder.
- Works over 3.5 m. movements that require high efforts or dangerous to the stability of worker will only be made if the safety harness is used or alternative security measures.
- The tools or materials being used will be placed in a bag attached to the ladder, or the worker's belt.
- It is forbidden the transport and handling of loads from ladders or when their weight or dimensions may compromise worker safety.
- Ladders shall not be used by two or more people simultaneously.
- Never move the ladder while the worker on it.
- Do not use ladders painted by the difficulty it poses to the detection of possible defects.
- After the use of the ladder you must:
 - Clean substances that might have fallen on it.
 - Review and, if you find any defect affecting the safety signal with a sign prohibiting their use, and send it to repair or replace.
 - Correctly Store, free of adverse weather conditions on the ground but never hanging and resting on the stringers.

- When assembling scaffolds the following measures are followed:
 - The use of metal supports is recommended. In the case of wood, it must be healthy wood without knots, glued perfectly without distortion or breakage.
 - Place the axle stands on the surface of asnillas level support. They are fully open until it stops with maximum aperture limiter (cable, chain, etc.).
 - In the event of exceeding 2 m spacing between axle stands, easels intermediate will be used.
 - To avoid the risk of tipping by tilting the platform planks shall not exceed the bearings on the axle stands over 20 cm, or less than 10 cm.
 - His height does not exceed 3 meters unbraced, and between 3 and 6 meters adjustable armed braced racks are used.
 - Will not be allowed, under any circumstances, install so that they are stacked in double rows or tubular scaffold with wheels.
- When using scaffolding be taken into account:
 - When performing on balconies and openings where appropriate to that achieved high railings, safety harness perfectly tied or nets covering the landing surface and secured in the bottom of the ground floor that is be used scaffold so that a perimeter wall is achieved.
 - When performing inside with openings in the walls of walls, the openings shall be protected by means of tables arranged horizontally.
 - When performing alongside floor openings, measures such as guardrails, horizontal and vertical networks security or resistant coverings for small holes will be taken.

Stepping on objects: foot injuries stepping and cutting with materials distributed around the floor of the workplace.

- Cuts excess material should be collected.
- When on the floor of workplaces exist or may exist sharp objects (nails, metal shavings, chips, etc.), footwear should be used with security sole.
- Remove the sharps out of the ground.

Accidents circulation: When navigating by car to the customer premises.

- Provide adequate means of support and establish procedures for checking the stability of the load before starting the movement with the vehicle.
- Establish a schedule for periodic review and maintenance of all company vehicles.
- It is also recommended that a procedure written notice of anomalies detected in vehicles.
- Repair any damage before what may have occurred in vehicles.
- Comply with the following safety standards for lead:
 - Strictly respect the rules given in the Highway Code.
 - Anticipating possible maneuvers by other users and dangerous traffic conditions or route.
 - Respect safety distances.
 - Pay special attention when alighting or walking beside it should stop on the shoulder of a road circulation.
 - Perform all maintenance checks specified by the manufacturer.
 - When any load is transported must be positioned so that hazardous movements are avoided by using suitable fastening means necessary. Check the stability and securing loads before starting the movement.
 - Do not drive under the influence of alcohol and / or CNS depressant medications or drugs. If medicines that may affect driving are taken, it must be reported to the Company through service health monitoring, appropriate action.
 - Avoid heavy meals or fatty foods when then must lead.
 - Do not drive long way; enough rest, making frequent short breaks.
 - Stop the vehicle immediately adequate security for you and other drivers if you notice symptoms of drowsiness.

Other risks: Peculiarities of each work (Health and Safety Plan)

- comply with safety standards in September out in health and safety plan of the work.

9. Conclusions

Analysis and risk assessment in the company Nuevas Tecnologías de la Ventana, SLU were conducted using three different methods (PN-N-18001, Risk Score and Silesian University of Technology method) on the following workplaces:

- Technical director,
- Workshop operator in the first group,
- Workshop operator in the second group.

In the table 9.1 were included results of the conducted risk assessment. According to the table it can be seen that all methods gave relatively similar results of risk assessment at given workplaces and highlighted the same areas where there are some weaknesses in safety.

Silesian University of Technology method focuses on the work activities risks and exposures evaluation while the other methods (Risk Score and Polish Standard Method) on the hazard assessment. In practice, that means that the diagnosis in the workplace even one hazard which exceeds the limits of its admissibility (whether of exposure or the likelihood of its occurrence) will qualify working activity to the category dangerous, particularly dangerous or critical. It draws attention on hazards and lead to the improvement of working conditions.

In studied company it was possible to use Silesian University of Technology Method to assess the work activities risk as well as risk in order to specified hazards what gave a possibility to compare the results of every three methods.

As it can be seen in the table below, Polish Standard Method tends to indicate the lower risk category than other methods. This is due to the fact that this method as opposed to the Risk Score method and Silesian University of Technology method, considers only two parameters (probability and consequences) in a 3-point scale. That is why risk assessment should be developed using different methods to see if there are reliable.

Table 9.1

Results of risk assessment

WORKPLACE	HAZARD	TIME OF EXECUTION (% OF WORKING JOURNEY)	RISK SCORE METHOD		PN-N 18002:2004		SILESIA UNIVERSITY METHOD	
			RISK CATEGORY	WORK ACTIVITY CATEGORY	RISK CATEGORY	RISK TOLERANCE	RISK CATEGORY	WORK ACTIVITY CATEGORY
TECHNICAL DIRECTOR	Traffic accident	40 (8.33%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
	Eye problems	30 (6.25%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
	Fallens	30 (6.25%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
	Striking against objects	30 (6.25%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
	Postural problems	180 (37.50%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
	Stepping on objects	170 (35.42%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
WORKSHOP OPERATOR (1 ST GROUP)	Fallen at the same level	6 (1.25%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
	Striking against objects	15 (3.13%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
	Electrical contacts	10 (2.08%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
	Projection of fragments or particles	45 (9.38%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
	Entrapment	45 (9.38%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
	Falling objects from crash or collapse	15 (3.13%)	Acceptable	Almost safe	Small	Tolerable	Acceptable	Almost safe
	Contact with sealant substances	140 (29.17%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
	Repetitive motions	100 (20.83%)	Acceptable	Almost safe	Small	Tolerable	Minimal	Safe
	Blows or cuts	45 (9.38%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
	Overexertion	8 (1.67%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
	Exposure to noise	45 (9.38%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
Falling objects being handled	6 (1.25%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous	
WORKSHOP OPERATOR (2 ND GROUP)	Fallen at the same level	100 (20.83%)	Acceptable	Almost safe	Low	Tolerable	Minimal	Safe
	Striking against objects	10 (2.08%)	Acceptable	Almost safe	Low	Tolerable	Minimal	Safe
	Entrapment	60 (12.5%)	Acceptable	Almost safe	Low	Tolerable	Acceptable	Almost safe
	Manual handling of loads	10 (2.08%)	Acceptable	Almost safe	Low	Tolerable	Acceptable	Almost safe
	Blows of cuts with objects or tools	80 (16.67%)	Acceptable	Almost safe	Medium	Tolerable	Acceptable	Almost safe
	Overexertion	30 (6.25%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
	Fall from heights	100 (20.83%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous
	Falling objects being handled	30 (6.25%)	Acceptable	Almost safe	Medium	Tolerable	Acceptable	Almost safe
Traffic accidents	60 (12.5%)	Significant	Dangerous	Medium	Tolerable	Significant	Dangerous	

After realizing the analysis and assessment of every working activity at workplace in the company, according to Silesian Univeristy of Technolgy method, it can be concluded that the number of safe/unsafe working operations in each workplace were estimated as it is shown in the table below.

Table 9.2

Relation between workplace and Safe/unsafe operations.

WORKPLACE	SAFE OPERATIONS	ALMOST SAFE OPERATIONS	DANGEROUS	ESPECIALLY DANGEROUS
TECHNICAL DIRECTOR	2	1	-	-
MANUFACTURING EMPLOYEES (7 WORKERS)	1	-	2	-
PACKING AND INSTALLATION EMPLOYEES (3 WORKERS)	2	-	1	-

Around 66.67% of the activities developed by the company can be considered as safe activities. The manufacturing and the installation processes involve the most important hazards for the worker (100% of dangerous operations in the company), however, taking into account and respecting the safety and prevention measures described below, any activity in that company should endanger the health and safety of workers.

All three methods showed the most dangerous activities and associated with it hazard:

- At the technical director workplace:
 - 1) Traffic accident
 - 2) Eye problems
- At the workshop (1st group of workers):
 - 1) Exposure to noise
 - 2) Blows or cuts
 - 3) Overexertion
 - 4) Falling objects being handled
- At the workshop (2nd group of workers):
 - 1) Fall from heights
 - 2) Overexertion
 - 3) Traffic accidents

Due to the high probability of these dangerous events and high losses caused by them, should be taken immediate actions to reduce risk to acceptable levels. Such activities include:

- periodic monitoring of risks and regular updating of the risk assessment,
- conducting training courses designed to introduce and consolidate the health and safety rules and regulations
- redrafting work instructions so that they are clear and understandable to employees read and enforcement guidelines contained therein
- ergonomic and functional reorganization of the workstations,
- provide employees with appropriate personal protective equipment (if possible),
- complement thematic boards informing about the respecting safety rules,
- taking care of the growth of a culture of safety among employees and management.

Activities listed above should be repeated according to continual improvement based on a Deming cycle to ensure, maintain and improve health and safety performance. Safety at work in the studied company has a high importance, because NUEVAS TECNOLOGÍAS DE LA VENTANA, S.L.U. is a manufacturer company and safe work in this place has a positive influence on productivity and financial results.

Bibliography and references

1. Collaboration and direct consultation with the company: Nuevas Tecnologías de la Ventana,SLU. <http://www.ntv-nuevatecnologiasdelaventana.com/>.
2. *Ley 31/1995, de 8 de Noviembre, de Prevención de Riesgos Laborales*, Instituto Nacional de Seguridad e Higiene en el Trabajo.
3. *Reglamento de los Servicios de Prevención*, REAL DECRETO 39/1997, de 17 de enero, Instituto Nacional de Seguridad e Higiene en el Trabajo.
4. *The introduction of measures to encourage improvements in the safety and health of workers at work*, Council Directive 89/391/EEC June 1989.
5. *Risk Assessment*, European Agency for Safety and Health at Work. <https://osha.europa.eu/en/topics/riskassessment>.
6. *Labour accidents in Poland*, Central Statistical Office of Poland. <http://stat.gov.pl/en/topics/labour-salaries/working-conditions-accidents-at-work/>.
7. Labour accidents statistics in Spain, Subsecretaría de empleo y seguridad social, Ministerio del Interior. <http://www.empleo.gob.es/estadisticas/eat/welcome.htm>
8. Joy, J., & Griffiths, D. (2007). *National Minerals Industry Safety and Health Risk Assessment Guideline*. Queensland: Minerals Industry Safety & Health Centre (MISHC), University of Queensland.
9. Goossens, L.H.: *Risk identification and evaluation*. Delft: Safety Science Group. Delft University of Technology. 1998
10. Department of Mining Management and Safety Engineering didactic materials, Politechnika Śląska.
11. Markowski, A.S.: *Zarządzanie ryzykiem w przemyśle. Atest – Ochrona Pracy nr 12* , pp. 4-8. 1994
12. PN-N 18001:2004. Systemy zarządzania BHP. Wymagania.
13. PN-N 18002:2000. Systemy zarządzania BHP. Ogólne wytyczne oceny ryzyka zawodowego.
14. PN-N 18004:2001. Systemy zarządzania BHP. Wytyczne.
15. PN-N 18011:2006. Systemy zarządzania BHP. Wytyczne audytowania.
16. OHSAS 18001:2007 Occupational health and safety management systems – requirements
17. ILO-OSH 2001 Guidelines on Occupational Safety and Healthy Management System
18. PKN-ISO Guide 73 „Risk management – Vocabulary”
19. PN-ISO 31000 „Risk management – Principles and guidelines”
20. PN-EN 31010 „Risk management – Risk assesment techniques”

Abstract

In this thesis has been carried out a risk assessment of an aluminum and PVC carpentry, explaining and complying with all the steps established in the current European law. The risk assessment has been made using three different methods, assessing each workstation with each method for the purpose of get more data and reliability.

For the performance of this thesis existed a direct collaboration with the company “Nuevas Tecnologías de la Ventana S.L.U.”.