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Assessment of the risks of occupational injury and illness for the position of sanitar worker

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Abstract. This paper presents a risk assessment and action plan for the sanitation worker position using the INCDPM method. This method prioritizes risks based on their severity and allocates resources effectively for labor protection. For the sanitation worker position, 40 risk factors were identified. The overall risk level calculated is 3.40, categorizing it as a job with an acceptable risk level. The identified risk factors are broken down as follows: 35% are factors specific to the contractor, 10% are workload-related, 30% are related to the means of production, and 25% pertain to the work environment. This risk assessment enables a comprehensive view of occupational safety at each workplace, facilitating preventive measures according to Romanian and European Union health and safety legislation..
Keywords: *risk assessment, accident, occupational disease, sanitation worker, occupational safety*

1. Object of activity of the company

CleanCity SRL is a private company providing municipal waste collection, street cleaning, and waste management services.

The company operates across a large urban area, primarily involving outdoor sanitation tasks. The primary focus is on waste collection, transportation, and disposal, requiring specialized sanitation vehicles and trained personnel.

CleanCity complies with national and EU regulations on workplace safety and environmental protection.

The company respects the legislative norms in the field of safety and health at work [1-17].

CleanCity SRL has implemented and maintains an Integrated Management System of Quality, Environment and Occupational Health and Safety in accordance with the requirements of the standards SR EN ISO 9001:2015, SR EN ISO 14001:2015 and SR ISO 45001:2015, system that was designed for the continuous improvement of performance by taking into account the needs and expectations of all interested parties (customers, suppliers, employees, society).

In order to fulfill the quality policy, CleanCity SRL has established the following objectives at the company level:

-providing high quality sanitation services, in accordance with the requirements of national and European legislation, respecting the decisions of the General Meeting of Shareholders and the Board of Directors, as well as the principles that govern this sector.

-improving the quality of the services offered and regulating the rules of professional conduct necessary to create and maintain the prestige of the company, involving the entire staff through competence, responsibility and an appropriate professional attitude.

-identifying and using appropriate work tools and continuously adapting procedures to meet explicit or implicit customer requirements.

-continuous training and evaluation of personnel to ensure their qualification at the level of requirements required to achieve the established objectives.

-reducing the response time to customer requests and meeting the terms of the contract.

-avoiding the waste of material and financial resources.

-gaining a solid position in the market and expanding the range of services offered to clients.

-compliance with the provisions of the reference standard SR EN ISO 9001:2015.

-creating a climate of trust and mutual respect between Eco Services and the beneficiaries of its services.

-adoption of a high-performance management system, including service quality parameters and actions taken for quality assurance and control.

2. The organizational structure of the company

CleanCity SRL employs an organizational structure optimized for efficient sanitation services, involving roles such as waste collection operators, drivers, maintenance personnel, and supervisors.

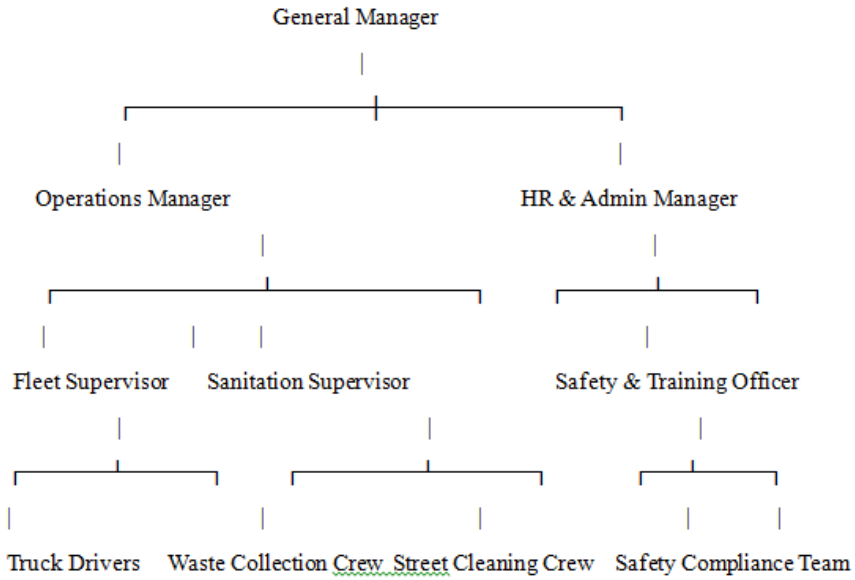

Figure 1. Organizational chart

3. Presentation of the risk assessment method

This report assesses occupational risks for the sanitation worker position at CleanCity using the INCDPM method. The method allows for risk prioritization based on severity and probability, facilitating the allocation of resources for optimal worker protection. The steps include identifying risk factors, assessing the severity and frequency of consequences, calculating risk levels, and prioritizing preventive measures.

Exposure duration is 8 hours per day, means 40hours per week. In carrying out this activity, the elements that may generate risks of injury for the exposed execution personnel are reproduced below.

4. Component elements of the work system.

The sanitation worker's tasks are analyzed according to the four work system components: Executor, Workload, Means of Production, and Work Environment.

Executor: The sanitation worker performs waste collection, lifting, and disposal tasks, frequently handling hazardous waste and heavy objects.

Means of production: Equipment includes garbage trucks, dumpsters, lifting mechanisms, protective gear, and handling tools.

Workload: Tasks include:

- lifting heavy loads, exposure to hazardous waste, and enduring repetitive movements;

-collection and sorting of waste according to applicable specifications and regulations;

-appropriate use of equipment and materials needed in the waste management process;

-application of appropriate waste treatment and recycling techniques;

-monitoring and reporting of environmental incidents and problems encountered during the work process;

-participation in periodic training and examinations to ensure a safe and responsible approach to work activities;

-immediate reporting to management in the event of environmental risks or incidents being identified during activities;

-ensuring the maintenance and cleanliness of equipment and work spaces;

-strict compliance with safety and environmental protection procedures and rules;

-perform other duties and responsibilities assigned by management in accordance with company objectives and policy.

Work environment: Sanitation workers operate outdoors in various weather conditions, exposing them to dust, waste fumes, and environmental hazards.

The main aspects of the work environment include:

-Office and administrative activities. A significant part of working time is dedicated to administrative activities carried out in the office. Here, the specialist analyzes the documentation, prepares reports, draws up waste management plans and carries out correspondence with the competent authorities and clients.

-Field activities. In addition to office work, the specialist must also carry out field activities, which involve trips to the locations where waste is managed. These activities may include landfill inspections, air and water quality monitoring, collection of samples for laboratory analysis and assessment of compliance with legal regulations.

-**Exposure to hazardous substances.** During field activities, the specialist may be exposed to various hazardous substances, such as toxic gases and vapors from managed waste. For protection against these substances, the use of appropriate protective equipment is recommended, including respiratory protective equipment and protective clothing

-**Interaction with various stakeholders**. The specialist must interact with various stakeholders, including regulatory authorities, customers, suppliers and the local community. Thus, it is important to have good communication and negotiation skills, as well as the ability to work in a team.

-**Varied working conditions**. The working environment can be varied and sometimes unpredictable depending on the specific projects and requirements of clients or regulatory authorities. The specialist must be flexible and adaptable to environmental changes and be able to effectively manage various situations and challenges.

5. Identification of risk factors

Separate tables are made for each element of the work system. The following notations are made in the tables: CG-Gravity Class; CF-Frequency class and NPR-Partial level of risk.

Table 1 presents the risk factors from the executor's side.

Table 1 Risk factors for the Executor

No	Name of risk factor	CG	CF	NPR
F1	Falling from the same level by tripping or unbalancing	2	2	2
F2	Incorrect handling of hazardous waste	7	2	4
F3	Failure to use appropriate protective equipment	4	2	3
F4	Presentation to the program in a state of fatigue, drunkenness, under the influence of hallucinogenic substances	7	1	3
F5	Manual lifting of containers with waste exceeding the maximum allowed load	2	3	2
F6	Interventions on waste management equipment without the necessary qualification	4	2	3
F7	Leaving equipment in operation unattended	4	1	2
F8	Carrying out waste management operations without turning on ventilation	3	3	3

Table 2 presents the risk factors from the workload's side.

Table 2 Risk Factors for Work load

No	Name of risk factor	CG	CF	NPR
F9	Failure to respect the areas specially designed for waste storage	7	2	4
F10	Incorrect work procedures from the point of view of occupational safety and health	7	1	3
F11	Slippery surface in work area	2	2	2
F12	Communication impairments due to noise	4	1	2
F13	Use of improvisations to perform the work task	7	1	3
F14	Forced working positions in narrow spaces	2	2	2

Table 3 presents the risk factors from the Work Environment 's side

Table 3 Risk Factors for the Work Environment 's side

No	Name of risk factor	CG	CF	NPR
F15	Large temperature variations during indoor-outdoor travel during winter/summer	2	2	2
F16	Low air humidity	3	1	2
F17	Slipping on wet or icy surfaces when traveling outside	2	3	2
F18	Pneumoconiogenic dusts (dust particles suspended in inhaled air)	3	2	2
F19	Natural disasters: earthquakes, lightning, storms	7	1	3
F20	Workplace noise generated by waste management equipment	2	1	2
F21	Drafts – doors open, ventilation on, etc.	2	1	1
F22	Artificial lighting, fluorescent lamps, dimly lit places	2	2	2
F23	Poisoning by vapors of chemicals used	3	2	2
F24	Toxic gases from the specific environment in which they temporarily operate	3	2	2
F25	Fire/explosion due to gas accumulations, in closed and unventilated areas	7	1	3

Table 4 presents the risk factors from the Means of Production's side.

Table 4 Risk Factors for the Means of Production's side

No	Name of risk factor	CG	CF	NPR
F26	Unbalance/rolling/falling of heavy parts	5	1	3

F27	Slipping on feet of heavy parts carried by hand	4	1	2
F28	Cuts, stings on contact with dangerous surfaces	2	2	1
F29	Pressure increase due to clogging of waste management equipment	3	2	2
F30	Faults in the pressure regulating valves	4	1	2
F31	Malfunctions of equipment barometers	4	1	2
F32	Failure to wear protective equipment when cleaning and handling waste	4	2	3
F33	Hitting, crushing by motor vehicles in company premises	7	1	3
F34	Eye/face splash with aggressive, irritating or corrosive substances	4	1	3
F35	Catching, driving by moving parts of work equipment	3	2	3
F36	Skin contact with toxic or irritating chemicals	2	1	2
F37	Low temperature of metal surfaces reached in cold season	2	1	2
F38	Electrocution by direct contact with uninsulated cables	7	1	3

5.Overall level of risk

The calculation of the overall risk level-ORL is presented in the below relation (1).

$$\mathbf{N_r} = \frac{\sum_{i=1}^{38} \mathbf{r_i} \cdot \mathbf{R_i}}{\sum_{i=1}^{38} \mathbf{r_i}} =$$

$$= \frac{\mathbf{0x(7x7) + 0x(6x6) + 0x(5x5) + 2x(4x4) + 14x(3x3) + 20x(2x2) + 2x(1x1)}}{\mathbf{0x7 + 0x6 + 0x5 + 2x4 + 14x3 + 7x2 + 2x1}} \quad (1)$$
$$= \mathbf{3,45}$$

6.Risk factors and partial levels of risk

Figure 2 shows all risk factors and partial risk levels. An overall risk level of 3.45 was also obtained.

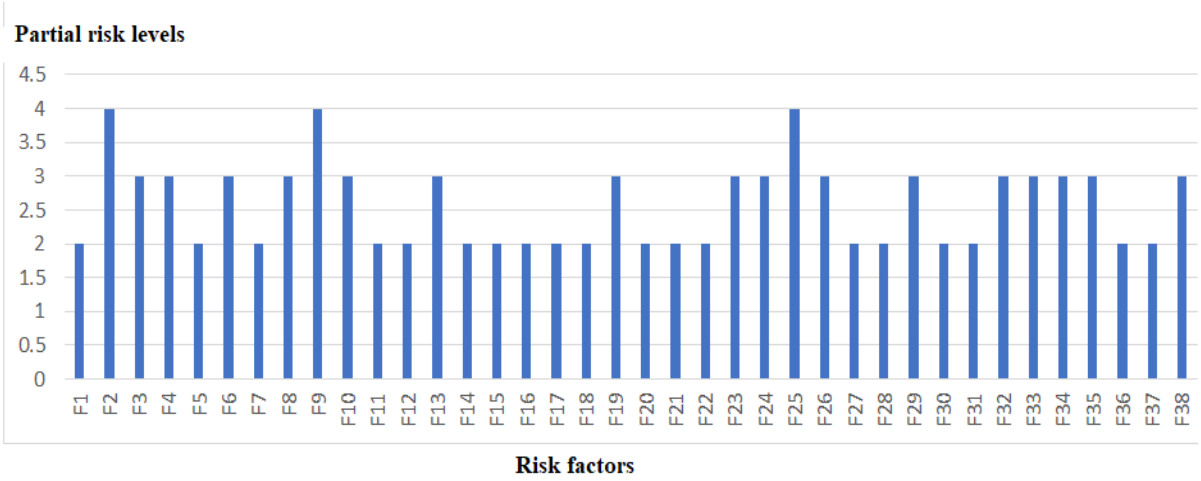

Figure 2 Risk factor and partial risk levels

7. Weight of risk factors by elements of the work system

Figure 3 shows the weight of risk factors according to the elements of the work system.

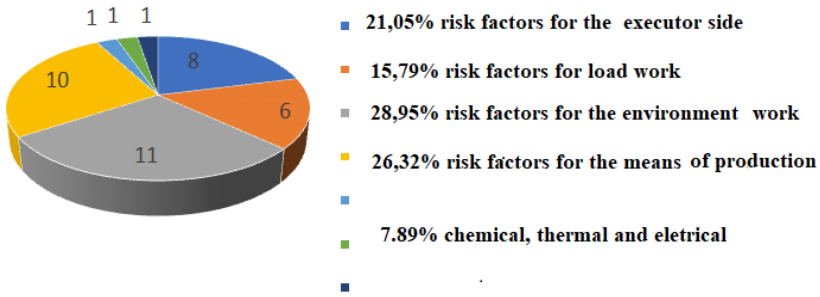

Figure 3. Weight of risk factors by elements of the work system

9. Conclusions.

The global risk level, calculated for the job/position of Specialist in waste management and environmental protection is 3.45%, a value that places it in the category of jobs with an acceptable level of risk.

The result is supported by the "Job Evaluation Form", from which it can be seen that out of the total of 38 identified risk factors, 7.89% (3) exceed the value of 3 as a partial level of risk, falling into the category of levels of high risk, which may have irreversible consequences on the executor. For these factors, the measures sheet attached to the evaluation was drawn up.

Regarding the distribution of risk factors by generating sources, the situation is as follows:

-21.05% are risk factors from the executor side
-15.79% are risk factors from the work load side
-28.95% are risk factors from the working environment
-26.32% are risk factors from the means of production
-7.89% are chemical, thermal, and and electrical risk factors

Table 5 Measures to combat risk factors that are in the unacceptable field

No	Name of risk factor	Measures to combat
F2	Improper handling of hazardous waste	- Training workers on hazardous waste handling - Use of appropriate protective equipment - Implementation of strict handling procedures
F9	Failure to respect the areas specially designed for waste storage	- Clear marking of storage areas - Implementation of disciplinary measures for non-compliance with the rules - Periodic monitoring and control of storage areas
F25	Fire/explosion due to gas accumulations in closed and unventilated areas	- Installation of an efficient ventilation system - Use of equipment and tools in anti-ex construction -Education of workers on risks and preventive measures -Periodic verification of equipment and installations
F38	Electrocution by direct contact with uninsulated cables	-Ensuring proper insulation of cables -Training workers on electrical hazards and safety measures -Implementation of procedures for checking and regular maintenance of electrical equipment
F9	The use of tools and devices in normal construction in rooms with a risk of explosion	Technical measures: - Installation of a ventilation system to remove solvent vapors - The use of equipment and tools in explosion-proof construction - Electrical installation in explosion-proof construction - Security signaling Organizational measures: - Preventing employees from the risks they are exposed to by working in closed and unventilated spaces where

		explosive atmospheres can occur – their training - Checking the wearing of individual protective equipment made of natural fibers - Careful supervision by the workplace manager of particularly risky activities - Limit access to outsiders and eliminate any potential source of spark or fire - Realization of paint mixtures in separate rooms
F4	Showing up to the program in a state of fatigue, intoxication, under the influence of hallucinogenic substances	-Implementation of strict policies regarding the consumption of alcohol and hallucinogenic substances -Carrying out periodic tests to detect the consumption of alcohol and drugs - Training employees on the risks and consequences of coming to work in such conditions
F5	Manual lifting of containers with waste exceeding the maximum allowed load	- Training workers on correct lifting techniques - Use of appropriate lifting equipment - Monitoring compliance with the permitted weight limits
F6	Interventions on waste management equipment without the necessary qualification	- Ensuring the appropriate training and qualification of staff - Implementation of strict equipment intervention and maintenance procedures - Periodic monitoring and control of maintenance activities

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