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CONSIDERATIONS REGARDING THE USE OF THE MEvAR METHODOLOGY IN PROFESSIONAL ASSESSMENT IN THE FIELD OF DETERGENT PRODUCTION

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Abstract: *The paper presents a study on the application of the MEvAR methodology of occupational risk assessment to a chemical operator workstation specific to the production of detergents. For this, we made a comparison between the professional risk assessment existing in a detergent production company for the chemical operator workplace and the assessment carried out using the MEvAR methodology. The results obtained ensure the comparison between the specific elements of the risk assessment methodologies to improve the identification of hazards and the realization of risk assessment. The conclusions at the end confirm the usefulness of using the MEvAR methodology in the field of detergent production.*

Key words: *detergents, occupational accidents, MEvAR, OH&S management system, assessment.*

1. INTRODUCTION

The current health and safety situation in detergent manufacturing is similar to the national one with an acceptable level mainly determined by the low number of recorded event or incidents.

The production of professional detergents in Romania after 1989 was continuously decreasing because, with the political and economic changes, most of the detergent manufacturers went bankrupt, were taken over by foreign companies or limited their production due to the impact and modernization of the market.

Subsequently, manufacturers were forced to adapt to the global market and after mergers, takeovers, modernizations, upgrades or process replacements they joined the global trend of increasing or maintaining production in line with the growing needs of the population.

The situation of events associated with detergent production activities did not follow the general trends and it can be seen from the statistical statements that this area is not highlighted in any chapter of the records [1, 2].

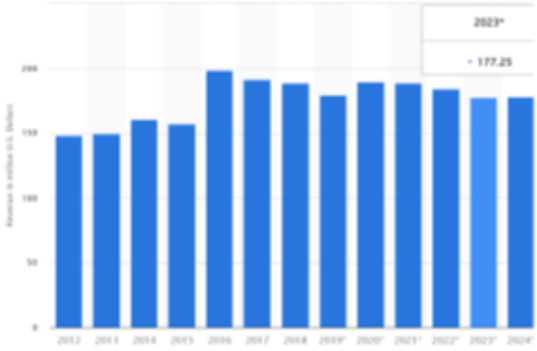

Fig. 1. Industry revenue of manufacture of soap and detergents in Romania 2012-2025 [15]

Due to the specific situation in Romania, which is undergoing a process of modernization and digitization of information, we do not have up-to-date public records and statistics, being forced to take data from alternative sources as follows.

Distribution of new cases of occupational diseases by causal agents and profession in the period 2020-2021 are shown in Tables 2 and 3.

Table 1

Situation of work accidents in Romania 2020-June 2022 [16]

Situation	Number
Total injured	10030
Injured with temporary incapacity for work (TIW)	9720
Fatally injured	310
Total route casualties	1203
Fatal road accidents	34
Temporary work incapacity concluded by the resumption of activity	7178
Temporary work incapacity by invalidity	125
Temporary work incapacity by death	57

Table 2

Distribution of new cases of occupational diseases by causal agents in 2020.

Causal agent	No. of newly reported occupational diseases
Overload (locomotor, other apparatus and systems)	254
Pathogens	65
Silica	30
Respiratory irritants	15
Other dusts	7
Biocide	3
Other organic solvents	3
Skin irritants/allergens	2
Organic powders	2
Respiratory allergens	2
TOTAL	405

Note: Bold and italic risks are specific to the field of detergent production

Table 3

Distribution of new cases of occupational diseases by causal agents in 2021

Causal agent	No. of newly declared occupational diseases
Overload (locomotor system)	320
Silicon	56
Pathogens	17
Coal	7
Biocide	4
Irritant gases and vapors	4
Other dusts	4
Asbestos	3
Vibration	2
Noise	2
Respiratory irritants	1
Other dusts	1
TOTAL	421

Note: Bold and italic risks are specific to the field of detergent production

As shown in the event statistics for the years 2020-2022 in detergent production activities there have been recorded injury situations due to the use of PPE, contact with hazardous chemicals or insufficient safety provisions communicated to workers (similar considerations as presented in [17, 18]).

The tasks of workers involved in detergent production do not differ from those common in other organizations, specifically working with raw materials, hazardous chemical mixtures, handling, mixing, bottling, activities that if not carefully monitored can generate events (similar with the findings of [19, 20]).

2. STUDY ON THE EVALUATION OF THE CHEMICAL OPERATOR JOB BY COMPARISON WITH EXISTENT PROFESSIONAL EVALUATION METHODOLOGIES AND MEvAR IN ORGANIZATION

2.1. Study design

In order to plan the study, I made a brief description of how to carry out risk assessments at the present time, of a job in the field of detergent production, and a comparison of two work methodologies.

For the analysis of how to improve the activities in the field of OHS we have chosen to apply the methodology of occupational risk assessment applicable with elements of OHS management system MEvAR to a workplace in a detergent factory in Romania.

For this I chose to analyze two ways of occupational risk assessments applied to the same workplace, to highlight the common parts and those that bring value to achieve an improvement in the identification of risks specific to the production of detergents. Starting from the general and the situation of a job, the sensitive aspects of the current evaluations and the innovations of the new methodology can be observed. Observation, comparison, analysis of documented information and case study were used as working tools.

2.2. Study details

The main occupational risk assessment methodologies used by specialists in Romania in the field of detergent production are [3], [4]:

- INCDPM Bucharest methodology (Romanian traditional approach in the field of OHS);
- Practical guide for the implementation of Directive 98/24/EC - chemical agents 2007 (EC);
- Employer's guide on reducing workers' exposure to hazardous chemical agents at work;
- Occupational risk assessment of skin contacts with hazardous chemical agents;
- INRS France Simplified Risk Assessment Methodology - a tool to help decision-making (INRS) - translation and publication authorized by INRS, November 2008;
- Technical rules for hazardous substances - Substitution - RTSP 600;
- COH&SH Essentials - HSE online tool,
- SEIRICH - INRS online tool (FR);
- SEVESO Directives;
- Guidance on information requirements and chemical safety assessment.

For the analysis, the work system specific to the chemical operator was directly observed, the documents regarding the activities carried out and the existing risk assessment report were studied.

The company chosen for the study DERO PROD SRL. was founded in the early 2000s by a young entrepreneur who wanted to develop a detergent production business in the professional, industrial HORECA sector.

The company produces, imports and markets professional liquid detergents, packaged in bottles and disinfectants [9].

The premises and buildings of the organization are private property provided, brick masonry construction on concrete structure, divided on one level into three areas: offices, production section, warehouse.

The handling area is delimited internally on the flow in the production area warehouse raw materials and finished products and externally in the access and handling area from the entrance-exit of the warehouse.

The utilities are provided by connection to the community network of electricity, gas, mains water, heating is provided internally.

The production and storage areas are organized according to the technological flow, ensuring the necessary technical requirements, the location of the means of production and the working environment [9].

The production area comprises the detergent production area, the packaging area, transfer and access areas, the storage area comprises the raw materials warehouse, the finished products warehouse and the temporary warehouse.

The detergent production space is separated from the packaging space, the noxious substances are neutralized and exhausted outside and are constantly monitored.

Wastewater is neutralized and filtered prior to discharge into the local network.

The raw materials warehouse contains the raw materials, substances and chemical preparations required for production and is equipped with the means, materials and substances required for intervention, mitigation and neutralization in the event of an accidental spill or event. Waste is collected selectively and handed over to a specialized company [9].

The number of staff is sufficient to carry out the activities, they are fit for work, trained and regularly checked, with an average length of service of about 8 years.

The equipment and machinery used are professional equipment such as semi-automatic manual bottling lines, stainless steel mixing vats, packaging machines, manual labelling machines, forklifts, pallet trucks, forklift trucks, drums and containers for chemicals [8].

The main hazards identified that can impact the organization are [5], [6]:

- failure to comply with employment requirements;
- failure to comply with travel mode;
- failure to comply with workload;
- failure to comply with work procedures and instructions, health and safety instructions;
- non-use or improper use of PPE;
- nervous demand;
- cutting;
- puncture;
- striking by incorrect movement in space;
- injuries from incorrect handling of office equipment;

- injuries due to carelessness;
- static and/or dynamic stress;
- slipping from the same level;
- musculoskeletal disorders;
- change in visual acuity;
- direct and/or indirect electrocution;
- improper use of chemical, toxic, dangerous, explosive substances;
- dusts and vapors in suspension;
- air currents;
- light contrast;
- noises;
- working at high and/or low temperatures;
- emergency situations;
- other risks arising from overlapping activities, performing other activities not foreseen in the workload additional costs material or financial losses in case of technological breakdowns;
- occupational diseases contravention and/or criminal activities.

We selected the most representative ones for the comparison of a classic methodology of occupational risk assessment and the one adapted to the management system in the field of OHS, the MEvAR methodology adapted for chemist operator [7]. For the classic methodology of assessing professional risks, we have the following indicators conform Table 4 [9]. Figure 2 presents the global risk graphic with partial risks values for chemist operator assessment [9].

According to the method used, the assessed risk values are maintained at the identified level through prevention and protection measures. Table 5 shows the sheet of prevention and protection measures proposed to maintain the overall risk level of the chemical operator workplace [9].

The global risk level of the workplace is 3.35 at value and according to the calculation grid corresponds to an acceptable average level provided it is maintained and preventive and protective measures are ensured [4].

In this article only the representative elements of evaluation methodologies are highlighted for this the study. For the MEvAR methodology of assessing professional risks we have the following indicators according to Table 6.

Table 4

Partial risk level analysis through the classic evaluation methodology.

Risk factor	Maximum consequences	Severity	Likelihood	Partial risk level
F2 Falling objects from a height	TIW 45-180 days	3	4	4
F3 Crushing by charges	DIS gr. III	4	3	4
F9 Electrocution by direct contact	fatality	7	2	4
F10 Electrocution by indirect contact	fatality	7	2	4
F12 Handling caustic substances – chemical products classified as dangerous	TIW 45-180 days	4	3	4
F23 Static and dynamic effort, working in vicious positions, especially in predominantly orthostatic positions and handling heavy products	TIW 45-180 days	3	4	4

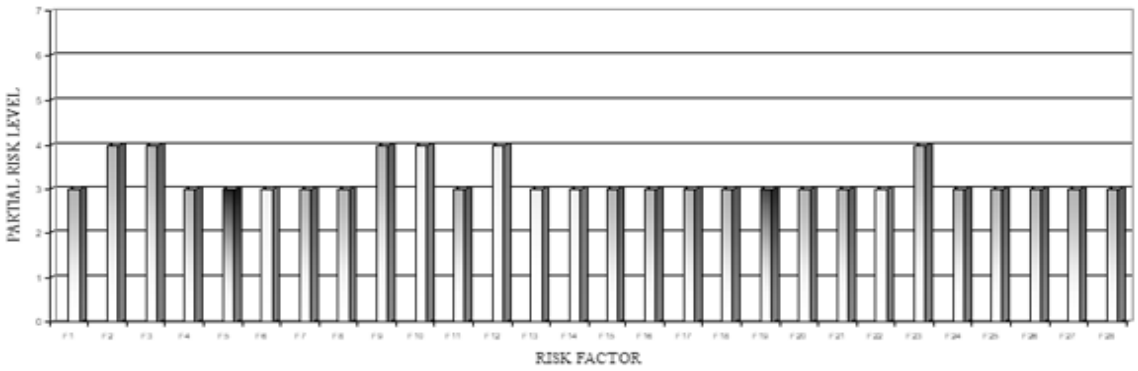

Fig 2. Global risk level for chemist operator.

Table 5

Measures proposed sheet for chemical operator workplace.

Risk factor	Risk level	Proposed measures
F2 Falling objects from a height	4	Organizational measures: regular training, provision of means of warning, signaling Technical measures: material and equipment stability assurance
F3 Crushing by charges	4	Organizational measures: regular training, provision of means of warning, signaling, analysis handling conditions
F9 Electrocution by direct contact	4	Organizational measures: regular training, provision of means of warning, signaling Technical measures: periodic verification and assurance of electrical safety measures
F10 Electrocution by indirect contact	4	Organizational measures: regular training, provision of means of warning, signaling
F12 Handling caustic substances – chemical products classified as dangerous	4	Organizational measures: regular training, provision of means of warning, signaling, update work tasks ,using the PPE provided
F23 Static and dynamic effort, working in vicious positions, especially in predominantly orthostatic positions and handling heavy products	4	Organizational measures: regular training, update work tasks , ensuring ergonomic measures

Table 6

Residual risk level analysis through the MEvAR evaluation methodology.

Risk factor	Maximum consequences	Residual severity	Residual likelihood	Level insurance requirements	Level of involvement	Level of residual risk
Executive organization/team/ group/worker skill level	TIW 45-180 days	average	low	conform	significant	managed
Executive organization/team/ group/worker the experience	TIW 45-180 days	average	low	conform	significant	managed
Executive organization/team/group/ worker authorized trades/qualifications	TIW 45-180 days	average	low	conform	significant	managed
Executive organization/team/ group/worker days of medical care/days worked	TIW 45-180 days	average	low	conform	significant	managed
Omissions: non-use of protective equipment	TIW 45-180 days	average	low	conform	significant	managed
movements, positioning in dangerous areas	DIS gr. III	high	low	conform	significant	managed
energetic fluids: electricity, gases, fuels, water under pressure, steam	fatality	high	low	conform	significant	controlled

dangerous energies: electric voltages, pressures, kinetic energies, potentials	fatality	high	low	conform	significant	controlled
Technical data: equipment compliance	TIW 45-180 days	average	low	conform	significant	managed
Technical data: evidence of defects/ disturbances/ damages	TIW 45-180 days	average	low	conform	significant	managed
Electrical risk factors - electric current: direct contact/ indirect contact/ step voltage	fatality	high	low	conform	significant	controlled
Chemical risk factors - caustic substances	TIW 45-180 days	average	low	conform	significant	controlled
Under/oversized task in relation to the performer's capacity physical demand: static effort/ forced or vicious work positions/ dynamic effort	TIW 45-180 days	average	low	conform	significant	managed
ergonomic assessments and other assessments related to injury prevention	TIW 45-180 days	average	low	conform	significant	managed

Table 7

Conversion and interpretation grid between common and MEvAR evaluation methodology.

common methodology	risk level	maximum	very high	high	average	low	very low	minimum
	values	7	6	5	4	3	2	1
MEvAR methodology	risk level	unacceptable		tolerated	accepted	controlled	managed	
	values	greater than 3,01		between 2,51 and 3,01	between 2,01 and 2,51	between 1,57 and 2,01	between 0,43 and 1,56	

To ensure the correlation between the results regarding the assessment of occupational risks between the common methodologies and MEvAR, a conversion and interpretation grid was created between them according to Table 7. The values are calculated in accordance with the formulas and calculation grids specific to the calculation methodologies in the evaluation.

The colors specified in the table are consistent with the level of risk acceptability red for unacceptable/maximum, yellow for tolerated/high, blue for average/accepted, green for controlled/low, gray for managed/minimum

3. RESULTS AND DISCUSSION

The study carried out at a workplace that includes activities in the field of detergent production is representative in relation to the methodology adapted to the management standards in the field of OHS because it shows the correlation with the common methodologies of assessing occupational risks and how to ensure continuous improvement specific to organizations.

Thus, the elements identified and revealed by the analysis specific to the evaluation methodologies are compared and an easy conversion and interpretation grid is created.

A number of six risks requiring special treatment according to existing methodologies and fourteen according to the MEvAR equivalent risk factor categories were analyzed.

The following aspects have resulted that require greater attention in the analysis as well as immediate solutions [10, 11].

By increasing the number of risk factors analyzed in MEvAR, the weight of each new risk factor introduced into the calculation will at first sight be reduced, each induces its own risk that must be analyzed and may present a dilution of importance.

However, by introducing the two elements of the OHS management system, compliance with legal and system requirements and management involvement in risk treatment, the value and weight of each risk changes significantly depending on the level of insurance.

Also, the analysis of the work system together with the OHS management system requirements ensures the identification of the main risk factors that can generate an impact on the activity and personnel in a complex system integrated with the organization's policies and objectives.

Table 8 shows the relationship between the risk factors assessed by the existent methodology and MEvAR in organization.

Table 8

Relating the risk factors assessed by the common methodology and MEvAR.

Risk factor	Level of residual risk	Risk factor	Risk level	Relationship between risks
Executive organization/team/group/worker skill level	managed	F2 Falling objects from a height	4	controlled
Executive organization/team/group/worker the experience	managed			
Executive organization/team/group/worker authorized trades/qualifications	managed			
Executive organization/team/group/worker days of medical care/days worked	managed			
Omissions: non-use of protective equipment	managed			
Movements, positioning in dangerous areas	managed			
		F3 Crushing by charges	4	controlled
Energetic fluids: electricity, gases, fuels, water under pressure, steam	managed	F9 Electrocution by direct contact	4	controlled
Dangerous energies: electric voltages, pressures, kinetic energies, potentials	managed			
Technical data: equipment compliance	managed			
Electrical risk factors - electric current: direct contact/ indirect contact/ step voltage	managed			
Technical data: evidence of defects/disturbances/damages	managed	F10 Electrocution by indirect contact	4	controlled
Chemical risk factors - caustic substances	managed	F12 Handling caustic substances – chemical products classified as dangerous	4	controlled
Under/oversized task in relation to the performer's capacity physical demand: static effort/ forced or vicious work positions/ dynamic effort	managed	F23 Static and dynamic effort, working in vicious positions, especially in predominantly orthostatic positions and handling heavy products	4	controlled
Ergonomic assessments and other assessments related to injury prevention	managed			

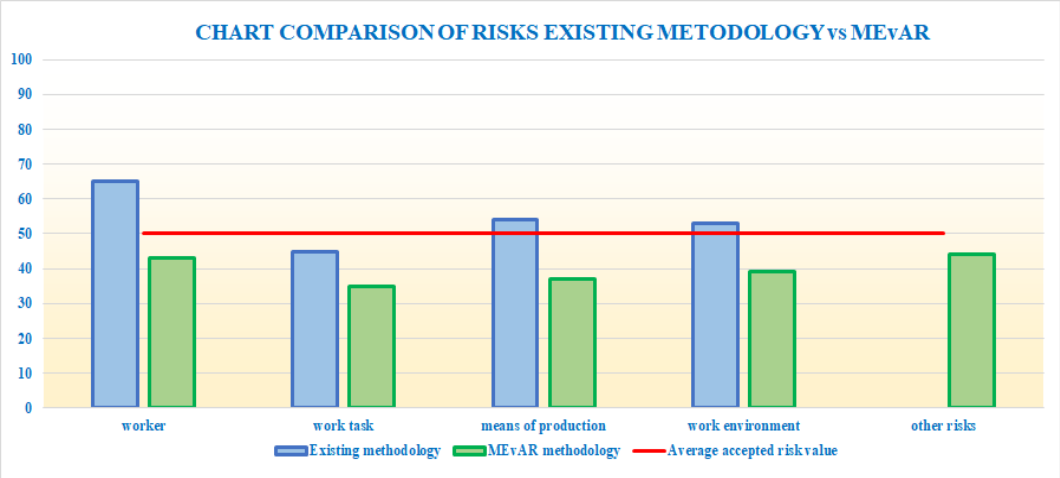

Fig. 3 Identified and residual identified risks situation existent vs MEvAR methodology.

The influence of changing the value of a risk factor higher than the average by ensuring measures in the case of common methodologies where on average between 20-50 risks referring to the risk level are presented is little significant depending on the number of risks, the weight of major risks and the methodologies specific calculation.

Comparative MEvAR by changing the value of a risk from the more than 200 identifiable risks because of the provision of prevention and protection measures ensures a significant decrease or increase of the risk, an unacceptable therefore dangerous risk that can be changed to managed therefore little significant [13],[14].

Figure 3 shows the comparison between the risks identified by the common risk assessment methodologies, those identified by the MEvAR and the residual risks resulting from ensuring the measures.

4. CONCLUSION

The proposed objectives were achieved and according to the results and analysis from the previous chapter, the necessary conclusions can be drawn regarding some significant advantages regarding the application of occupational risk assessment by the MEvAR methodology.

The existent assessment methodologies used in organization provide data on the partial risks, the risk level and the security level, which ensures the requirement for the identification and assessment of risks, the proposal of preventive measures and the maintenance of the risk level.

The MEvAR methodology additionally ensures the highlighting of risks with unacceptable values and insists on how to treat them in the sense of ensuring the principles aimed at the elimination, replacement, transfer, control and monitoring of those that cannot be avoided

In conclusion, it can be observed from the study that if we overlap with the existent risk assessment methodologies the requirements of compliance and the involvement of management in ensuring prevention and protection measures, a reduction of the initially identified risk level will be obtained by changing the way of risk analysis in the sense of highlighting particular risks that have an intolerable level, not accepted in accordance with the policies and objectives of the organization and the current legal requirements.

After analyzing the application of the MEvAR methodology in detergent production we can conclude:

- The methodology is also applicable to the field of chemical and detergent production;
- The methodology applies the management system principles and new identified risk factors;
- The methodology presents significant advantages considering;
- The introduction of novelties such as managerial involvement in risk treatment;

- Compliance with legislation and management systems;
- The use of real-time spreadsheets for visualizing the impact of the measures proposed to treat risks;
- Analysis of dangerous chemical substances and preparations;
- Analysis of the way of setting up the workplaces;
- Analysis of sensitive groups;
- Presentation of performance indicators.

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Considerații privind utilizarea metodei MEvAR în evaluarea profesională în domeniul producției de detergenți

Lucrarea prezintă un studiu privind aplicarea metodologiei MEvAR de evaluare a riscurilor profesionale la un post de lucru operator chimic specific producției de detergenți. Pentru aceasta, am făcut o comparație între evaluarea riscului profesional existent într-o firmă de producție de detergenți pentru locul de muncă al operatorului chimic și evaluarea efectuată folosind metodologia MEvAR. Rezultatele obținute asigură compararea elementelor specifice metodologiilor de evaluare a riscurilor pentru a îmbunătăți identificarea pericolelor și realizarea evaluării riscurilor. Concluziile de la final confirmă utilitatea utilizării metodologiei MEvAR în domeniul producției de detergent.

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