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OCCUPATIONAL RISK ASSESSMENT FOR CHEMICAL LABORATORY STAFF WORKING IN CHROMATOGRAPHY – SAMPLING – WASTEWATER ANALYSIS WITHIN S.C. ROMPETROL QUALITY CONTROL LLC

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ABSTRACT

An effective Occupational Health and Safety risk assessment is crucial for identifying potential hazards in the workplace and implementing measures to minimize harm. By evaluating risks, organizations can create a safer environment for employees, ensuring compliance with safety regulations and enhancing overall productivity. Regular assessments foster proactive safety culture and prevent accidents before they occur, ultimately promoting employee well-being and reducing organizational liabilities. This article aimed to analyze and assess the risks of injury and illness, identify the preventive and protective measures necessary to ensure a healthy and safe working environment, so as to highlight the importance of assessing the occupational risks associated with the jobs of chemical laboratory workers within the investigated company, focusing in particular on chromatography, sampling and waste water analysis activities. The results of the research facilitated the adoption of the most suitable measures to mitigate the risks highlighted as being located in the field of unacceptability. Through the careful and systematic examination of the activities carried out by chemical laboratories and the identification of potential hazards and related risks, practical and effective solutions to protect workers safety and health were already implemented.

Keywords: Occupational Health and Safety (OHS), hazard, risk level, likelihood, severity, injury, prevention and protection

INTRODUCTION

Occupational injury and disease risk assessment is carried out to identify potential hazards and threats to the health and safety of workers in various work environments, as well as to assess the level of these risks and plan preventive and protective measures [1, 2, 3]. By identifying and assessing risks, we can adopt effective strategies to reduce and control them, the aim being to ensure a healthy and safe work environment for employees [4, 5].

By carefully examining the activities carried out by chemical laboratories in these specific areas, it is aimed to identify potential hazards and associated risks, such as exposure to harmful chemicals, handling of specific equipment, unsafe working conditions or other risk factors [6, 7, 8]. We aim to find practical and effective solutions to reduce or eliminate risks and protect the safety and health of employees [9, 10].

Laboratory work in the petrochemical industry involves detailed and precise activities that may expose workers to various risks [11]. Careful assessment of these risks is essential to ensure a safe and healthy working environment for the personnel involved [12]. Laboratory workers, whether involved in chromatography, sampling or wastewater analysis, face potential hazards that require a rigorous approach to their prevention and management [13, 14]. Identifying, assessing and reducing the risks of occupational injury and illness are key priorities to ensure the well-being and safety of employees performing chemically sensitive work [15, 16].

This article aims to analyze and assess the risks of injury and illness, identify the preventive and protective measures necessary to ensure a healthy and safe working environment, so as to highlight the importance of assessing the occupational risks associated with the jobs of chemical laboratory workers within the company S.C. Rompetrol Quality Control SRL Navodari, focusing in particular on chromatography, sampling and wastewater analysis activities.

BRIEF DESCRIPTION OF THE INVESTIGATED COMPANY

S.C. Rompetrol Quality Control LLC (RQC) is part of the KMG International Group from Romania, which includes various entities active in Europe and Central Asia. In Romania, the Rompetrol brand is one of the most important of the group, being involved in key areas such as trade in petroleum products, refining and petrochemicals. Established in 2004 through the outsourcing of laboratory activities on the Rompetrol Rafinare (Petromidia) platform, RQC has established itself as a benchmark of professionalism in the Romanian market for the analysis of petroleum products, petrochemicals and environmental factors.

Throughout the almost two decades of activity, experts from the RQC laboratories have performed millions of tests, contributing significantly to the operational success of the Petromidia refineries in Năvodari and Vega in Ploiești. These reviews ensured quality customer service, meeting deadlines and complying with environmental and occupational safety regulations.

RQC laboratories hold RENAR certification according to the SR EN ISO/IEC 17025:2018 standard and offer a full range of analysis services for petroleum products (solid, liquid and gaseous), environmental factors (water, air, waste and soil), noxes assessment in the work environment, analysis of petrochemical products and biofuels (biodiesel and bioethanol). The accumulated professional experience, the endowment with advanced technical and technological equipment, as well as the certifications obtained from specialized institutions, position these laboratories as the first option for industrial analysis in the Dobrogea area. Currently, the company owns four laboratories:

1. Two petroleum product laboratories: one on the Năvodari platform and the other on the Vega platform (Ploiesti).
2. Petrochemicals Laboratory: located on the Petromidia platform, it offers a wide range of tests to assess the quality of polymers and polymer products.
3. Environmental laboratories: from Năvodari and Ploiesti, which include ACIRAR and the Vega Environmental Technical Unit.

The laboratory in Năvodari specialized in petroleum products offers a full range of tests necessary to evaluate the quality of products according to national and international standards, including up-to-date skills in the elemental analysis of coal. Within the Vega petroleum products laboratory in Ploiesti, tests are carried out on liquid petroleum products, bitumen, solvents and n-hexane, benefiting from specialized technical units adapted to different types of tests (figure 1).

***Figure 1**. Images of the laboratory equipment provided*

The petrochemicals laboratory on the Petromidia platform carries out physical-mechanical, thermal, optical, rheological tests and compliance tests with EU and national legislation in force, including the determination of the content of heavy metals in polymers and the migration of components according to European Directive 10/2011/ EC regarding contact with food (Figure 2).

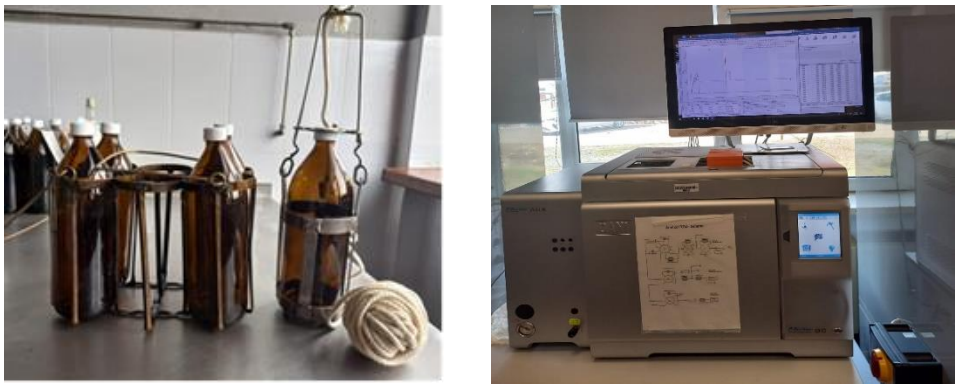

***Figure 2**. Sample collection system (left) and data acquisition and processing (right)*

The environmental laboratories in Năvodari and Ploiești monitor in real time the quality of air, water, soil, sludge, marine sediments and waste. RQC has a mobile laboratory for interventions in case of accidental pollution, which measures the specific indicators for pollutants in the atmosphere, according to EU requirements. The continuous monitoring of specific indicators of pollutant sources is carried out through a wide range of tests.

The laboratory rooms are equipped with specific equipment, means of transport for sampling, dedicated work spaces, chemical niches, safety devices, air conditioning systems, IT equipment, changing rooms and dining areas. The buildings are connected to utilities such as water, sewage, energy (methane gas and electricity). The breakdown of workers by jobs/jobs is shown in the table 1.

Table 1. *List of workplaces for which occupational risk assessment was carried out*

Nr. crt.	Department	Workplace	Number of workers
1.	**Navodari Petroleum Products Laboratory**	Chemist II - Analytical Technical Unit	15
2.		Special analysis laboratory technician	2
3.		Laboratory chemist manufacturing I	11
4.		Laboratory chemist manufacturing II	11
5.		Chemist - Octanic NumberManufacturing Technical Unit	5
6.		Oil foreman	1
7.		Laboratory chemist sampling samples	10
8.		Laboratory chemist - Chromatography Technical Unit	14
9.		Chemical laboratory assistant - Expedition Technical Unit (day schedule)	1
10.		Chemical laboratory assistant - Expedition Technical Unit (shift program)	5
11.		Production technical unit coordinator	1
12.		Analytic technical unit coordinator	1
13.		Special Analysis technical unit coordinator	1
14.		Expedition technical unit coordinator	1
15.		Coordinator of the Chromatography technical unit	1
16.		Metrological measurements analyst	1
17.		Test Manager	5
18.		Driver	2
19.		Head of Petroleum Products Laboratory	1
20.	**Environmental Laboratory**	Boiler water chemist laboratory technician	4
21.		Cooling water chemist laboratory technician	3
22.		Waste water chemist laboratory assistant	3
23.		Water treatment chemist laboratory technician	3
24.		Chromatography special analyses	3
25.		Toxicology Chemist	5
26.		Chemical technician	2
27.		Responsible for water-soil tests	3
28.		Toxicology Test Manager	4
29.		Head of Environmental Laboratory	1
30.		AAS special analysis chemist laboratory assistant	2
31.		Toxicology technical unit coordinator	1
32.		Chemist technician	3
33.		Test Manager	1
34.	**Development of Contracts**	Accountant/economist/developer of contracts/petrochemical engineer	4
35.		Warehouse manager	1
36.	**Management**	Director General	1
37.	**Vega Petroleum**	Chemical laboratory worker, Shipping-Manufacturing Technical Unit	11

Nr. crt.	Department	Workplace	Number of workers
38.	**Products Laboratory**	Coordinator of the technical unit Special Analysis	1
39.		Coordinator of the technical unit Shipping - Manufacturing	1
40.		Coordinator of the Chromatography technical unit	1
41.		Laboratory chemist Special Analyses	5
42.		Chemical laboratory assistant, Chromatography Technical Unit	5
43.		Sample collector, Technical Unit, Shipping, Manufacturing	4
44.		Head of Laboratory	1
45.		Test manager	5
46.		Chemical technician	1
47.		Laboratory chemist, Technical Unit Shipping-Manufacturing - manager of laboratory materials and reagents	1
48.	**Petrochemicals Laboratory**	Chemical laboratory assistant for physical-mechanical determinations, Polymers Technical Unit	13
49.		Chemical laboratory technician - Special Experiments Technical Unit (tour program)	5
50.		Chemist - Special Experiments Technical Unit (day program)	2
51.		Chemical laboratory assistant, Technical Unit, Instrumental experiments (schedule program)	5
52.		Chemical laboratory assistant Technical Unit Instrumental experiments (day program)	2
53.		Head of Laboratory	1
54.		Test manager	5
55.		Technical unit coordinator, Polymers Technical Unit	1
		Technical Unit Coordinator, Instrumental Tests Technical Unit	1
56.		Coordinator of the technical unit of the Special Trials Technical Unit	1
57.	**QHSE**	QHSE Coordinator	1
58.		QHSE Specialist	2
59.	**Total**		**208**

MATERIALS AND METHODS

Occupational health and safety (OHS) risk assessment is a systematic process aimed at identifying, evaluating, and managing potential hazards in the workplace to protect employees and ensure compliance with safety regulations [17]. This process involves recognizing risks that may arise from various workplace activities, such as physical, chemical, biological, ergonomic, and psychosocial hazards. The first step in an OHS risk assessment is to conduct a thorough workplace inspection, followed by identifying any possible dangers associated with machinery, equipment, or materials used. Employees' roles and the work environment must be evaluated for potential risks, considering aspects like exposure to hazardous substances, noise, or physical strain [18, 19].

Once hazards are identified, the severity and likelihood of each risk must be assessed, typically using a risk matrix to prioritize them. Effective control measures, such as engineering controls, personal protective equipment (PPE), training programs, and

changes in work processes, should then be implemented to reduce the identified risks to acceptable levels. Regular reviews and updates of the risk assessment are essential to adapt to changes in the workplace, such as new machinery, processes, or regulations. Involving employees in the process enhances awareness and promotes a culture of safety. Proper documentation and communication of the findings help in maintaining a safe work environment, reducing accidents, improving productivity, and ensuring legal compliance [20, 21, 22].

One commonly used method for this evaluation is the **Risk Matrix**, a tool that helps organizations assess and manage potential hazards by plotting the likelihood of their occurrence against the severity of their impact. The **Risk Matrix** typically consists of a grid with two axes: one for **probability** (the likelihood of an event occurring) and one for **severity** (the potential consequences or harm). The axes are usually divided into categories such as **Low**, **Medium**, and **High [23]**. The matrix is then used to assign a **risk level** by combining these two factors, often resulting in a color-coded chart that categorizes risks from **low** to **high**. Here's how the process works [23]:

1. **Identify Hazards**: List potential hazards that could occur in the workplace.
2. **Assess Likelihood**: Estimate the probability of each hazard happening (e.g., rare, unlikely, likely, or very likely).
3. **Assess Severity**: Evaluate the consequences of the hazard if it does occur (e.g., minor, moderate, major, or catastrophic).
4. **Risk Rating**: Combine the likelihood and severity scores on the matrix to determine the overall risk rating. For example, a high likelihood and catastrophic severity may result in a "high" risk.
5. **Prioritize Actions**: Based on the risk ratings, prioritize which hazards need immediate attention and control measures, such as implementing safety protocols, providing training, or introducing protective equipment [24].

The **INCDPM Bucharest Method** refers to a specific approach developed by the **National Research and Development Institute of Occupational Safety (INCDPM) "Alexandru Darabont"**, based in Bucharest, Romania, for risk assessment in various industrial and environmental contexts, particularly in relation to safety and explosion risks. INCDPM is well-known in Romania and – even – over –used, for its contributions to safety standards in areas such as mining, civil protection, and industrial safety. The INCDPM Bucharest method is primarily focused on ensuring the safety of industrial operations, particularly those in hazardous environments like mining and explosion-prone industries. It involves a structured, scientific approach to identifying, assessing, and managing risks, with an emphasis on prevention and mitigation through engineering, procedural, and training measures [25].

While the exact details of the **INCDPM Bucharest Method** might not be universally standardized or widely published in a global context, based on the institute's activities, the following general approach is likely involved:

1. **Risk Identification**:
   - This involves recognizing all potential hazards in a given environment, especially those related to explosions, mining, and industrial accidents.

- Methods might include a combination of qualitative techniques (e.g., expert opinions) and quantitative techniques (e.g., hazard and operability studies, HAZOP).

2. **Risk Analysis**:
   - Once hazards are identified, the next step is analyzing the likelihood and consequences of each identified risk
   - This may involve mathematical modeling, simulations, historical data analysis, and scenario-based assessments.
   - The goal is to estimate both the **probability** and **severity** of potential incidents.
3. **Risk Evaluation**:
   - In this phase, the assessed risks are compared against predefined risk acceptance criteria. This step helps determine whether the risks are tolerable or need mitigation.
   - A matrix is often used, where risks are categorized based on their likelihood and impact, prioritizing actions for the most significant threats.
4. **Risk Control**: this involves determining and implementing appropriate measures to reduce or eliminate the identified risks. Measures can include engineering controls (e.g., safety equipment), administrative controls (e.g., procedures and training), and personal protective equipment (PPE).

Resorting to the well-established instruments of the cited risk evaluation tool [26], we obtained the results described briefly in the following section.

RESULTS AND DISCUSSIONS

a. Working process

Within S.C. Rompetrol Quality Control S.R.L Năvodari, the chemist-chromatography laboratory technician performs tests/analyses, according to the Test Programs, for internal customers and according to contracts/orders, for external customers in order to determine specific quality indicators to satisfy customer requirements.

***Figure 3**. Workplace and work equipment specific to the job „chemist technician - chromatography"*

b. The components of the evaluated work system (figure 3)

➢ **Means of production/ work equipment:**

- Gas chromatograph
- Liquid chromatograph
- LPG vaporizer
- Apparatus for determining vapor pressure
- Corrosion device
- Huber CC 805 refrigerator
- Office furniture
- Office equipment (computer)
- Laboratory utensils (burets, pipettes, laboratory glassware)
- Reagents: ethanol, acetone, n-pentane, n-heptane, 3 pentanol, nanodecanoate;
- Petroleum products: petrol, diesel, oil, LPG, gas, MTBE, light naphtha, biodiesel, bioethanol.
- Gases: cylinders with hydrogen, helium, nitrogen

➢ **Working task:**

- Collects and destroys samples/residues in order to avoid contamination of work spaces and avoid accidents: Handles dangerous substances;
- Comply with the instructions for collection and destruction of samples and residues resulting from tests, taking into account incompatibilities;
- Clean equipment and materials used for the test.
- Respects the requirements of the integrated management system and ISO 17025 requirements, works according to the system procedures and according to the specific procedures;
- Participates, at the supervisor's request, in intra- and interdepartmental projects or activities, of a temporary nature, depending on his role and competences, in order to contribute to the achievement of the team's objectives.

➢ **Work environment**

- Work in the rooms of the laboratory. The activity takes place in 3 shifts, shift schedule, 8 hours and night shift.
- During the program, may be exposed to: temperature variations, air currents, noise, vibrations, low lighting level, artificial lighting, natural disasters, pneumoconiogenic dusts, gases, vapors, toxic or caustic aerosols, flammable gases or vapors or explosives, microorganisms suspended in the air: bacteria, viruses, coronaviruses, rickets, spirochetes, fungi, protozoa.

c. Evaluation of occupational injury and illness risks

The risk assessment sheet for the investigated workplace is systematized in table 2, and the sheet summarizing the risk prevention and protection measures identified as being in the unacceptable field is reproduced in table 3.

Figure 4 graphically summarizes the "landscape" and the corresponding level of individual risks, and figure 5 the distribution of risk factors on the four component elements of the work system.

In table 2, the following acronyms are used: LTI –Lost Time Injury; INV – Invalidity.

Table 2. *Risk Assessment Sheet for petroleum products laboratory – chromatography technical unit, Job: Chromatography chemist laboratory assistant*

Rompetrol Quality Control S.R.L.	**Job evaluation sheet**		Exposed workers: 14			
Petroleum products laboratory – chromatography technical unit,			Exposure duration: 8 hours/shift			
Job: Chromatography chemist laboratory assistant						
Work system component	**Identified risk factors**	**Concrete form o manifestation of the risk factors (description, parameters)**	**Maximal foreseeable consequence**	**Severity class**	**Likelihood**	**Partial risk level**
Worker	Wrong actions/ violations	F1. Defective execution of operations: positioning, fixations, maneuvers, fixations, etc. during analysis.	LTI 45-180 days	3	1	2
		F2. Improper storage of used reagents or laboratory materials (danger of falling).	Death	7	1	3
		F3. Failure to label containers with reagents (uncontrolled reactions).	LTI 45-180 days	3	1	2
		F4. Handling heavy gas cylinders / cylinders - risk of musculoskeletal disorders; risk of violent impact when the cylinder accidentally falls	LTI 45-180 days	3	1	2
		F5. Failure to comply with work procedures/instructions and SSM when performing analyzes or using inappropriate work methods.	Death	7	1	3
		F6. Execution of unforeseen operations in the work load.	Death	7	1	3
		F7. Performing operations on the equipment during its operation.	Death	7	1	3
		F8. Improper dosing or wrong use of reagents.	LTI 45-180 days	3	1	2
		F9. Unannounced leaving the workplace during the analysis.	LTI 3 - 45 days	2	2	2
		F10. Use of petroleum products (gasoline, petroleum, or other volatile products) for washing the floor, cleaning clothes, protective equipment, hands, etc.	Death	7	1	3
		F11. Use of laboratory vessels for drinking or serving food.	Death	7	1	3
		F12. Carrying out operations not foreseen by the workload: traveling/stationary in dangerous areas, other operations.	Death	7	1	3

		F13. Wrong use of technical means of extinguishing fires (depending on the nature of the fire - electrical or petroleum products).	Death	7	1	3
		F14. Falling due to imbalance, slipping, tripping on the access stairs in the laboratory premises or in the technological sectors (work at height).	Death	7	1	3
		F15. Falling from the same level due to imbalance, slipping, stumbling or from a low height by stepping on empty or unbalancing	LTI 45-180 days	3	3	3
		F16. Not using the ventilation system/niches during the analysis.	***INV. Gr. III***	***4***	***3***	***4***
		F17. Contraindicated actions while reactions are taking place in niches: putting the head in the niche, wearing a gas mask, leaving the window open, etc.	Death	7	1	3
		F18. Missing/uncoupling/removal of protective devices of work equipment.	LTI 45-180 days	3	3	3
		F19. Actions that can affect the safety and health of the individual as well as the other participants in the production process: -blocking access or escape routes; blocking the access paths to hydrants, electrical installations and exit doors but various materials; failure to maintain free and clean access and evacuation routes; blocking the laboratory windows with furniture, shelves, equipment or other objects	Death	7	1	3
		F20. Presence at the workplace under the influence of alcoholic beverages, some drugs (which can influence the mental capacity of the worker) or in an advanced stage of fatigue.	Death	7	1	3
		F21. Removing substances from the laboratory and performing unauthorized experiments.	LTI 3 - 45 days	2	2	2
		F22. Keeping near vessels and bottles whose contents may give rise to violent reactions or the release of toxic/flammable gases or vapors.	LTI 45-180 days	3	3	3
		F23. Failure to comply with restrictions on entering explosive/special environments (use of mobile phone, shoes with metal accessories, non-static clothing) or entering the premises of technological sectors without the consent of the workplace leader and unaccompanied.	Death	7	1	3
		F24. Non-use of fittings and gaskets of non-ferrous material (copper, brass, etc.) for hydrogen cylinders - risk of explosion.	Death	7	1	3
		F25. Non-wearing or incomplete wearing of protective equipment according to regulations.	Death	7	1	3

		F26. Omitting the performance of operations mentioned in the work instructions, safety and health at work and emergency situations.	Death	7	1	3
		F27. Failure to show up for the periodic medical check-up, as scheduled (there is a risk of using medically unfit personnel).	LTI 45-180 days	3	3	3
		F28. Carelessness when washing laboratory glassware.	LTI 3 - 45 days	2	2	2
Working Task	Content inadequate of the work task	F29. Inadequate training of laboratory personnel regarding work instructions, safety and health at work, when performing analyses.	Death	7	1	3
		F30. Inadequate training of laboratory personnel regarding the risks of occupational injury and/or illness to which they are exposed, including the safety data sheets of the substances used in the laboratory.	Death	7	1	3
		F31. Inadequate training regarding: fire prevention and extinguishing rules and how to intervene in case of fire, Storage plan, evacuation plan.	Death	7	1	3
		F32. Lack of technical sheets for the substances and reagents used in the laboratory.	LTI 3 - 45 days	2	2	2
		F33. Inadequate training on providing first aid in case of injury: splashing with acids, caustic substances, poisoning, electrocution.	LTI 45-180 days	3	3	3
		F34. Lack or insufficient signaling of risks in the laboratory as well as of evacuation plans.	ITM 3-45zile	2	2	2
		F35. The use in niches of their work equipment for lighting, in normal construction.	Death	7	1	3
		F36. Lack of equipment or insufficient equipment of medical kits or neutralizing substances.	LTI 3 - 45 days	2	2	2
		F37.Utilization of personnel declared medically unfit.	Death	7	1	3
		F38. Lack of control over compliance with technical and organizational OSH measures regarding the admission to work of employees and the performance of analyses.	Death	7	1	3
	Under/oversized work load	F39. Static effort during analysis.	LTI 3 - 45 days	2	2	2
		F40. Mental stress associated with risks from the technological sectors: risk of explosion, fire, intoxication.	LTI 3 - 45 days	2	2	2
		F41. Eye fatigue due to the workload that requires prolonged work at the computer (not alternating with another type of activity).	LTI 45-180 days	3	4	3

Equipments	Mechanical risk factors	F42. Spilling / scalding / chemical burning by breaking / pricking / cracking of laboratory equipment during the analysis.	LTI 45-180 days	3	3	3
		F43. Contraindicated self-triggering or self-locking of work equipment.	ITM 3-45zile	2	2	2
		F44. Niches with insufficient circulation to ensure the allowed level of the concentration of the toxic substances being worked with.	Death	7	1	3
		F45. Movements under the effect of gravity: sliding, rolling, overturning, free fall of stored materials, laboratory equipment, etc.	LTI 45-180 days	3	2	2
		F46. Spraying with the specific substances used in laboratory analyzes (acids, caustic substances, etc.) and products with high temperatures.	***INV. Gr. III***	***4***	***3***	***4***
		F47. Fires/explosions in the laboratory or in the technological sectors.	***Death***	***7***	***2***	***4***
	Electrical risk factors	F48. Electrocution by direct or indirect contact with power cables with destroyed or non-insulated insulation.	Death	7	1	3
	Chemical risk factors	F49. Working with chemicals classified as dangerous according to EC Regulation 1272/2008.	LTI 45-180 days	3	3	3
		F50. Poisoning by accidentally touching a lethal concentration of toxic vapors in the laboratory.	Death	7	1	3
		F51. Accumulations of hydrogen in the gas chromatograph oven - risk of explosion.	Death	7	1	3
		F52. Hydrogen leaks from defective cylinders or resulting from defects in the gas chromatograph (broken columns, damaged injectors) - risk of explosion.	***INV. Gr. III***	***4***	***3***	***4***
		F53. Air currents formed by opening windows and doors for better ventilation in the laboratory.	LTI 3 - 45 days	2	2	2
		F54. Artificial lighting in certain areas or points of the devices.	LTI 3 - 45 days	2	2	2
Environment	Physical risk factors	F55. Noise generated by the operation of the ventilation system in the niche.	INV. Gr. III	4	2	3
		F56. Slipping on wet (floors, stairs) or icy surfaces when traveling outside.	LTI 45-180 days	3	2	2
		F57. The formation of pneumoconiogenic dusts when cleaning the workplace.	ITM 3-45 days	2	2	2
		F58. Natural disasters (lightning, floods, wind, hail, landslides, landslides, land or tree collapses, earthquakes, etc.)	Death	7	1	3

Environment	Chemical risk factors	F59. Gases, vapors, toxic or caustic aerosols resulting in the work environment following the analysis.	LTI 3 - 45 days	2	2	2
	Biological risk factors	F60. Contamination with viruses of the SARS Cov-2 type, etc. in the air or through contact with people.	INV. Gr. III	4	2	3

The overall risk level of the job is:

$$N_{rg} = \frac{\sum_{i=1}^{60} r_i \cdot R_i}{\sum_{i=1}^{60} r_i} = \frac{4 \cdot (4 \times 4) + 37 \cdot (3 \times 3) + 19 \cdot (2 \times 2)}{4 \times 4 + 37 \times 3 + 19 \times 2} = \frac{473}{165} = 2.87$$

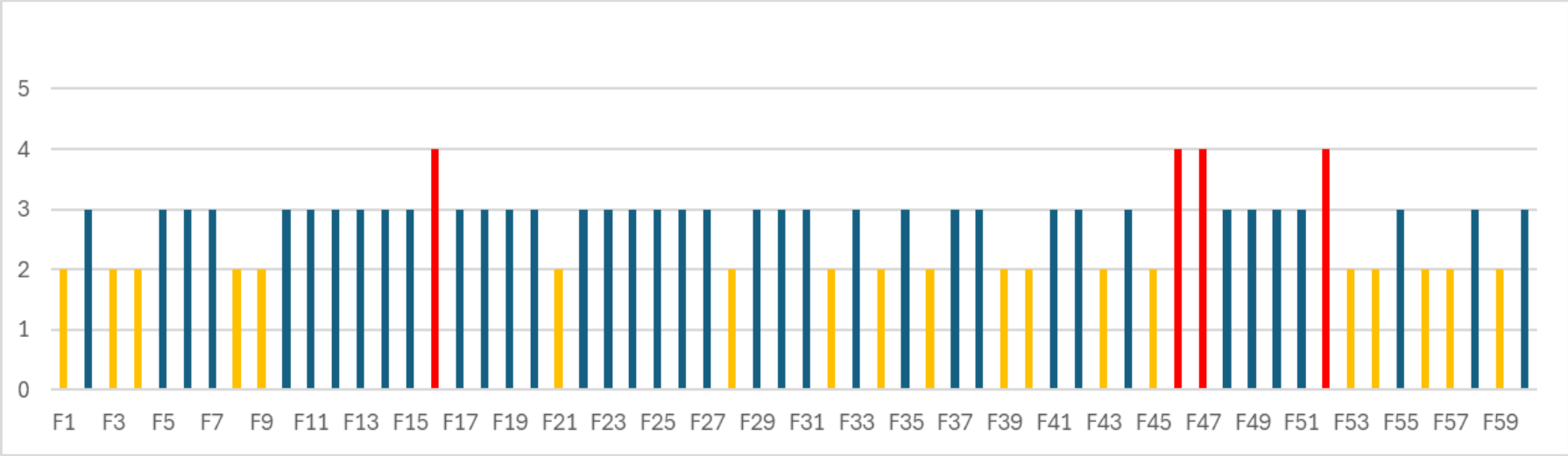

Fig. 4. *The partial levels of risk by risk factors, Workplace: "chemical laboratory assistant - chromatography". Global risk level: 2.87*

Table 3. *Sheet of proposed measures "chemical laboratory assistant - chromatography"*

Crt. no.	Risk factor	Risk level	Proposed measures (naming the measure)
1	**F16** - Not using the ventilation system/niches during the analysis.	4	**Organizational measures** Work with harmful substances and concentrated acids or heating substances toxic, in an open vessel, must be executed under the niche, whose circulation will be checked in advance. In the niches where installations containing particularly toxic substances are installed, ventilation will be ensured during the night as well. -Training and testing workers regarding work procedures and techniques. -Verification of the way of storage and use of chemical substances
2	**F46** - Spraying with the specific substances used in laboratory analyzes (acids, caustic substances, etc.) and products with high temperatures.	4	**Organizational measures** The workers will be trained to respect the work procedure when performing the analyzes to avoid accidental splashes; The workers will be trained and checked to wear the individual protective equipment suitable for the activity carried out (obligatory shirt/blouse with long sleeves well closed at the sleeves and neck). The heating of the dishes will be done gradually; tongs will be used when handling hot equipment
3	**F47** - Fires/explosions in the laboratory or in the technological sectors.	4	**Technical measures** Permanent control of the ventilation installation: efficiency, technical condition, revision, repair. Use of all available ventilation devices. **Organizational measures** Checking the physical condition of the substances before starting work. Display of evacuation plans in case of emergency situations. The display in each analysis room of the numbers to call in case of emergency situations.

			It is forbidden to block the laboratory windows with furniture, shelves, equipment or other objects. - It is forbidden to block access or escape routes; they will be kept free and ugly. - It is forbidden to block access paths to hydrants, electrical installations and escape doors with various materials; - It is forbidden to wash the floor, work tables, clothes, protective equipment, etc. in gasoline or other volatile products. Practical exercises/applications (simulations) will be carried out with the laboratory staff regarding the correct way of acting in case of emergency situations;
4	**F52**- Hydrogen leaks from defective cylinders or resulting from defects in the gas chromatograph (broken columns, damaged injectors) - risk of explosion.	4	**Organizational measures** Pressure vessels will be stored away from sources of fire and electrical discharges, oxidizing gases and other materials that promote fire, in a well-ventilated place. - The containers will be very well fixed against overturning in specially provided racks and where untrained/unauthorized persons have no access. -Containers and cylinders for compressed gas will be checked before use regarding the condition of the outer surface and will not be kept near heat sources - Opening the valve on the cylinders must be done slowly, without jerking; -Glass vessels that work under pressure will be provided with protection systems in case of breakage that will not allow them to scatter; - The glass tubes used at high pressures will be handled with great care and under the conditions of the use of protective screens.

d. Interpretation of the risk assessment results

The global risk level calculated for the job "*Chemical laboratory assistant - chromatography*" is equal to 2.87 value, which places it in the category of jobs with very low to low risk, not exceeding the maximum acceptable limit (3.5).

The result is supported by the "Job Evaluation Sheet" from which it can be seen that, out of the total of 60 identified risk factors, only 4 exceed, as a partial level of risk, the value of 3, falling into the category of maximum risk factors, 37 factors are in the category of low risk factors (3), and 19 factors are in the category of very low risk (2). To reduce or eliminate the 4 risk factors (which are in the unacceptable range), the generic measures presented in the "Proposed measures sheet" are necessary.

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

- 46%, human factor's own factors;
- 22%, factors specific to the workload;
- 22%, factors specific to the means of production/work equipment;
- 6%, factors specific to the work environment.

From the analysis of the Evaluation Sheet, it is found that 33 (55 %) of the identified risk factors can have irreversible consequences on the performer (death or disability)..

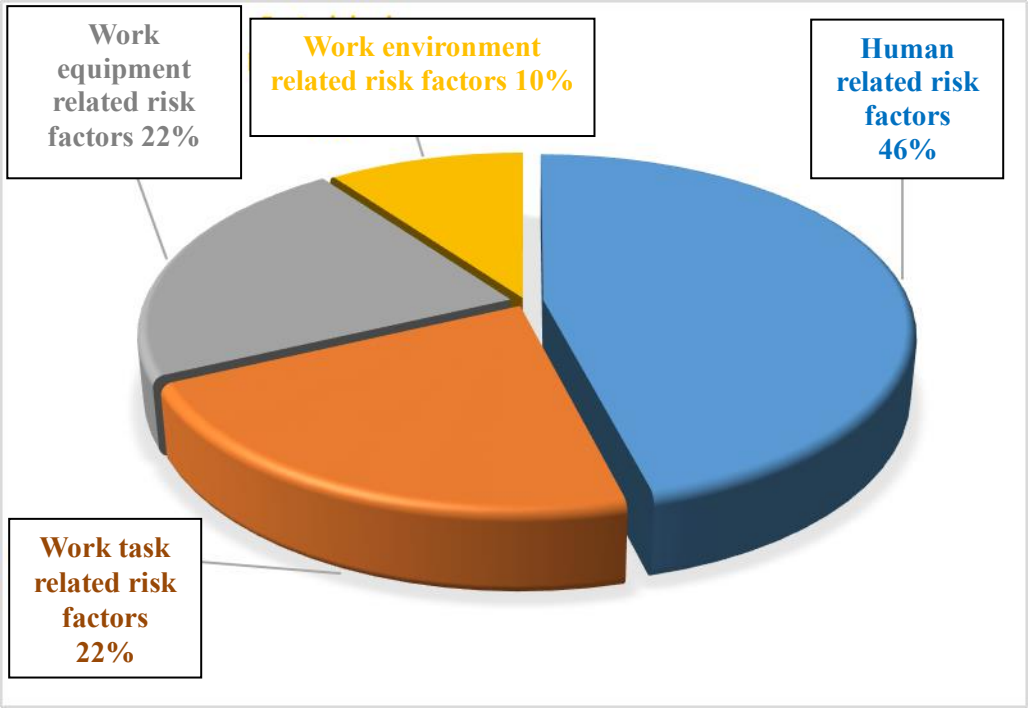

Figure 5. *The share of risk factors identified by the elements of the work system.*
Job: „Chemical laboratory assistant - chromatography", Global level of risk: 2.87

Based on the results obtained and the measures stated in table 3, the prevention and protection plan was developed in accordance with the requirements of the applicable legislation (table 4 shows a relevant excerpt, for the job analyzed).

Table 4. *Prevention and protection plan: Chemical laboratory assistant - chromatography*

Assessed risks	Technical measures	Organizational measures	Sanitary measures	Other measures	Actions in order to achieve the measure	Deadline	Responsible person
Traveling / stationary in hazardous areas (on car access roads, under suspended loads, etc.)	Signaling of hazardous areas, areas where work is carried out and their delimitation with means of collective protection	Keeping the signs and protective means in proper condition. The OSH training of workers, regarding the risks of injury when parking or traveling in dangerous areas, with risk of injury.	Equipping workplaces with first aid kits	-	The existence and efficiency of signaling and means of protection will be checked; in case of defects, they will be repaired or replaced.	Permanently	Worker Workplace manager
Missing/uncoupling/removing protective devices of the work equipment	Installation/checking and repair of all protective devices	Training workers regarding the consequences of removing protective devices from work equipment. The use of only trained, qualified personnel in the work process.	-	-	Installation and repair of protective devices	Permanently	Workplace manager
Wrong operations, rules, work procedures, wrongly received orders for carrying out the activity.	-	The assignment of tasks will be done in accordance with the training and training of the workers, as well as in accordance with the mentions of the occupational medicine doctor in the skills sheet.	-	-	Posting own instructions at workplaces so that they can be consulted whenever the situation requires it.	Permanently	Workplace manager
Improper use of protective equipment	-	Prohibition of carrying out activities without individual protective equipment. Training workers in the correct use of the PPE provided	-	-	Checking the way workers use the individual protective equipment provided	Permanently	Workplace manager

Electrocution by direct or indirect contact	Periodic verification through measurements of the insulation, the grounding socket, the grounding belt, the thermal protection relay and the repair of faults	Retraining of all staff regarding the risk of electrocution and first aid measures in case of electrocution	Equipping workplaces with first aid kits	-	The display of instructions on protection against electric shock at each workplace	According to the maintenance program Permanently	Workplace manager
Slipping, hindering, falling on the same level	Keeping the access and circulation paths, the floors at the work site free and in a clean condition	Training employees on "Preventing incidents caused by slipping, tripping and falling from the same level"	Equipping workplaces with first aid kits	-	-	Permanently	Workplace manager Worker
Noise generated by the operation of laboratory equipment and ventilation.	Checking the noise level and taking measures to reduce it if the noise level exceeds the maximum allowed limit	Provision of individual noise protection equipment (earmuffs)	-	Request (if necessary) additional medical control	Verification of the inclusion of noxes in the professional exposure limit values	Permanently - wearing earplugs	Workplace manager OHS Professional

CONCLUSIONS

The results of the risk assessment are presented in the "*Job Evaluation Sheet*" and the "*Proposed Measures Sheet*" related to each analyzed workplace.

The list of evaluated jobs is shown in table 5.

Table 5. *Risk assesment results*

Crt. No.	***File number***	***Workplace***	***Overall risk level***
1	F01	Chemical laboratory assistant - chromatography	2.87
2	F02	Chemical laboratory assistant – sample collector	3.01
3	F03	Chemical laboratory assistant – waste waters	2.89

The overall risk level for the 3 workplaces is:

$$N_{gS} = \frac{\sum_{i=1}^{3} r_i \cdot N_{gi}}{\sum_{i=1}^{3} r_i} = 2.92$$

The ranking of work places, depending on the global level of risk, is shown in table 6.

Table 6. *Workplaces ranking as a function of their risk level*

Crt. No.	***File number***	***Workplace***	***Overall risk level***
1	F02	Chemical laboratory assistant – sample collector	3.01
2	F03	Chemical laboratory assistant – waste waters	2.89
3	F01	Chemical laboratory assistant - chromatography	2.87

According to the hierarchy, it is found that all workplaces have a global risk level below the allowed limit (3.5), falling into the category of those with a low to medium risk level.

The aggregated global risk level of the company, N_{gS} = 2.92, confirms this classification, reflecting the effectiveness of the preventive and protective measures implemented. Therefore, S.C. Rompetrol Quality Control SRL Năvodari falls into the category of companies with a low level of risk, demonstrating its commitment to ensuring a safe working environment and in compliance with legal standards.

Occupational injury and disease risk assessment is crucial for identifying and assessing potential hazards and threats to the health and safety of workers in various work environments, as well as for planning and implementing appropriate prevention and protection measures.

Adopting effective risk reduction and control strategies aims to ensure a healthy and safe work environment for employees. By carefully examining the activities carried out by chemical laboratories and identifying potential hazards and associated risks, the aim is to find practical and effective solutions to protect their safety and health.

Risk assessment in occupational settings is a vital tool for identifying, evaluating, and managing potential hazards to protect workers' health and safety. Its strengths lie in its proactive, structured approach to hazard identification, compliance with legal standards, and contribution to a safety-conscious culture. However, its limitations - such as subjectivity, the dynamic nature of risks, and potential resource constraints - highlight the need for continuous review and adaptation.

To be truly effective, risk assessments must be thorough, updated regularly, and combined with robust implementation strategies that address both physical and human factors in the workplace. Rigorous assessment of the risks of occupational injury and illness in the petrochemical industry is essential to ensure a safe and healthy working environment for personnel involved in chemically sensitive activities.

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