TECHNICAL UNIVERSITY OF CLUJ-NAPOCA

ACTA TECHNICA NAPOCENSIS

Series: Applied Mathematics, Mechanics, and Engineering
Vol. 65, Issue Special IV, December, 2022

# RISK FACTORS AND OCCUPATIONAL HEALTH IN OFFICE ACTIVITY

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***Abstract:*** *The paper aims to identify potential risk factors in office activities such as registration, administrative, financial, human resources, planning, purchasing a.s.o. where the operators perform operational tasks using computer and/or checking documentation on paper and/or digital registers or databases, prepare documents and work in open-space or in offices with numerous persons. The risk factors were identified as follows: electromagnetic field, power / dust, ozone, carbon monoxide, noise, and measured using dedicated equipment in multiple locations. Values exceeding the regulatory level are reported and a mitigation plan is proposed to encompass the effects on the occupational health of the operators. Usually, top management adopt a slightly compensation financial scheme, but on long term such an option does not reveal sustainable.*

***Key words:*** *risk assessment, sustainability, occupational safety*

## 1. INTRODUCTION

Even if industrial companies have extensive operational processes, all support (financial, human resources, administrative, planning, purchasing), data management, processes assessment frame as office activity and, in this context, the study appears applicable. The regulatory framework [1] requires working places risk assessment and subsequent measures to mitigate risks and manage occupational health [2,3].

Premises in many companies do not comply the regulatory requirements for ergonomics and operational activities' dynamics, including multiple problems related to working conditions. These facts lead to the need to identify the risk factors, then to measure them and to compare the factors' values with the acceptable level in order to identify possible solutions on short term and in the next step, actions to set in place on long term for sustainable development.

Previous work has focused on border offices and included workplaces risk assessment using two different methods, i.e. checklists [4] and questionnaires [5].

As known, many public administrative offices are located in old buildings where infrastructure has been set in place based on occasional investments, mainly using EU projects / funds, without a long-term strategy to overcome political frameworks and to ensure continuity and sustainability.

In line to EU regulations [6], this study has initiated a systematic and structured approach to reveal, based on a previous risk assessment [4,5], the risk factors' values so as to offer to the management (part of the political executive) a comprehensive perspective of how extensive and significant appears the on-site deviation as compared to the recommended health and safety legislation. The issue of documenting the problem using factors' measurement in the majority of locations appears quite sensitive, needs significant resources and adequate organisation to maintain staff engagement.

This paper tends to extrapolate the results obtained for specific jobs (customer officer in non-destructive laboratory and in border offices) to offices in administrative, financial, human resources, planning, purchasing operations a.o. where the working activity consists of document preparation, databases or digital registers research and registration and all these in conditions of open-space offices, with public exposure, multitasking jobs, time pressure and high responsibility as financial effects occur following the concerned working tasks.

## 2. EXPERIMENTAL PROCEDURE

Risk factors for office working places to accomplish European and national regulation in the field of occupational safety were identified as follows: electromagnetic field, power / dust, ozone, carbon monoxide and noise.

These factors were measured and the number of locations is mentioned in the corresponding graphs.

The merit of the study is the broad range of locations of the National Agency for Fiscal Administration in the whole Romanian territory where the risk factors were measured in order to have an extensive view of the working conditions to document a mitigation plan and improve the occupational health of the personnel in charge for administrative activities. The approach may be extended to any similar office activity.

### 2.1 Electromagnetic field

Measurements in accordance with the standards SR EN 50413:2020/A and SR EN 50413:2020/A concerning the measurement procedures of human body exposure to electric, magnetic and electromagnetic fields (100…400 MHz) were implemented using a portable equipment for multi field (electromagnetic filed meter) EMF 450 in multiple locations (i.e. 617 working places) in normal working conditions, at the operator common use distance of 5…10 cm of the portable radio terminals (antenna, server, laptop, video projector, printer, audio systems, scanner, router, switch, hubb etc.).

The mean intensity of the electric field AL(E) [$Vm^{-1}$] (RMS), the mean magnetic induction AL (B) [μT] (RMS) and the power density for equivalent plane wave (RMS) mean per 6 min (S) [$Wm^{-2}$] were measured and reported as compared with the regulated target values. In accordance to the national regulation (Government Decision 520/2016) for portable terminals with frequencies between 10…400 MHz, AL(E) [$Vm^{-1}$] should not exceed 61 V/m and AL (B) [μT] should limit below 0.2 μT.

An extract of the reported results is given in table 1. Results for the other locations are similar, in the same range.

As noticed, for all the locations of the investigated organization from the occupational

*Table 1*

**Risk factor - Electromagnetic field.**

| Location | Number of working places | AL (E) [$Vm^{-1}$] | AL (B) [μT] |
|---|---|---|---|
| Iasi DGESCS | 7 | 69.7 | 0.232 |
| | 1 | 65.6 | 0.219 |
| Prahova DGESCS | 6 | 63.7 | 0.212 |
| | | 61.6 | 0.205 |
| Brasov DGESCS | 3 | 63.7 | 0.212 |
| | 3 | 61.9 | 0.206 |
| | 1 | 61.6 | 0.205 |
| Cluj DGESCS | 2 | 68.52 | 0.228 |
| | 1 | 62.2 | 0.207 |
| Dolj DGESCS | 1 | 63.8 | 0.213 |
| | 1 | 61.5 | 0.205 |
| | 1 | 69.7 | 0.232 |
| Galati DGESCS | 4 | 63.7 | 0.212 |
| | | 65.6 | 0.219 |
| Galati DGESCS | 4 | 61.8 | 0.208 |
| | | 61.9 | 0.206 |
| Alba DGESCS | 2 | 61.5 | 0.205 |
| Covasna DGESCS | 1 | 63.7 | 0.212 |
| Mures DGESCS | 1 | 65.6 | 0.219 |
| Sibiu DGESCSDRAF | 1 | 61.8 | 0.206 |
| | 1 | 65.6 | 0.219 |
| | 1 | 61.7 | 0.206 |
| | 1 | 63.7 | 0.212 |
| | 1 | 61.9 | 0.206 |
| | 1 | 61.5 | 0.205 |
| | 1 | 63.7 | 0.212 |
| | 1 | 62.52 | 0.208 |
| Harghita DGESCS | 2 | 62.39 | 0.208 |
| Gorj DGESCS | 4 | 62.2 | 0.207 |
| Gorj DRAF | 4 | 61.9 | 0.206 |
| | 9 | 63.3 | 0.211 |
| | 10 | 65.3 | 0.218 |
| | 11 | 61.7 | 0.206 |
| Vilcea DGESCS | 3 | 62.2 | 0.207 |
| Mehedinti DGESCS | 4 | 61.8 | 0.206 |
| Olt DGESCS | 2 | 65.6 | 0.219 |
| Vrancea DGESCS | 3 | 67.9 | 0.226 |
| Tulcea DGESCS | 5 | 61.8 | 0.206 |
| Braila DGESCS | 3 | 61.5 | 0.205 |
| Arges DGESCS | 4 | 61.9 | 0.206 |
| Calarasi DGESCS | 2 | 61.5 | 0.205 |
| Buzau DGESCS | 6 | 61.9 | 0.206 |
| Dimbovita DGESCS | 1 | 61.6 | 0.205 |
| Giurgiu DGESCS | 1 | 62.2 | 0.207 |
| | 6 | 61.6 | 0.205 |

| | | | |
|---|---|---|---|
| | 2 | 61.9 | 0.206 |
| Constanta DGESCS | 1 | 61.6 | 0.205 |
| Constanta DRAF | 4 | 61.9 | 0.206 |
| | 4 | 61.6 | 0.205 |
| | 4 | 63.7 | 0.212 |
| | 6 | 65.6 | 0.219 |

health perspective concerning the operators' exposure to the electromagnetic field the ceiling values are exceeded. The maximum measured values were the mean intensity of the electric field AL(E) [$Vm^{-1}$] (RMS) **69.7** (versus the limit of 61) and the mean magnetic induction AL (B) [µT] (RMS) **0.232** (versus the limit of 0.2). These values were reported in several locations, as seen in Figure 1. Similar synthesis was prepared with the results for all the measured locations and included in the report for management.

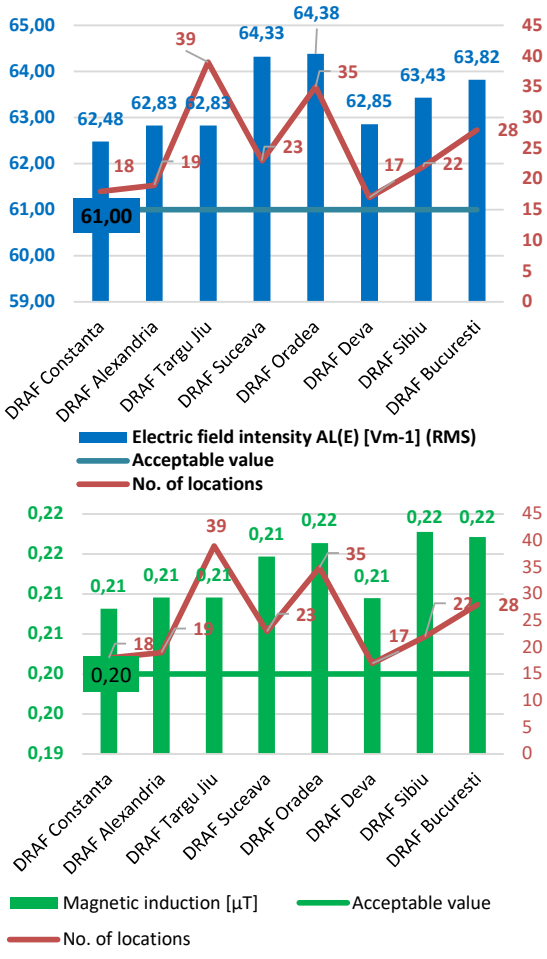


**Fig. 1** Electromagnetic field effect in the locations of National Administration premises

## 2.2 Particles (inhalable fraction) in the air

Measurements in accordance with the standards SR 10813: 1976 and SR EN 12341: 2002 concerning the air were implemented using an Air Particle Counter DT-9881 able to measure particle of (0.3; 0.5; 1.0; 2.5; 5.0; 10) µm with an efficiency of 50% for particles of 0.3 µm and 100 % for particle > 0.45 µm. Measurements are implemented in multiple locations (i.e. 617 working places) in normal working conditions of 480 min (8 hours per day).

*Table 2*

**Risk factor – Air quality (inhalable fraction of particles)**

| Location | Number of working places | Particles in the air mean [mg/m$^3$] |
|---|---|---|
| Iasi DGESCS | 7 | 10.1 |
| | 1 | 10.1 |
| Prahova DGESCS | 6 | 10.1 |
| | | 10.1 |
| Brasov DGESCS | 3 | 10.1 |
| | 3 | 10.1 |
| | 1 | 7.2 |
| Cluj DGESCS | 2 | 10.1 |
| | 1 | 10.1 |
| Dolj DGESCS | 1 | 10.1 |
| | 1 | 6.9 |
| | 1 | 10.1 |
| Galati DGESCS | 4 | 10.1 |
| | | 7.8 |
| Alba DGESCS | 2 | 10.1 |
| Covasna DGESCS | 1 | 10.1 |
| Mures DGESCS | 1 | 10.1 |
| Sibiu DGESCS DRAF | 1 | 10.1 |
| | 1 | 10.1 |
| | 1 | 7.8 |
| | 1 | 10.1 |
| | 1 | 8.4 |
| | 1 | 10.1 |
| | 1 | 10.1 |
| | 1 | 10.1 |
| Harghita DGESCS | 2 | 10.1 |
| Gorj DGESCS | 4 | 10.1 |

In accordance with the national regulations (Government Decision 806/2016 and 53/2021 and the Law 104/2011 concerning the air quality) particles (inhalable fraction without specific effect) should not exceed 10 mg/m$^3$ during 8 hours.

An extract of the reported results is given in table 2 and figure 2. Results for the other locations are similar, in the same range.

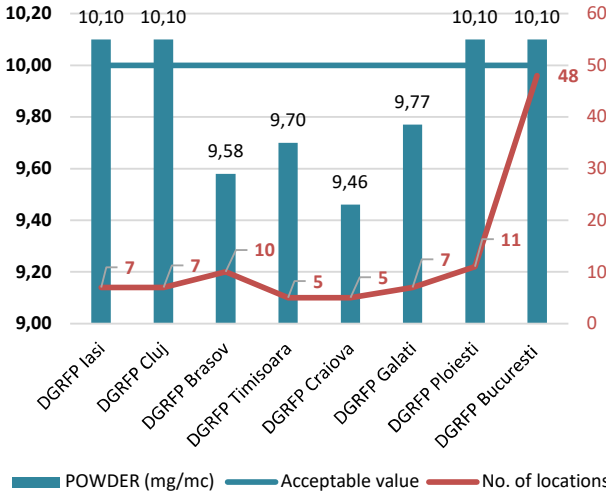


**Fig. 2** Extract of the report on particle inhalable fraction in the air in the locations of National Administration premises

As noticed, for the majority of locations (557 from 617) of the investigated organization from the occupational health perspective concerning the operators' exposure to inhalable particles with no specific effect in the air during the working hours inside the working locations, values are exceeded. The maximum measured value of the mean particles was 10.1 mg/m$^3$ versus the acceptable mean of 10 mg/m$^3$.

In several locations the values were below the limits, but these locations were very few (60 from 617) and did not count more than 10% of the totality.

## 2.3 Ozone concentration

Measurements were implemented in normal conditions of working and functioning of technical equipment.

A portable analyzer Ozon Cole-Parmer Eco Sensors A-21ZX is used in normal working conditions of 480 min (8 hours per day) and short exposure of 15 min.

Measurements are implemented in multiple locations (i.e. 617 working places). In accordance with the national regulations (Government Decision 806/2016 and 53/2021 and the Law 104/2011 concerning the air quality) ozone particles should not exceed the mean of 0.10 mg/m$^3$ during 8 hours, respectively 0.20 mg/m$^3$ for 15 min of exposure. An extract of the reported results is given in table 3 and figure 3. Results for the other locations are similar, in the same range.

*Table 3*

**Risk factor – Ozone concentration**

| Location | Number of working places | Ozone mean [mg/m$^3$] 8 h | Ozone mean [mg/m$^3$] 15 min |
|---|---|---|---|
| Iasi DGESCS | 7 | 0.11 | 0.21 |
| | 1 | 0.11 | 0.21 |
| Prahova DGESCS | 6 | 0.11 | 0.21 |
| | | 0.11 | 0.21 |
| Brasov DGESCS | 3 | 0.11 | 0.21 |
| | 3 | 0.11 | 0.21 |
| | 1 | 0.11 | 0.21 |
| Cluj DGESCS | 2 | 0.11 | 0.21 |
| | 1 | 0.11 | 0.21 |
| Dolj DGESCS | 1 | 0.11 | 0.21 |
| | 1 | 0.11 | 0.21 |
| | 1 | 0.11 | 0.21 |
| Galati DGESCS | 4 | 0.11 | 0.21 |
| | | 0.11 | 021 |
| Galati DGESCS | 4 | 0.04 | 0.05 |
| | | 0.11 | 0.21 |
| Alba DGESCS | 2 | 0.11 | 0.21 |
| Covasna DGESCS | 1 | 011 | 0.21 |
| Mures DGESCS | 1 | 0.11 | 0.21 |
| Sibiu DGESCS DRAF | 1 | 0.11 | 0.21 |
| | 1 | 0.11 | 0.21 |
| | 1 | 0.11 | 0.21 |
| | 1 | 0.04 | 0.1 |
| | 1 | 0.11 | 0.21 |
| | 1 | 0.11 | 0.21 |
| | 1 | 0.11 | 0.21 |
| | 1 | 0.03 | 0.09 |
| Harghita DGESCS | 2 | 0.11 | 0.21 |
| Gorj DGESCS | 4 | 0.11 | 0.21 |
| Gorj DRAF | 4 | 0.02 | 0.19 |

| | | | |
|---|---|---|---|
| | 9 | 0.11 | 0.21 |
| | 10 | 0.06 | 0.12 |
| | 11 | 0.11 | 0.21 |
| Vilcea DGESCS | 3 | 0.11 | 0.21 |
| Mehedinti DGESCS | 4 | 0.11 | 0.21 |
| Olt DGESCS | 2 | 0.11 | 0.21 |
| Vrancea DGESCS | 3 | 0.11 | 0.21 |
| Tulcea DGESCS | 5 | 0.11 | 0.21 |
| Braila DGESCS | 3 | 0.11 | 0.21 |
| Arges DGESCS | 4 | 0.11 | 0.21 |
| Calarasi DGESCS | 2 | 0.11 | 0.21 |
| Buzau DGESCS | 6 | 0.11 | 0.21 |
| Dimbovita DGESCS | 1 | 0.11 | 0.21 |
| Giurgiu DGESCS | 1 | 0.11 | 0.21 |
| | 6 | 0.11 | 0.21 |
| | 2 | 0.11 | 0.21 |
| Constanta DGESCS | 1 | 0.11 | 0.21 |
| Constanta DRAF | 4 | 0.03 | 0.04 |
| | 4 | 0.04 | 0.05 |
| | 4 | 0.11 | 0.21 |
| | 6 | 0.06 | 0.11 |

Based on the measurements in a number of 536 locations from the total of 611 measured, the ozone limit, as legally regulated, is at the limit or slightly exceeded. Both short exposure (15 min) and regular daily exposure (8 hours) are at the limit and slightly over for the majority of locations.

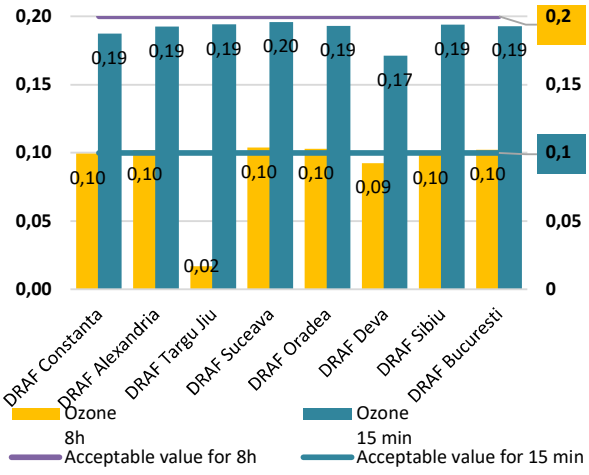


**Fig. 3** Extract of the report on ozone level in the locations of National Administration premises

## 2.4 Carbon monoxide

Measurement of carbon monoxide concentration in natural ventilation conditions are implemented using an Air Particle Counter DT-9881with the measurement field 10÷1000 ppm**.** The report is given in table 4.

*Table 4*

**Risk factor – Carbon monoxide.**

| Location | Number of working places | Carbon monoxide mean [mg/m$^3$] 8 h | Carbon monoxide mean [mg/m$^3$] 15 min |
|---|---|---|---|
| Drivers | 12 | 25 | 119 |

In accordance with the national regulations (Government Decision 806/2016 and 53/2021 and the Law 104/2011 concerning the air quality), the acceptable limits 23 (8 hours), respectively 117 (15 minutes) are exceeded, as seen from table 4, in the case of carbon monoxide, too.

## 2.5 Noise factor

Measurements are implemented in multiple locations (55 locations) in accordance to the standards SR EN ISO 11201:2010 and SR EN ISO 11200:2014 concerning the noise emitted by machines and equipment in normal working conditions (8 hours).

The acceptable limit given by the national regulation (Government decision 601/2007) for working places with special neuropsychological pressure (working with public, financial operations, registration, administrative activities etc.) is set to 60 dBA.

A professional sound-meter EN 300 was used with the field measurement 30…130 dBA, frequency 31.5 Hz…8 KHz and measurement incertitude ± 1.5 dB.

An extract of the results report is given in table 5 and figure 4. For the other locations, results are similar with the values indicated in the table and figure.

The highest registered value was 65.89 dBA exceeding with nearly 10% the acceptable regulated limit of the sound level. For all the investigated locations the maximum level of 60 dBA was exceeded.

*Table 5*

**Risk factor – Noise**

| Location | Number of working places | Daily exposure to noise [dBA] |
|---|---|---|
| Iasi DGESCS | 7 | 64.38 |
| | 1 | 62.32 |
| Prahova DGESCS | 6 | 64.11 |
| Timis DGESCS | 2 | 65.21 |
| | 3 | 63.32 |
| Brasov DGESCS | 3 | 62.45 |
| | 3 | 65.20 |
| Craiova DGESCS | 4 | 65.29 |
| | 2 | 63.56 |
| Cluj DGESCS | 2 | 62.34 |
| Galati DGESCS | 4 | 64.12 |
| Alba DGESCS | 2 | 65.26 |
| Covasna DGESCS | 1 | 62.78 |
| Mures DGESCS | 1 | 63.86 |
| Sibiu DGESCS | 1 | 65.28 |
| Harghita DGESCS | 2 | 62.45 |
| Gorj DGESCS | 4 | 64.15 |
| Râmnicu Vâlcea DGESCS | 1 | 65.29 |
| Turnu Severin DGESCS | 2 | 63.12 |
| Slatina DGESCS | 4 | 62.89 |
| Focsani DGESCS | 3 | 62.37 |
| Tulcea DGESCS | 2 | 63.77 |
| Braila DGESCS | 2 | 63.32 |
| Buzau DGESCS | 3 | 62.11 |
| Constanta DGESCS | 2 | 64.11 |
| Pitesti DGESCS | 1 | 62.43 |
| Calarasi DGESCS | 1 | 65.24 |
| Târgoviste DGESCS | 1 | 63.88 |
| Giurgiu DGESCS | 2 | 64.18 |
| Slobozia DGESCS | 1 | 62.85 |
| Alexandria DGESCS | 1 | 62.90 |
| Bacau DGESCS | 2 | 64.10 |

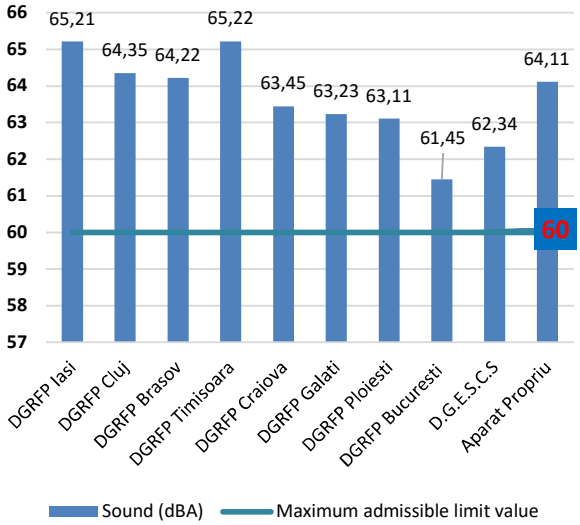


**Fig. 4.** Sound level in measured locations

## 3. MITIGATION MEASURES

Based on these experimental measurements the top management concluded that mitigation measures should be implemented together with a slightly financial compensation allocated to operators under risk working conditions. The financial allocation may be an incentive for staff engagement, but this is not a sustainable measure for operators' health and safety on medium and long term.

### 3.1 Electromagnetic field

Electromagnetic field influence may be decreased with increasing the working distance to at least 20 cm from the functional equipment; in this sense working instructions to mitigate this risk factor are drafted together with operators' attention drawn on. Finally, working instructions appear reliable and with immediate application so as to limit and avoid influence of old-generation equipment until adequate investment may be done.

Certainly, acquisition of new equipment with lower emission are advised, too. Meantime, a preventive maintenance plan for all terminals should be drafted and implemented in line with EU regulations [6]. These measures may ensure medium and long-term improvement of operators' health and safety.

### 3.2 Inhalable fraction of particles

To mitigate the inhalable fraction of particles electronic archive is recommended, appropriate ventilation of the working space, regular professional cleaning, strict rules to avoid mixing in the same space of working with refreshment breaks or eating breaks.

Working instructions should be implemented and monitored in a conscious way so as to ensure hygiene and safe conditions when manipulating dossier / paper, terminals or proceeding the activity with the public / the contributors (citizens).

Finally, the working instructions, part of the management system (internal control management) or quality and health and safety management system, together with their implementation monitoring, ensure an immediate alternative for the management to demonstrate the will to improve the working conditions in line to the regulations.

### 3.3 Noise limitation

For noise mitigation, the discipline working improvement combined with a plan for equipment preventive maintenance, replacement with more safe terminals and working medicine implementation for operators under potential risk are recommended.

Open space, largely used in recent years, may contribute to the noise increase with highly negative influence on working comfort and working productivity, too.

### 3.4 Synergetic mitigation – further research

As measured and reported to the management, all investigated factors exceed the regulated level and the operators are affected with effects on working productivity, but motivation and satisfaction, too.

Unfortunately, these factors, identified in the first iteration of the process, overlap and on the other hand, other potential factors may be revealed. As for all investigated factors regulated levels are exceeded, a more extensive risk assessment [7] is needed so as to foresee the synergetic negative effects of different risk factors on operators' health and safety on long term.

Other environmental factors may be considered such as temperature [8], the ergonomics and the working position influence on the skeletal system, the psychological and social factors in crowded and under public pressure working place and other factors may be identified, too.

## 4. CONCLUSION

Starting from risk factors identification in previous work, the study has implemented measurements of risk factors identified in office activity. Measurements were implemented in nearly all the 600 locations of the National Fiscal Administration. The specific of the office working activity consists of document preparation, databases or digital registers research and registration and all these in conditions of open-space offices, with public exposure, multitasking jobs, time pressure and high responsibility as financial effects occur following the concerned working tasks.

This study may be extended to any office activity such as: administrative, financial, human resources, planning, purchasing operations etc. proceeding in any industrial environment.

Values exceeding the regulation level are found for the majority of the investigated locations for all the factors such as electromagnetic field, particles, ozone, carbon monoxide, noise. The experimental procedure may be extended to any office activity in order to set in place a mitigation plan.

Immediate actions possible to set in place are connected to the discipline working improvement based on working instructions / procedures and adequate implementation monitoring. A plan for equipment preventive maintenance, equipment replacement with more safe terminals and working medicine implementation for operators under potential risk may be adopted with few investments and reliable results.

Considering the organizational culture, open space may be reanalyzed to contribute to working comfort and working productivity, too.

Further research should concentrate on the synergetic effects of different risk factors on health and safety in different working conditions.

## 5. REFERENCES


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## FACTORI DE RISC ȘI SĂNATATEA OCUPAȚIONALĂ ÎN ACTIVITATEA DE BIROU


Lucrarea propune identificarea factorilor de risc ce pot interveni în activități profesionale de birou precum registratură, administrație, financiar, resurse umane, planificare, achiziții ș.a. al căror specific constă în sarcini operaționale cu utilizarea calculatorului și/sau verificarea documentației în format tipărit și/sau digital în registre sau baze de date, pregătirea documentelor, precum și lucrul în birou deschis sau cu numeroase persoane. Au fost identificați factorii de risc, după cum urmează: câmp electromagnetic, pulberi / praf, ozone, monoxid de carbon, zgomot aceștia a fost măsurați utilizând echipamente dedicate în locații multiple. Valorile care au depășit nivelul reglementat au fost raportate și s-a propus un plan de diminuare a riscurilor pentru a compensa sănătatea ocupațională a operatorilor. Uzual, managementul de vârf adoptă o schemă de compensare financiară cu valori mici, dar, pe termen lung, o astfel de opțiune nu este sustenabilă.



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