

WORK SAFETY SELF-ASSESSMENT. APPLICATION, WORK LOADCostica BEJINARIU¹, Doru-Costin DARABONT², Lucian-Ionel CIOCA³DOI [10.56082/annalsarscieng.2024.1.5](https://doi.org/10.56082/annalsarscieng.2024.1.5)

Rezumat. *Sistemul de autoevaluare a securității în muncă pentru întreprinderile mici și mijlocii (IMM) este un instrument puternic, prin care IMM-urile sau compartimentele unei întreprinderi mari pot decide unde și cum trebuie îmbunătățită activitatea de securitate și sănătate în muncă prin propuneri și prioritizări concrete. În lucrare tratăm modul de autoevaluare a componentei independente a sistemului de muncă, respectiv sarcina de muncă, la Laboratorul de turnarea metalelor din cadrul Facultății de Știința și Ingineria Materialelor a Universității Tehnice „Gheorghe Asachi” din Iași. Se urmărește atât realizarea evaluării calitative prin intermediul tabelului Puncte slabe – Puncte tari, cât și realizarea evaluării cantitative prin obținerea aceluși Scor care ne conduce la un calificativ corespunzător valorii scorului. Aceste evaluări, calitativă și cantitativă, ne conduc la adoptarea măsurilor de îmbunătățire sau menținere a securității muncii la un nivel apropiat de nivelul de securitate pentru care a fost proiectată firma sau compartimentul.*

Abstract. *The occupational safety self-assessment system for small and medium-sized enterprises (SMEs) is a powerful tool, through which SMEs or departments of a large enterprise can decide where and how occupational safety and health activity should be improved through concrete proposals and prioritization. In the paper we deal with the self-assessment of the independent component of the work system, namely the work load, at the Metal Casting Laboratory within the Faculty of Materials Science and Engineering of the "Gheorghe Asachi" Technical University in Iași. The aim is both to achieve the qualitative assessment through the Weaknesses - Strengths table, as well as to achieve the quantitative assessment by obtaining that Score that leads us to a qualification corresponding to the value of the score. These evaluations, qualitative and quantitative, lead us to adopt measures to improve or maintain work security at a level close to the level of safety for which the company or department was designed.*

Keywords: occupational safety and health, qualitative self-assessment, quantitative self-assessment

¹Professor, PhD, Eng., Materials Engineering and Industrial Safety Department, Faculty of Materials Science and Engineering, Vice Dean, Gheorghe Asachi Technical University of Iasi, Iasi, Romania (e-mail: costica.bejinariu@academic.tuiasi.ro).

²PhD, Eng., Senior Researcher, The National Research and Development Institute of Occupational Safety - "Alexandru Darabont", Bucharest, Romania (e-mail: darabont_d@yahoo.com).

³Professor, PhD, Eng., Industrial Engineering and Management Department, Faculty of Engineering, Lucian Blaga University of Sibiu, Full member of the Academy of Romanian Scientists (e-mail: lucian.cioca@ulbsibiu.ro).

1. Introduction

The occupational safety self-assessment method for SMEs was elaborated by the National Research and Development Institute for Occupational Safety - INCDPM "Alexandru Darabont" Bucharest, [1].

The application of the method, as it was initially conceived, is laborious. In this sense, with the appearance of general data processing software such as the "Microsoft Office" package, the application of the method has become much simpler, [2].

The paper presents the self-assessment of occupational safety applied to the Metal Casting Laboratory within the Faculty of Materials Science and Engineering of the "Gheorghe Asachi" Technical University in Iasi. The self-assessment of work security is applied to the independent component of the work system, namely to the work load. Of course, the method can also be applied to the other components of the work system.

For each item corresponding to the work load, a self-assessment value is assigned. Based on these values, with the help of a benchmark grid, a so-called qualitative assessment is obtained, namely the Weaknesses - Strengths table. The obtained table leads us to the measures that must be taken at the company or the evaluated department, so that the weak points are transformed into strong points, and the strong points are maintained at least at the same level.

Also based on the self-assessment values assigned for each item corresponding to the work load, the so-called quantitative assessment is also determined. The number of strong points obtained in relation to the number of items applicable to the evaluated company or compartment is taken into account, obtaining a so-called Score that leads us to a qualifier corresponding to the value of the score.

This self-assessment is closely related both to the assessment of the level of safety at work [3, 4], and to the assessment of the risks of occupational injury and illness [5-7]. Also, self-assessment is a part related to occupational health and safety management and professional risk management [8, 9]. The self-assessment of work safety is useful in order to carry out a risk analysis on a scientific basis [10, 11].

2. Self-assessment method

The occupational safety self-assessment system is intended for occupational safety assessment for small and medium-sized enterprises. The system can be applied to economic units of any size, when the assessment is carried out on subsystems: department, workshop, workplace, etc.

The self-assessment is applied by the staff of these units, with occupational safety and health attributions, without the intervention of an expert from outside the unit.

The reporting of the obtained self-assessment is done at the time when it was carried out, representing a momentary picture of the safety at work in the evaluated unit.

2.1. Method description

The method is based on 119 questions (items) covering all the essential aspects related to occupational safety and health in a company, aspects that refer to: the ability to control risks; risk prevention policy; traffic, horizontal and vertical risks; machine protection; noise and vibration; temperature and refreshing the air; lighting; risks of fire, explosion and electrical hazards; dangerous materials – risks related to health and labour protection; collective and individual protection at work and in the surrounding areas; transport of weights; maintenance activity; first aid organization; the participation of workers in the process of ensuring labour safety.

Each item requires an evaluation by the designated worker, taking into account the concrete situation in the company, by giving a score in the range [0, 5] with the increment of 0.5 for the applicable questions. For questions that may be irrelevant for a particular company, practically inapplicable questions are assigned the value {-1}. The evaluations for each of the questions of the self-assessment system will be entered in the *Items_Self-Assessment* sheet, values that will be compared with the standard values, contained in the *Standard_Grid* sheet in the Excel document [2].

The system allows a qualitative assessment through "Weak points - Strong points" (WP-SP) tables and a quantitative assessment by relating the number of "Strong points" to the number of "Applicable Items" on the four components of the work system.

2.2. Obtaining the WP-SP Table

For the qualitative assessment, the *Qualitative_Self-Assessment* sheet is used, in which the sections and chapters are highlighted in the first column, and in the following columns WP, respectively SP (the "*abbreviated item*" is written if the assessment value corresponds to the gray or white portion of the standard grid, or "-"). In this sense, a connection relationship must be used between the evaluation value granted for an item and the gray, white or inapplicability portions. Next, the obtaining of the connection relationship is presented.

Let V be an assigned value for one of the items in the range $[0, 5]$ with increment of 0.5. The interval $[0, 5]$, in the most general case, can be assimilated to an interval $[a, b]$.

We consider a point c in the interval (a, b) , a point that divides the interval $[a, b]$ into two subintervals, namely the subinterval $[a, c)$ corresponding to the V values for WP – the gray area in the standard grid and the subinterval $[c, b]$ corresponding to the V values for SP – the white area in the standard grid. For each item in the standard grid, there corresponds a value c in the interval (a, b) .

A set of logical values is also considered $VL \in \{m, n\}$. Value $m = \textit{abbreviated item}$, and value $n = -$.

Next, we will derive the relation syntax for WP. Thus, it can be said that:

$$\begin{cases} \textit{IF } V \in [a, c), \textit{ then } VL = m \\ \textit{IF } V \notin [a, c), \textit{ then } VL = n \end{cases} \quad (1)$$

The two mathematical propositions in relation (1) can be synthesized in a single relation, as follows:

$$\textit{IF}(V \in [a, c), VL = m, VL = n) \quad (2)$$

true false

Simpler,

$$\textit{IF}(V \in [a, c), m, n) \quad (3)$$

Excel software does not use a range, so we will transform the range in (3) into an AND relationship:

$$\begin{aligned} V \in [a, c) &\Rightarrow \\ a \leq V < c &\Rightarrow \\ \begin{cases} a \leq V \\ \textit{AND} \Rightarrow \\ V < c \end{cases} & \quad (4) \\ \textit{AND}(a \leq V, V < c) & \end{aligned}$$

Corroborating relations (3) and (4), the syntax for WP is obtained:

$$= \textit{IF}(\textit{AND}(a \leq V, V < c), m, n) \quad (5)$$

Similarly, the syntax for SP is obtained:

$$= \textit{IF}(\textit{AND}(c \leq V, V \leq b), m, n) \quad (6)$$

When in the *Qualitative_Self-Assessment* sheet, an abbreviated item does not appear at either WP or SP, it means that item is inapplicable and has been assigned the value $V = -1$.

Relations (5) and (6) are applied for each individual item, thus obtaining the WP-SP table.

3. Applying of Self-assessment method

Next, the occupational safety self-assessment applied at the Metal Casting Laboratory of the Faculty of Materials Science and Engineering of the "Gheorghe Asachi" Technical University in Iași is presented. The self-assessment of work safety is applied to the independent component of the work system, namely the work load.

3.1. Work system

The work load represents all the actions that the executor must perform in order to achieve the goal of the work system [12].

According to the Occupational Health and Safety Law no. 319/2006 [13] and Government Decision no. 1425/2006 – Methodological Norms for Applying the Occupational Health and Safety Law [14], the work system consists of: executor; work load; means of work/work equipment and the work environment.

In the Metal Casting Laboratory, students perform a series of practical applications, the most important being: manual execution of forms and cores with models and core boxes; designing and dimensioning of casting networks; determining the fluidity of metallic materials; determining the linear contraction of metallic materials.

Casting is one of the most common and economical methods of the current technique of obtaining metal products, which is why it is widespread. By casting is understood the operation of filling with liquid metal a mold having the cavity corresponding to the geometry of the cast piece. Upon solidification, it will reproduce and preserve the geometric configuration and dimensions of the mold cavity that represents the part to be manufactured. The basis of casting processes is the physical principle by virtue of which any liquid takes the shape of the container that contains it.

Manual execution of molds and cores with models and core boxes provides the necessary knowledge regarding manual molding in frames, with model and manual molding of cores in core boxes as well as the materials and tools necessary for manual molding, also aiming at the consumption of materials and the time required for manual molding.

The design and dimensioning of casting networks presents the necessary knowledge regarding the design of casting networks and the calculation method for their dimensioning. The quality of the liquid metal that enters the mold cavity,

as well as the obtaining of parts without defects, largely depends on the design and sizing of the casting nets.

The determination of the fluidity of metallic materials provides the necessary knowledge regarding the determination of the fluidity of metallic materials as well as the factors that influence the fluidity, the methods, the samples and the way of assessing the fluidity.

Determining the linear shrinkage of metallic materials highlights the necessary knowledge regarding the shrinkage of metallic materials as well as the factors that influence shrinkage, the methods of determining it and the defects of cast parts due to shrinkage.

3.2. Work load

The work load is the independent component of the work system, the other components being in close dependence, firstly with the work load, and secondly with each other.

The application of the self-assessment system for the work load requires the creation of tables regarding: *Items_Self-Assessment*, Table 1; *Standard_Grid*, Table 2; *Qualitative_Self-Assessment*, Table 3; *Quantitative_Self-Assessment*, Table 4 [2]. The evaluation of the quantitative self-assessment is based on the value of the obtained score, [1, 2].

Table 1. Items_Self-Assessment

| <i>Section/Chapter/Item</i> | <i>Abbreviated Item</i> | <i>Value granted</i> |
|---|---|----------------------|
| <i>1. The ability to control risks</i> | | |
| <i>1.1. Avoiding risks</i> | | |
| 2. Does your overall attitude towards risk factors lead to the adoption of actual risk prevention measures. | 2. General Attitude / Prevention Efficiency | 4.0 |
| <i>1.3. Fighting risks at their source</i> | | |
| 5. Assess your attitude towards the existing or potential risks within your company. | 5. Attitude towards risks | 4.0 |
| <i>1.4. Keeping up with technology</i> | | |
| 6. Are you keeping in touch with new technological breakthroughs in your field of activity? | 6. Knowing the news | 3.0 |
| <i>1.5. Risk prevention by properly organizing work – Replacing risk factors with non-hazardous or less hazardous factors</i> | | |
| 7. Organization of work and choice of production methods. | 7. Organization of work | 4.0 |
| <i>1.6. Adaptation of work tasks to the human factor (ergonomic aspects)</i> | | |
| 8. In your company: are you choosing, as a priority, the | 8. Attitude towards | 4.0 |

| <i>Section/Chapter/Item</i> | <i>Abbreviated Item</i> | <i>Value granted</i> |
|---|---------------------------------------|----------------------|
| equipment whose security features contribute actively to productivity? (intrinsic protection); are you considering the previous training or experience of your staff in carrying out similar tasks?; are you considering the physical measures of your employees when choosing equipment and materials?; are you making sure that the monotony of work is minimized by proper organization and proper choice of materials, products and procedures? | ergonomics | |
| <i>1.7. Collective and individual protection</i> | | |
| 9. In your Company: are you choosing (do you prefer) collective protection measures against individual protection (e.g. railing instead of safety belts)?; are you considering the means of eliminating or reducing risks at the source before distributing, for example, hearing protectors or masks (with or without a special filter)? | 9. Prioritizing collective protection | 4.0 |
| <i>2. Risk prevention policy</i> | | |
| 19. Assess workplace security monitoring (specialists from within or outside the company) within your company. | 19. Security surveillance | 4.5 |
| <i>3. Traffic, horizontal and vertical risks</i> | | |
| <i>3.1. Traffic</i> | | |
| 21. Assess the quality of maintenance of traffic areas in your unit (for example, garbage removal, the cleaning of accidentally spilled liquid, obstructions caused by stored materials). | 21. Maintenance of traffic areas | 4.5 |
| 23. Separation of traffic areas: are the working areas of machinery distinctly separated from traffic areas?; are there distinct traffic areas for pedestrians and for vehicles (stevedores, forklifts)? | 23. Separation of traffic areas | 3.5 |
| 24. Assess the quality of training of the drivers of the company's means of transportation. | 24. Drivers training | -1.0 |
| 25. Assess the information provided to outsiders, information regarding in-house traffic rules. | 25. Information of outsiders | -1.0 |
| <i>3.2. Horizontal risk</i> | | |
| 26. Security measures against falling, within your company. Assess the safety measures taken to protect workers against falling from a low height. Use the assessment of the following statements: high passages are equipped with protections; are the people working at a height equipped with individual protective equipment?; is this protective equipment used correctly? | 26. Protection against falling | 3.5 |
| 27. Assess the system used to prevent two pieces of equipment working at the same height from colliding or interfering with one another (for example, two loads placed in the hook). | 27. Preventing collision | -1.0 |
| 28. Assess the competence and qualification of personnel operating lifting equipment. | 28. Information of operators | -1.0 |
| <i>3.3. Vertical risk</i> | | |

| <i>Section/Chapter/Item</i> | <i>Abbreviated Item</i> | <i>Value granted</i> |
|--|---|----------------------|
| 31. Assess the maintenance of access areas to and from the workplace located at height (removal of drained fluids, cleaning of surfaces). | 31. Maintenance of vertical traffic areas | -1.0 |
| 32. The security of people passing below these areas. In providing your answer assess the following aspects: the quality of the accessories used to transport the loads; the presence of warning signs (lights, pictograms); demarcation of the hazardous area; the presence of nets to prevent the fall of objects. | 32. Security below these areas | -1.0 |
| <i>4. Machine protection</i> | | |
| 35. Information. Does your company provide: clear and easily accessible information on machine safety rules?; specific information for new employees?; information on newly introduced machines?; information written in Romanian? | 35. Information | 4.5 |
| 36. Assess the real level of protection of machinery and basic equipment (ladders, trolleys, etc.) during activities of interruption, repair, etc. | 36. Protection during maintenance and/or inspection | -1.0 |
| <i>5. Noise and vibration</i> | | |
| <i>5.1. Noise</i> | | |
| 39. Assess the importance you grant to noise when installing a machine (for example, placing powerful noise sources separate from other workplaces that do not produce noises). | 39. Installation of noisy machines | 5.0 |
| <i>6. Temperature and refreshing the air</i> | | |
| 47. Assess whether temperature adjustment and air refreshing are correlated with the type of activity being carried out (for example, a higher degree of air refreshing in welding activities). | 47. Regularization of temperature according to the task carried out | 2.5 |
| 52. Assess the quality of maintenance of the heating/cooling systems. | 52. Maintenance of heating/cooling | 4.5 |
| <i>7. Lighting</i> | | |
| 58. Maintenance. In your company, is there performed: the regular replacement of light sources?; regular cleaning of luminaires?; regular window cleaning (maintenance of natural lighting)? | 58. Maintenance | 3.5 |
| <i>8. Risks of fire, explosion and electrical hazards</i> | | |
| <i>8.1. Fires and explosions</i> | | |
| 63. Checking the fire extinguishing equipment. Does your company have qualified staff for: the regular control of fire extinguishers?; the regular control of fire detection systems?; assessing the (required) number of fire extinguishers?; assessing the correct location of fire extinguishers? | 63. Extinguishing material check | 3.0 |
| 64. Training to take action in case of fire (firefighting and prevention measures). In your company, the training of staff to take action in case of fire: is repeated regularly (at least once a year)?; is appropriate for the number of people to be evacuated?; is repeated each time the building is changed or a new installation is introduced? | 64. Evacuation drills | 4.0 |

| <i>Section/Chapter/Item</i> | <i>Abbreviated Item</i> | <i>Value granted</i> |
|---|---|----------------------|
| 65. Evacuation areas and routes. Does your company have: emergency exits?; permanently opened evacuation routes?; non-restricted access to these evacuation routes and areas?; precise evacuation plans?; signs indicating emergency exits? | 65. Evacuation areas and routes | 4.5 |
| 66. Staff training. Does your company have: clear instructions in case of fire?; first aid teams?; alarm procedures (in order to warn the competent services from within the company or from the outside - firefighters)?; alarm procedures (to indicate to all staff to leave their workplaces)? | 66. Staff training, fire/explosion | 4.5 |
| 68. Storage of flammable and/or explosive products. Within your company: are the instructions provided by the labour protection legislation and its own instructions regarding these issues observed?; is a list of stored flammable and/or explosive products kept?; are these products labelled?; are these products present in the company in limited quantities (as much as needed for production)?; are they stored in a separate area?; are they stored in ventilated and fire-resistant areas? | 68. Storage of flammable/explosive products | -1.0 |
| 70. Tanks and containers containing pressurized gases. Are such tanks or containers in your company: identified by content?; stored in separate places?; stored with the opening up (for containers)?; secured (to avoid falls that could cause an explosion)?; protected against heat and/or sunlight? | 70. Tanks and cylinders | -1.0 |
| <i>8.2. Electric hazards</i> | | |
| 75. Assess the security rules and procedures against the electrical hazards in your company (if they exist but are not known by the workers, the score shall be 0). | 75. Rules against electricity | 5.0 |
| <i>9. Dangerous materials: risks related to health and labour protection</i> | | |
| 82. Assess the extent to which the access to hazardous areas is restricted (access only for authorized personnel). | 82. Restriction of hazardous areas | 4.5 |
| 83. Assess the quality of internal and/or external health checks of your staff. | 83. Checking working conditions | 4.5 |
| <i>10. Collective and individual protection at work and in the surrounding areas</i> | | |
| <i>10.1. Collective protection</i> | | |
| 90. Assess the clear separation of hazardous areas from the risk free areas. | 90. Separation of areas | 3.0 |
| 93. Intervention plans. Does your company have: detailed plans of hazardous areas?; a clear list of the dangerous products and substances used?; a list of persons to be notified in the event of an accident? | 93. Intervention plan | 4.0 |
| 94. Assess the organisation of visitors access in your company. | 94. Visitors access | 5.0 |
| <i>10.2. Individual protection</i> | | |
| 98. Assess the extent to which workers are informed about these means of protection. | 98. Information of employees | 5.0 |

| <i>Section/Chapter/Item</i> | <i>Abbreviated Item</i> | <i>Value granted</i> |
|---|---|----------------------|
| <i>11. Transport of weights</i> | | |
| <i>11.1. Hand transport of weights</i> | | |
| 99. Assess the measures taken by your company to avoid handling operations involving the risk of injuries. | 99. Avoid manual handling | 4.5 |
| 100. Weights handling stations. When designing such a station, you consider: the distance to be travelled?; the difference in height between the starting point and the arrival point?; the frequency of manipulations?; the mass of objects to be handled? | 100. Handling stations | 4.5 |
| <i>11.2. The mechanical transport of weights</i> | | |
| 104. Assess the maintenance (controls, cleaning, etc.) of the mechanical handling equipment. | 104. Maintenance of mechanical handling equipment | -1.0 |
| <i>12. Maintenance activity</i> | | |
| 107. Assess the measures taken to point out to the staff (and third parties) that the maintenance activity is in progress (signs, cords around the area, etc.). | 107. Signalization | 4.0 |
| 108. Assess the attention you grant to the additional risks introduced by the maintenance activity (which you can foresee). | 108. Additional foreseeable hazards | 5.0 |
| <i>13. First aid organization</i> | | |
| 111. Assess the suitability of first-aid equipment that you possess with the dangers present in your company. | 111. Suitability of equipment | 4.5 |
| 113. Assess the extent to which workers know the location of first aid facilities and the staff to be contacted in the event of an accident. | 113. Staff information | 4.5 |
| <i>14. The participation of workers in the process of ensuring labour safety</i> | | |
| 118. Do you encourage the team to express their opinions (in writing or through discussions) on the preventive measures regarding: internal transportation, work at height and work at low height?; protective devices?; noise and vibrations?; temperature and air quality?; lighting?; risks of fire, explosion and electrical hazards?; dangerous materials and occupational diseases?; collective and personal protection?; the transport of heavy loads?; maintenance?; first aid? | 118. Encouraging participation | 4.5 |

Table 2. Standard_Grid

| Section/Chapter/Abbreviated Item | Standard Grid | | | | | | | | | | | Logical values | | | |
|--|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------|---|---|--|
| | | | | | | | | | | | | | | | |
| 1. The ability to control risks | | | | | | | | | | | | | | | |
| 1.1. Avoiding risks | | | | | | | | | | | | | | | |
| 2. General Attitude / Prevention Efficiency | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 1.3. Fighting risks at their source | | | | | | | | | | | | | | | |
| 5. Attitude towards risks | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 1.4. Keeping up with technology | | | | | | | | | | | | | | | |
| 6. Knowing the news | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 1.5. Risk prevention by properly organizing work – Replacing risk factors with non-hazardous or less hazardous factors | | | | | | | | | | | | | | | |
| 7. Organization of work | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 1.6. Adaptation of work tasks to the human factor (ergonomic aspects) | | | | | | | | | | | | | | | |
| 8. Attitude towards ergonomics | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 1.7. Collective and individual protection | | | | | | | | | | | | | | | |
| 9. Prioritizing collective protection | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 2. Risk prevention policy | | | | | | | | | | | | | | | |
| 19. Security surveillance | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 3. Traffic, horizontal and vertical risks | | | | | | | | | | | | | | | |
| 3.1. Traffic | | | | | | | | | | | | | | | |
| 21. Maintenance of traffic areas | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 23. Separation of traffic areas | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 24. Drivers training | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 25. Information of outsiders | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 3.2. Horizontal risk | | | | | | | | | | | | | | | |
| 26. Protection against falling | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 27. Preventing collision | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 28. Information of operators | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 3.3. Vertical risk | | | | | | | | | | | | | | | |
| 31. Maintenance of vertical traffic areas | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 32. Security below these areas | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 4. Machine protection | | | | | | | | | | | | | | | |
| 35. Information | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 36. Protection during maintenance and/or inspection | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 5. Noise and vibration | | | | | | | | | | | | | | | |
| 5.1. Noise | | | | | | | | | | | | | | | |
| 39. Installation of noisy machines | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 6. Temperature and refreshing the air | | | | | | | | | | | | | | | |
| 47. Regularization of temperature according to the task carried out | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 52. Maintenance of heating/cooling | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |

| Section/Chapter/Abbreviated Item | Standard Grid | | | | | | | | | | | Logical values | | | |
|--|---------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------------|---|---|--|
| | | | | | | | | | | | | | | | |
| <i>7. Lighting</i> | | | | | | | | | | | | | | | |
| 58. Maintenance | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>8. Risks of fire, explosion and electrical hazards</i> | | | | | | | | | | | | | | | |
| <i>8.1. Fires and explosions</i> | | | | | | | | | | | | | | | |
| 63. Extinguishing material check | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 64. Evacuation drills | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 65. Evacuation areas and routes | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 66. Staff training, fire/explosion | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 68. Storage of flammable/explosive products | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 70. Tanks and cylinders | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>8.2. Electric hazards</i> | | | | | | | | | | | | | | | |
| 75. Rules against electric shock | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>9. Dangerous materials: risks related to health and labour protection</i> | | | | | | | | | | | | | | | |
| 82. Restriction of hazardous areas | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 83. Checking working conditions | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>10. Collective and individual protection at work and in the surrounding areas</i> | | | | | | | | | | | | | | | |
| <i>10.1. Collective protection</i> | | | | | | | | | | | | | | | |
| 90. Separation of areas | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 93. Intervention plan | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 94. Visitors access | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>10.2. Individual protection</i> | | | | | | | | | | | | | | | |
| 98. Information of employees | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>11. Transport of weights</i> | | | | | | | | | | | | | | | |
| <i>11.1. Hand transport of weights</i> | | | | | | | | | | | | | | | |
| 99. Avoid manual handling | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 100. Handling stations | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>11.2. The mechanical transport of weights</i> | | | | | | | | | | | | | | | |
| 104. Maintenance of mechanical handling equipment | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>12. Maintenance activity</i> | | | | | | | | | | | | | | | |
| 107. Signalization | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 108. Additional foreseeable hazards | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>13. First aid organization</i> | | | | | | | | | | | | | | | |
| 111. Suitability of equipment | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| 113. Staff information | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |
| <i>14. The participation of workers in the process of ensuring labour safety</i> | | | | | | | | | | | | | | | |
| 118. Encouraging participation | 0.0 | 0.5 | 1.0 | 1.5 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 | 4.5 | 5.0 | - | 1 | 2 | |

Table 3. Qualitative_Self-Assessment

| <i>Section/Chapter</i> | <i>Weaknesses</i> | <i>Strengths</i> |
|---|---|---|
| <i>1. The ability to control risks</i> | | |
| <i>1.1. Avoiding risks</i> | | |
| | - | 2. General Attitude / Prevention Efficiency |
| <i>1.3. Fighting risks at their source</i> | | |
| | - | 5. Attitude towards risks |
| <i>1.4. Keeping up with technology</i> | | |
| | 6. Knowing the news | - |
| <i>1.5. Risk prevention by properly organizing work – Replacing risk factors with non-hazardous or less hazardous factors</i> | | |
| | - | 7. Organization of work |
| <i>1.6. Adaptation of work tasks to the human factor (ergonomic aspects)</i> | | |
| | - | 8. Attitude towards ergonomics |
| <i>1.7. Collective and individual protection</i> | | |
| | - | 9. Prioritizing collective protection |
| <i>2. Risk prevention policy</i> | | |
| | - | 19. Security surveillance |
| <i>3. Traffic, horizontal and vertical risks</i> | | |
| <i>3.1. Traffic</i> | | |
| | - | 21. Maintenance of traffic areas |
| | - | 23. Separation of traffic areas |
| | - | - |
| | - | - |
| <i>3.2. Horizontal risk</i> | | |
| | 26. Protection against falling | - |
| | - | - |
| | - | - |
| <i>3.3. Vertical risk</i> | | |
| | - | - |
| | - | - |
| <i>4. Machine protection</i> | | |
| | - | 35. Information |
| | - | - |
| <i>5. Noise and vibration</i> | | |
| <i>5.1. Noise</i> | | |
| | - | 39. Installation of noisy machines |
| <i>6. Temperature and refreshing the air</i> | | |
| | 47. Regularization of temperature according to the task carried out | - |

| <i>Section/Chapter</i> | <i>Weaknesses</i> | <i>Strengths</i> |
|--|----------------------------------|-------------------------------------|
| | - | 52. Maintenance of heating/cooling |
| <i>7. Lighting</i> | | |
| | - | 58. Maintenance |
| <i>8. Risks of fire, explosion and electrical hazards</i> | | |
| <i>8.1. Fires and explosions</i> | | |
| | 63. Extinguishing material check | - |
| | - | 64. Evacuation drills |
| | - | 65. Evacuation areas and routes |
| | - | 66. Staff training, fire/explosion |
| | - | - |
| | - | - |
| <i>8.2. Electric hazards</i> | | |
| | - | 75. Rules against electric shock |
| <i>9. Dangerous materials: risks related to health and labour protection</i> | | |
| | - | 82. Restriction of hazardous areas |
| | - | 83. Checking working conditions |
| <i>10. Collective and individual protection at work and in the surrounding areas</i> | | |
| <i>10.1. Collective protection</i> | | |
| | - | 90. Separation of areas |
| | - | 93. Intervention plan |
| | - | 94. Visitors access |
| <i>10.2. Individual protection</i> | | |
| | - | 98. Information of employees |
| <i>11. Transport of weights</i> | | |
| <i>11.1. Hand transport of weights</i> | | |
| | - | 99. Avoid manual handling |
| | - | 100. Handling stations |
| <i>11.2. The mechanical transport of weights</i> | | |
| | - | - |
| <i>12. Maintenance activity</i> | | |
| | - | 107. Signalization |
| | - | 108. Additional foreseeable hazards |
| <i>13. First aid organization</i> | | |
| | - | 111. Suitability of equipment |
| | - | 113. Staff information |
| <i>14. The participation of workers in the process of ensuring labour safety</i> | | |
| | - | 118. Encouraging participation |

Table 4. Quantitative_Self-Assessment

| <i>Section/Chapter/Abbreviated Item</i> | <i>Weaknesses</i> | <i>Strengths</i> |
|---|-------------------|------------------|
| <i>1. The ability to control risks</i> | | |
| <i>1.1. Avoiding risks</i> | | |
| 2. General Attitude / Prevention Efficiency | - | 2 |
| <i>1.3. Fighting risks at their source</i> | | |
| 5. Attitude towards risks | - | 2 |
| <i>1.4. Keeping up with technology</i> | | |
| 6. Knowing the news | 1 | - |
| <i>1.5. Risk prevention by properly organizing work – Replacing risk factors with non-hazardous or less hazardous factors</i> | | |
| 7. Organization of work | - | 2 |
| <i>1.6. Adaptation of work tasks to the human factor (ergonomic aspects)</i> | | |
| 8. Attitude towards ergonomics | - | 2 |
| <i>1.7. Collective and individual protection</i> | | |
| 9. Prioritizing collective protection | - | 2 |
| <i>2. Risk prevention policy</i> | | |
| 19. Security surveillance | - | 2 |
| <i>3. Traffic, horizontal and vertical risks</i> | | |
| <i>3.1. Traffic</i> | | |
| 21. Maintenance of traffic areas | - | 2 |
| 23. Separation of traffic areas | - | 2 |
| 24. Drivers training | - | - |
| 25. Information of outsiders | - | - |
| <i>3.2. Horizontal risk</i> | | |
| 26. Protection against falling | 1 | - |
| 27. Preventing collision | - | - |
| 28. Information of operators | - | - |
| <i>3.3. Vertical risk</i> | | |
| 31. Maintenance of vertical traffic areas | - | - |
| 32. Security below these areas | - | - |
| <i>4. Machine protection</i> | | |
| 35. Information | - | 2 |
| 36. Protection during maintenance and/or inspection | - | - |
| <i>5. Noise and vibration</i> | | |
| <i>5.1. Noise</i> | | |
| 39. Installation of noisy machines | - | 2 |
| <i>6. Temperature and refreshing the air</i> | | |
| 47. Regularization of temperature according to the task carried out | 1 | - |
| 52. Maintenance of heating/cooling | - | 2 |
| <i>7. Lighting</i> | | |
| 58. Maintenance | - | 2 |
| <i>8. Risks of fire, explosion and electrical hazards</i> | | |
| <i>8.1. Fires and explosions</i> | | |
| 63. Extinguishing material check | 1 | - |
| 64. Evacuation drills | - | 2 |
| 65. Evacuation areas and routes | - | 2 |

| <i>Section/Chapter/Abbreviated Item</i> | <i>Weaknesses</i> | <i>Strengths</i> |
|--|-------------------|------------------|
| 66. Staff training, fire/explosion | - | 2 |
| 68. Storage of flammable/explosive products | - | - |
| 70. Tanks and cylinders | - | - |
| 8.2. <i>Electric hazards</i> | | |
| 75. Rules against electric shock | - | 2 |
| 9. <i>Dangerous materials: risks related to health and labour protection</i> | | |
| 82. Restriction of hazardous areas | - | 2 |
| 83. Checking working conditions | - | 2 |
| 10. <i>Collective and individual protection at work and in the surrounding areas</i> | | |
| 10.1. <i>Collective protection</i> | | |
| 90. Separation of areas | - | 2 |
| 93. Intervention plan | - | 2 |
| 94. Visitors access | - | 2 |
| 10.2. <i>Individual protection</i> | | |
| 98. Information of employees | - | 2 |
| 11. <i>Transport of weights</i> | | |
| 11.1. <i>Hand transport of weights</i> | | |
| 99. Avoid manual handling | - | 2 |
| 100. Handling stations | - | 2 |
| 11.2. <i>The mechanical transport of weights</i> | | |
| 104. Maintenance of mechanical handling equipment | - | - |
| 12. <i>Maintenance activity</i> | | |
| 107. Signalization | - | 2 |
| 108. Additional foreseeable hazards | - | 2 |
| 13. <i>First aid organization</i> | | |
| 111. Suitability of equipment | - | 2 |
| 113. Staff information | - | 2 |
| 14. <i>The participation of workers in the process of ensuring labour safety</i> | | |
| 118. Encouraging participation | - | 2 |
| TOTAL points | 4 | 29 |

SCORE Work load: **87.88**

APPRECIATION Work load

Very Good. Some aspects can be improved. Keep the same way.

3.3. Interpretation of the results

In Table 1, the items in extenso from the sections and chapters and also the abbreviated items were presented. In the last column, the self-assessment values were assigned. Table 3 represents the WP-SP table determined on the basis of the self-assessment values and the standard grid from Table 2. Table 4 also represents a WP-SP type table used for the quantitative assessment, where depending on the value of the Score the assessment is obtained through the four ratings: Very Good. Some aspects can be improved. Keep the same way (75-100%); Medium Score. You have to be more careful (50-75%); Critical Situation. You have to improve the theme as soon as possible (25-50%); It is time to act. You have many things to do in order to improve to situation (0-25%).

As can be seen from the WP-SP table, for the Metal Casting Laboratory work load, the items „6. Knowing the news”, „26. Protection against falling”, „47. Regularization of temperature according to the task carried out” and „63. Extinguishing material check” represent Weak Points. Finally, it can be said that for these items the request for financial resources, materials, etc. is required to turn them into strengths. For some strong points, resources are also requested for maintaining.

Conclusions

The occupational safety self-assessment system is intended for occupational safety assessment by the company's designated worker with attributions on occupational safety and health, without the intervention of an expert from outside the company. The obtained self-assessment is related to the time when it was carried out, representing a momentary picture of the safety at work in the evaluated company.

The designated worker fills in the Excel document only the third column of Table 1, automatically generating Table 3 which actually represents the WP-SP table, based on relations (5) and (6) for the Work load and Table 4 with the total number of weak and strong points, with the score and rating. Practically, the appointed person focuses only on safety and health issues at work, not on data processing issues, thus eliminating human error.

The qualitative self-assessment identifies the strong points that must be maintained at least as they are and the weak points that must be improved. During the quantitative self-assessment, the score and the rating are automatically obtained, determining the course of action in order to implement the Preventive and Protective Plan.

REFERENCES

- [1] Darabont A, Kovacs S, Darabont DC. Guidelines for occupational safety self-assessment for SMEs, INCDPM, București, Romania, 1997.
- [2] Bejinariu C, Darabont DC, Baci ER, Ionita I, Bernevig-Sava MA, Baci C. Considerations on the Method for Self-Assessment of Safety at Work, Environmental Engineering and Management Journal, Iasi, vol. **16**, no 6, pp. 293-298, 2017, WOS:000409071500022, ISSN: 1582-9596.
- [3] Darabont A, Tanase N. Guidelines for assessment of the occupational safety level, INCDPM, București, Romania, 1997.
- [4] Bejinariu C, Darabont DC, Baci ER, Georgescu IS, Bernevig-Sava MA, Baci C. Considerations on Applying the Method for Assessing the Level of Safety at Work, Sustainability, Basel, Switzerland, 2017, **9**, 1263, doi:10.3390/su9071263. 2017, WOS:000406709500190, ISSN: 2071-1050.
- [5] Pece S. Risk assessment in the human-machine system, Atlas Press Publishing House, București, Romania, 2003.
- [6] Pece S. Occupational injury and illness risk assessment, Europrint Publishing House, Galați, Romania, 2011.
- [7] Bejinariu C, Darabont DC, Burduhos-Nergis DP, Cazac AM, Chiriac-Moruzzi C. Considerations Regarding the Application of the Occupational Injury and Illness Risk Assessment Method at Workplaces/Workstations, in Relation to the ISO 45001 Standard. Sustainability. Volume **15**. Issue 3. Article Number 212. DOI 10.3390/su15032121. FEB 2023. Accession Number WOS:000930875800001. eISSN 2071-1050.
- [8] Cioca, L. I., Occupational health and safety management, „Lucian Blaga” University of Sibiu Publishing House, Romania, 2010.
- [9] Cioca, L. I. și Moraru, R. I. Management of the psychosocial professional risks, „Lucian Blaga” University of Sibiu Publishing House, Sibiu, ISBN 978-973-924-3, Romania, 2010.
- [10] Moraru RI, Băbuț G. Risk Analysis, Universitas Publishing House, Petroșani, Romania, 2000.
- [11] Vasilescu GD. Unconventional methods for occupational risk analysis and assessment, INSEMEX Publishing House, Petroșani, Romania, 2008.
- [12] Pece S. Dăscălescu A. Occupational Health and Safety - Explanatory dictionary, GENICOD Publishing House, București, Romania, 2001.
- [13] *** Occupational Health and Safety Law no. 319/2006, Romania.
- [14] *** Government Decision no. 1425/2006 – Methodological Norms for Applying the Occupational Health and Safety Law, Romania.
-