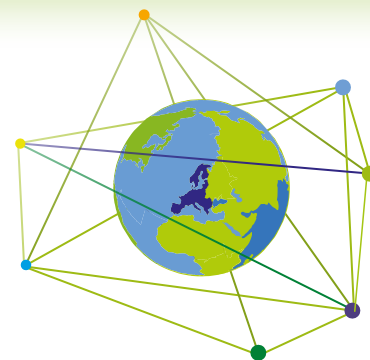


World in transition
Europe in adaptation
OSH under pressure



EUROSHNET – European Occupational Safety and Health Network

Book of Poster Abstracts

PROGRAMME

13 June 2024

8:30 Registration and coffee

10:00 Opening of the conference and welcome address

Daniel Podgórski: Central Institute for Labour Protection – National Research Institute (CIOP-PIB), Poland
Ewa Zielińska: Polish Committee for Standardization, CENELEC

10:20 Session 1. EU OSH and standardization strategies

EU Strategies on OSH and digitalization and their implementation

Maurizio Curtarelli: European Agency for Safety and Health at Work (EU-OSHA)

Standardization strategies of the EU: overview

Mattias Bergdahl: European Commission, DG GROW

11:00 Q&A session

11:10 Coffee break/poster session

11:35 Session 2. Implications of the Machinery, AI and Cyber Resilience Regulations for standardization and market surveillance

The Machinery Regulation and its links with the AI and Cyber Resilience Acts

Frank Wohnsland: VDMA, CEN Sector Forum Machinery, Germany

Challenges for standardization associated with the Machinery Regulation

Catherine Lubineau: Union de Normalisation de la Mécanique (UNM), France

Implications of the Machinery, Cyber Resilience and AI Regulations for market surveillance

Jorge Iriesta: Community of Madrid, Spain

12:35 Q&A session

12:45 Lunch break/poster session

14:15 Session 3. Circular Economy, Green Deal and REACH: challenges and standardization

Waste recycling and extended producer responsibility - Standardisation as an opportunity to enhance occupational risks prevention

Bertrand Delecroix: Institut National de Recherche et de Sécurité (INRS), France

The European Green Deal. A standardization perspective

Jörg Megow: Deutsches Institut für Normung (DIN), Germany

EU Green Deal - climate change implications for OSH

Anna-Maria Teperi: Finnish Institute of Occupational Health (FIOH), Finland

REACH Regulation: revision and implications for OSH

Ruth Jimenez: Instituto Nacional de Seguridad y Salud en el Trabajo (INSST), Spain

15:40 Q&A session

15:50 Coffee break/poster session

16:20 Session 4. Human approach towards new forms of work and OSH management

Managing Work activities in 2040: which challenges for OSH?

Jennifer Clerté: Institut National de Recherche et de Sécurité (INRS), France

Algorithmic management and artificial intelligence to organize workers: psychosocial risks and challenges for standardization

Jorge Martín González: Instituto Nacional de Seguridad y Salud en el Trabajo (INSST), Spain

Human acceptance of technology (example: exoskeletons)

Jean-Jacques Atain Kouadio: Institut National de Recherche et de Sécurité (INRS), France

17:25 Q&A session

17:35 Closing remarks/organizational aspects (End of Day 1)

20:00 Conference Dinner, Restaurant Plac Nowy 1

PROGRAMME

14 June 2024

- 9:00 Session 5. Product design: innovative aspects**
Innovative products and smart solutions
Karin Eufinger: CENTEXBEL, Belgium
OSH and sustainability in global supply chains
Pia Perttula: Finnish Institute of Occupational Health (FIOH), Finland
Examples of innovative smart textile prototypes
Daniela Zavec: TITERA, ITP, Slovenia, Germany
Human factors in smart PPE design, testing and evaluation
Małgorzata Okrasa: Central Institute for Labour Protection – National Research Institute (CIOP-PIB), Poland
- 10:25 Q&A session**
- 10:35 Coffee break/poster session**
- 11:00 Session 6. Current and future challenges in standardization, testing and certification - interactive session**
Round table 1: Standardization system
Ewa Zielińska: Polish Committee for Standardization, CENELEC, Poland
Claes-Mikael Stahl: European Trade Union Confederation (ETUC), Belgium
Normen Günzroth: DIN Media, Germany
Frank Wohnsland: VDMA, CEN Sector Forum Machinery, Germany
Round table 2: Recent developments and needs
Tania Marcos: UNE – Spanish Association for Standardisation, Spain
Henk Vanhoutte: European Safety Federation (ESF), Belgium
Thomas Krügerke: Former chairman of CEN/TC 79, Certification advisor in 425assist, Germany
- 12:30 Final Round**
- 12:45 Closing of the conference/Best Poster Award**
Carita Aschan: Finnish Institute of Occupational Health (FIOH), Finland
- 13:15 Lunch**

Workplaces Digital Transformation: Psychosocial Exposure and Mental Health Trends

Cláudia Fernandes
CATIM - Technological Centre for the Metal Working Industry, Portugal
claudia.fernandes@catim.pt

Digital transformation in workplaces is being pushed by the emergence of new technologies, such as IoT, AI, embedded systems, collaborative and autonomous robotics, cloud computing, online platforms among many others. Algorithmic breakthroughs combined with computing hardware have catalysed us into an era of unprecedented growth and possibilities but also with great ethical and practical challenges concerning the human and digital entities interaction and its impact on workers' health and safety, including workers' psychosocial exposure and mental health. Therefore, it is important to know the main drivers and barriers posed by workplaces digital transformation concerning psychosocial risks exposure and mental health of workers.

Whit this work we intend to review the main drivers and barriers identified in the literature and standards, concerning psychosocial and mental health at work and trends associated with digitalization and standardization and its transposition into practice in working settings.

This study finds that there are mediating roles between psychosocial factors exposure, workers mental health and digital transformation of workplaces. The outcomes pointed are helpful either for future research, or for policymakers, managers, and workers.

Acknowledgments

This research is supported by the ongoing project MissãoINcatim, co-funded by the Programa de Financiamento Base - Missão Interface – from the Plano de Recuperação e Resiliência (PRR), from European Union.



Workplaces Digital Transformation: Psychosocial Exposure and Mental Health Trends

Cláudia Fernandes

claudia.fernandes@catim.pt

CATIM - Technological Centre for the Metal Working Industry, Porto, Portugal

Abstract

Digital transformation in workplaces is being pushed by the emergence of new technologies, such as IoT, AI, embedded systems, collaborative and autonomous robotics, cloud computing, online platforms among many others. Algorithmic breakthroughs combined with computing hardware have catalysed us into an era of unprecedented growth and possibilities but also with great ethical and practical challenges concerning the human and digital entities interaction and its impact on workers' health and safety, including workers' psychosocial exposure and mental health. Therefore, is important to know the main drivers and barriers posed by workplaces digital transformation concerning psychosocial risks exposure and mental health of workers.

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Keywords: Digital Transformation, Mental Health, Psychosocial Risks, OHS Systems, Standards

Advanced
Robotics &
Artificial
Intelligence

Worker
Management
through AI

Smart Digital
Systems

Remote &
Hybrid Work

Digital
Platforms
Work

- Cognitive demands
- Unforeseen situations
- Lack of transparency in algorithms
- Situational awareness
- Task deprivation/cognitive overload
- Deskilling/Upskilling
- Mixed scenarios (old vs new)
- Pace of technological change
- Performance pressure
- Constant oversight
- Privacy "invasion"
- Competencies and skills
- Boundaries – professional vs personal

- Ethical framework for digitalization
- People/processes centered digitalization
- Cybersecurity and Data protection
- Prevention through design – Worker centered design
- Collaboration between different interested parties
- Advanced workplace risk assessments
- Regulatory framework clarification
- Lifelong learning (formal, informal, non-formal)
- Effective OSH services to the digital workplace

Acknowledgments: This research is supported by the ongoing project MissãoINcatim, co-funded by the Programa de Financiamento Base - Missão Interface – from the Plano de Recuperação e Resiliência (PRR), from European Union.



A legislative fresco to collectively understand tomorrow's challenges

Richard Cleveland
EVOLIS, France
rcleveland@evolis.org

World in transition - Change is coming to Europe through regulation

Since 2019, the implementation of the Green Deal has led to a raft of cross-sectoral and sectoral legislative measures aimed at decarbonization and sustainability with an approach based on greater circularity of the economy. This wave of legislation is unprecedented in its scope, speed and objectives, and has created the conditions for a systemic change in Europe.

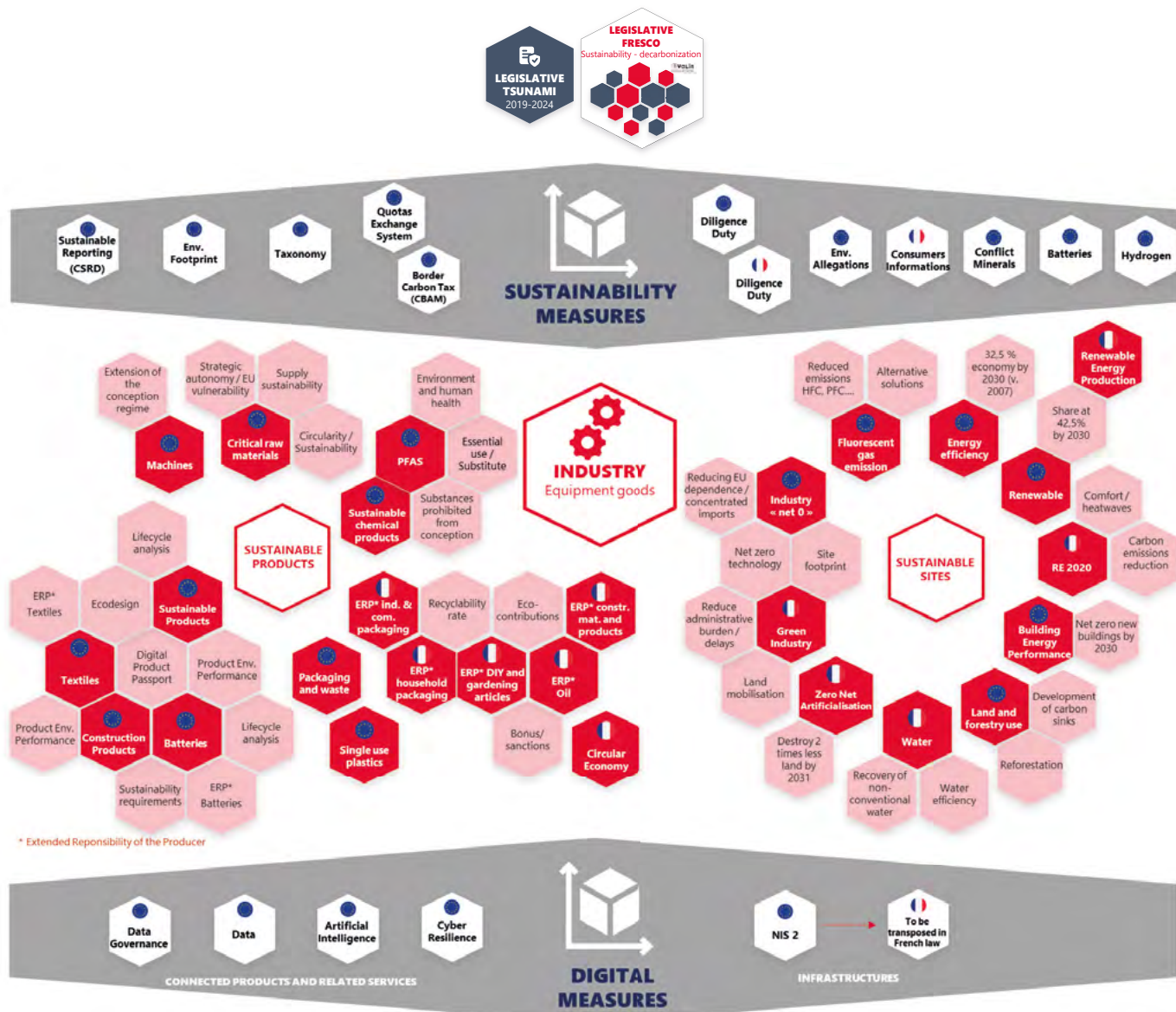
This tsunami has resulted in dozens of new legislative acts, totalling thousands of pages of articles, and the various players (particularly SMEs) are finding it extremely difficult to grasp the subject in its entirety. In this context, how can we move forward collectively, in line with each other, to meet the future challenges?

For this, a legislative fresco has been created aiming at presenting in a factual and visual way the mapping of the texts, identifying the main issues associated with each piece of legislation, and offering a very macroscopic deciphering of them. This jigsaw puzzle, which explores the challenges facing different sectors, particularly the industrial sector of machinery and equipment, is intended to be shared widely, so that we can collectively grasp and anticipate the profound changes that are underway.

Industry Main Legal acts since 2019 and associated challenges

Legislative Fresco

**A tool showing the legislative acts relating to sustainability and decarbonisation
and deciphering the main issues at stake**



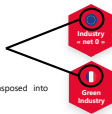
Key:

- Code names**
of legislative or regulatory
themes



➤ **A distinction EU/FR texts**

Note: EU regulations are not transposed into national laws



- **Focus on challenges**
linked to legislative or regulatory texts



Note: The environmental performance of products is a common issue to both the "sustainable products" and "batteries" regulations, whereas the issue of battery recycling is specific to the "batteries" regulation.

Evaluation of the measurement of chemical degradation of polymer protective gloves due to liquid chemicals - metrological aspect

Emilia Irzmańska, Natalia Litwicka, Paulina Kropidłowska, Małgorzata Okrasa
Central Institute for Labour Protection – National Research Institute (CIOP-PIB), Poland
maokr@ciop.lodz.pl

The study of chemical degradation of protective gloves is aimed at normatively confirming the possible adverse change of a minimum, one or more physical-mechanical properties after contact with chemicals for polymeric materials, which are used in chemically resistant protective glove constructions. According to PN-EN ISO 374-4:2020-03, a material in which the above-mentioned changes are observed constitutes an ineffective barrier to penetrating chemicals at the molecular level. This fact can affect the performance of safe work, since the employer, based on, among other things, the results of chemical degradation tests of protective gloves, should determine the conditions of their use and make a decision on their reuse. The method for assessing the measurement of chemical degradation of polymeric protective gloves was prepared and implemented in the quality management system of the CIOP-PIB research laboratory, in accordance with PN-EN ISO/IEC 17025:2018-02. A series of validation tests were conducted for three polymeric materials from protective gloves and disposable medical gloves of dual use. Tests were conducted for two chemicals. The metrological preparation of the test stand for performing measurements in terms of repeatability, reproducibility and identification of measurement errors caused by material inhomogeneity was confirmed on the basis of verification tests.

Acknowledgements

This poster was created (and published)* on the basis of results of a research task carried out within the scope of the 6th stage of the National Programme “Governmental Programme for Improvement of Safety and Working Conditions”, funded by state services of the Ministry of Family, Labour and Social Policy (under the name of the Ministry of Family and Social Policy prior to December 12th 2023). Task no 1.ZS.06 entitled “Method for determining the chemical degradation resistance of polymeric protective gloves, including dual-use medical gloves taking into account the requirements of the European standard PN-EN ISO 374-4:2020-03. The Central Institute for Labour Protection - National Research Institute is the Programme’s main co-ordinator.

Evaluation of the measurement of chemical degradation of polymer protective gloves due to liquid chemicals - metrological aspect

Case study of evaluation of polymeric protective gloves against chemical agents – study results

IRZMAŃSKA E., LITWICKA N., KROPIDŁOWSKA P., OKRASA M.

Central Institute For Labour Protection – National Research Institute
Warsaw 00-701, Czerniakowska 16

INTRODUCTION

The study of the chemical resistance of protective gloves evaluates potential changes in their physical and mechanical properties upon exposure to chemicals. This is crucial for materials used in the manufacture of these gloves, as defined by the standard PN-EN ISO 374-4:2020-03 [1]. Identifying any degradation is vital because a compromised glove can fail to provide an effective barrier against chemicals at the molecular level, posing a risk to safety [2-3]. Therefore, employers must rely on these degradation test results to set appropriate usage conditions and decide whether gloves can be safely reused [4-5].

MATERIALS AND METHOD

Protective glove samples underwent chemical degradation testing following the PN-EN ISO 374-4:2020-03 standard [1]. Samples with a 20 mm diameter were conditioned at $(23 \pm 2 \text{ }^{\circ}\text{C})$ for 24 hours before testing. They were then immersed in 2 ml of 40% sodium hydroxide solution and methanol, contained in inverted glass vials to ensure direct contact with the glove's outer layer. The puncture resistance, a key mechanical parameter, was measured both pre- and post-exposure to the chemicals, with the pre-exposure values serving as a control [2-4]. This testing procedure was applied to three types of polymeric materials used in protective gloves—polyacrylonitrile, butyl, and vinyl—and extended to disposable medical gloves made of polyacrylonitrile.

PROBLEMS

The test stand's metrological setup for ensuring measurement repeatability and reproducibility, as well as identifying errors from material inhomogeneity, has been validated through verification tests.

Notably, over a two-month testing period, rusting on the puncture force test mandrel was noted. This observation underscores the importance of routine inspection and maintenance of test equipment components to guarantee that measurement outcomes remain consistent and reliable over time.

A BENCH FOR DETERMINING RESISTANCE TO CHEMICAL DEGRADATION

Material for testing was sampled from the palm area of the protective glove, ensuring that regions with noticeable thickening or moleting were included [1,3]

The material from the protective glove was maintained in uninterrupted contact with the test chemical in its liquid form for a duration of one hour [1,3]

The mechanical parameter was determined by comparing the puncture force value of the polymeric material prior to chemical contact to the same value post-contact [1,3]

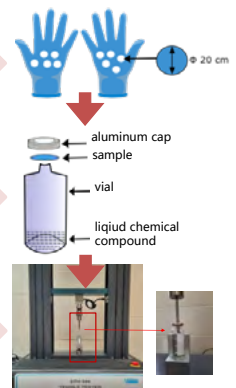


Figure 1. Step-by-Step Procedure for Conducting a Chemical Degradation Assessment in Accordance with PN-EN ISO 374-4:2020-03 [1,3].

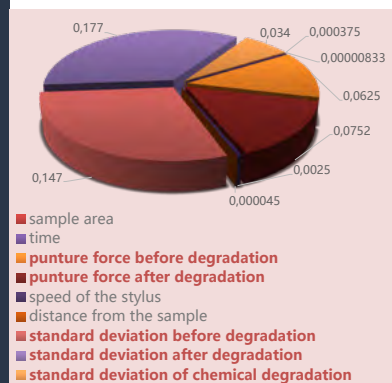
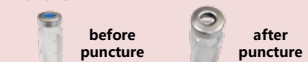


Figure 2. Components of the Uncertainty Budget

1. Non-homogeneous and thick glove materials

For thick materials the sample was not punctured, it fell into the vial – **test failure**



2. Rusting of the puncture stylus

For chemical degradation studies against strong alkalis and acids, needle cores are observed is a minimum of 2 months exposure – **test failure**

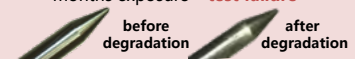


Figure 3. Technical Considerations for Executing a Chemical Degradation Test

RESULTS AND CONCLUSION

The method exhibits high precision within the established limits for repeatability and reproducibility. The most significant contributors to the uncertainty budget are the standard deviation and the value of the puncture force. Extra caution is advised when handling thick or textured samples, as well as when working with strong acids and bases. Additionally, frequent checks of the stylus parameters, such as roughness and angle, are recommended to ensure continued precision.

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Guarantee provision methodology for working in hazardous conditions: a risk-oriented approach

Anel Yensebayeva¹, Inara Sarybayeva²

¹Republican Research Institute for Occupational Safety and Health of the Ministry of Labor and Social Protection of the Population of the Republic of Kazakhstan, Kazakhstan

²Republican Research Institute for Occupational Safety and Health of the Ministry of Labor and Social Protection of the Population of the Republic of Kazakhstan, L.N. Gumilyov Eurasian National University, Kazakhstan
nel1212kz@gmail.com

This article presents a methodology for guarantee provision concerning work conducted in hazardous or risky labor conditions, emphasizing a risk-oriented approach. As workplaces vary significantly in terms of potential hazards and associated risks, implementing effective guarantees becomes imperative to ensure worker safety and mitigate potential liabilities for employers. The proposed methodology integrates risk assessment techniques with tailored guarantee strategies to address specific workplace hazards systematically. By prioritizing risk identification, evaluation, and management, this approach facilitates the development of comprehensive and targeted guarantees tailored to the unique risk profiles of different workplaces. The article discusses the key components of the methodology, including risk assessment frameworks, guarantee formulation strategies, and implementation considerations. Furthermore, case studies and practical examples illustrate the application and effectiveness of the proposed methodology in real-world scenarios. Ultimately, adopting a risk-oriented approach to guarantee provision enhances workplace safety, fosters regulatory compliance, and promotes a culture of proactive risk management within organizations operating in hazardous or dangerous working environments.

Integral Assessment of professional risks: methodology and application

Alimzhan Bekmagambetov

Republican Research Institute for Occupational Safety and Health of the Ministry of Labor and Social Protection
of the Population of the Republic of Kazakhstan, Kazakhstan

bekmagambetov.a@rniiot.kz

The article introduces a methodology for the integrative assessment of professional risks, aiming to provide a comprehensive framework for analyzing and managing workplace hazards. Grounded in a systemic approach, the methodology encompasses the evaluation of diverse factors such as physical, chemical, biological, and psychosocial elements inherent in professional environments. By systematically assessing these factors, the methodology facilitates the identification of critical risk areas, their potential impact on employee well-being and safety, and the formulation of targeted risk management strategies. Through its structured approach, the methodology offers organizations a robust tool to enhance workplace safety protocols, mitigate risks, and promote employee health. The versatility of this methodology makes it applicable across various industries and organizational contexts, enabling tailored risk assessments and interventions. Overall, the integration of this methodology into organizational risk management practices can foster a proactive approach to addressing occupational hazards, ultimately contributing to safer and healthier work environments.

Dynamic occupational risk management during rescue operations

Małgorzata Pęciłło

Central Institute for Labour Protection – National Research Institute (CIOP-PIB), Poland

mapec@ciop.pl

Dynamic risk management is a concept based on a continuous process involving the following elements: (1) hazard identification, (2) assessment of the associated risks, (3) actions to eliminate or reduce the risks and (4) risk monitoring. At first glance, this assessment differs little from the traditional approach to occupational risk assessment. However, it requires continuous analysis of risks as situations and working conditions change. Each such analysis should be treated as a new, separate process, even if it is based on a previously and recently completed risk assessment of the same tasks, e.g. the same rescue operation. It therefore requires the continuous analysis of a huge amount of information. Thus, modern technologies can provide important support for dynamic occupational risk management, especially for emergency services that are forced to operate in unpredictable and rapidly changing conditions. However, all decisions are always made by people and depend on their willingness to accept risk. Decisions about what is risky and what is not are made in real situations and under dynamically changing circumstances and time pressure, mainly using own experience. The poster will present the general principles of dynamic risk management and the factors influencing its effectiveness during rescue operations.

Acknowledgements

Prepared on the basis of the results of the National Programme for the Improvement of Safety and Working Conditions – Phase VI (2023-2025), financed within the scope of the tasks of state services from the funds of the Ministry of Family and Social Policy. Programme Coordinator: Central Institute for Labour Protection - National Research Institute

Studies towards the development of a standard for anthraquinone determination in the workplace air

Małgorzata Szewczyńska, Elżbieta Dobrzyńska, Joanna Kowalska
Central Institute for Labour Protection – National Research Institute (CIOP-PIB), Poland
jokow@ciop.pl

Standardization plays an important role in the economy and is a guarantee of quality in ensuring safety and health in the working environment. Hazardous chemicals are a challenge in this area and occupational exposure assessment requires the development of new methods for their determination.

Anthraquinone, commonly used in the paper and dye industry, is a carcinogenic substance with hazard class „Carc. 1B” according to the Regulation EC No1272/2008. It can affect humans when inhaled.

In Poland, the maximum allowable concentration value for the inhalation fraction of anthraquinone was proposed at 0.5 mg/m³. Therefore, research has been undertaken to develop a method for its determination in the workplace air. It is based on collection of the inhalation fraction onto a glass fiber filter, extraction with dichloromethane and analysis by gas chromatography-mass spectrometry. The method has been validated according to EN 482:2021 for linearity, sensitivity, selectivity, precision and accuracy.

As a result, a draft standard will be created, which, once established by the Polish Committee for Standardization, will become a Polish Standard for air purity protection.

Acknowledgements

This poster was created on the basis of results of a research task carried out within the scope of the 6th stage of the National Programme “Governmental Programme for Improvement of Safety and Working Conditions” funded by the resources of the National Centre for Research and Development - task no. III.PN.02 entitled “Development of 9 new methods for the determination of hazardous chemicals for the assessment of the work environment”. The Central Institute for Labour Protection – National Research Institute is the Programme’s main co-ordinator.

Influence of CO₂ concentration in the environment on the use of filtering respiratory protection

Agnieszka Brochocka, Aleksandra Nowak, Mateusz Wojtkiewicz
Central Institute for Labour Protection – National Research Institute (CIOP-PIB), Poland
agbro@ciop.lodz.pl

The level of carbon dioxide (CO₂) concentration in the environment is a good indicator of the effectiveness of the ventilation system and a good measure of the quality of air inside buildings where a significant number of people work. People produce CO₂ when breathing, which increases the value in rooms, and everyone produces about 20L of CO₂/h. The CO₂ reference value of 0.1% is considered the minimum hygienic level ensuring comfort and safety. Exceeding this value may lead to discomfort, loss of concentration, drowsiness, headache and other symptoms.

A good fit and the appropriate type of half-masks can help minimize the impact of changes in CO₂ concentration on the comfort of use. The impact of changes in the CO₂ content in the environment on the comfort of use of half-masks is important because in conditions of extreme air humidity, half-masks fit better and the time of their safe use is shortened. If the CO₂ concentration is <0.5%, it is recommended to use a filtering half-mask, above 0.5% it is necessary to use other RPD.

Preliminary research highlights the importance of taking care of air quality in workplaces and using appropriate RPD measures to ensure the comfort and safety of users.

Acknowledgements

This poster was created on the basis of results of a research task carried out within the scope of the 6th stage of the National Programme “Governmental Programme for Improvement of Safety and Working Conditions”, funded by state services of the Ministry of Family, Labour and Social Policy (under the name of the Ministry of Family and Social Policy prior to December 12th, 2023). The Central Institute for Labour Protection – National Research Institute is the Programme’s main co-ordinator.

INFLUENCE OF CO₂ CONCENTRATION IN THE ENVIRONMENT ON THE USE OF FILTERING RESPIRATORY PROTECTION

Agnieszka Brochocka¹, Aleksandra Nowak¹, Mateusz Wojtkiewicz¹

¹Central Institute for Labour Protection – National Research Institute (CIOP-PIB)
Department of Personal Protective Equipment, Laboratory of Respiratory Protective Devices
Poland

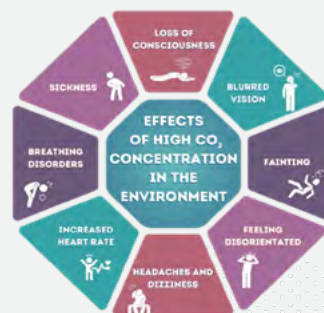


Introduction

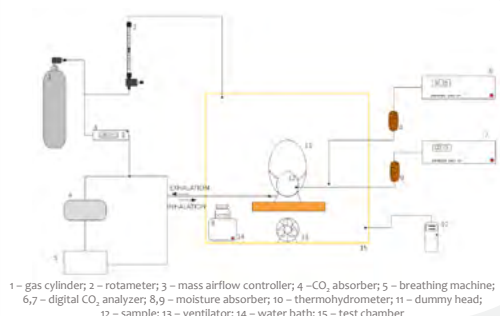
Carbon dioxide (CO₂) is a greenhouse gas, invisible and imperceptible to human senses, and because it is heavier than air, it tends to accumulate in the lower layers of the atmosphere, where it leads to oxygen deficiency. The systematic increase in CO₂ concentration in the atmosphere (including as a result of industrial emissions) contributes to global climate warming, but the high concentration of this gas in workplaces is also a problem. The level of CO₂ concentration in the environment is a good indicator of the effectiveness of the ventilation system and a good measure of the quality of air inside buildings where a significant number of people work. People produce CO₂ when breathing, which increases the value in rooms, and everyone produces about 20L of CO₂/h. The CO₂ reference value of 0.1% is considered the minimum hygienic level ensuring comfort and safety. Exceeding this value may lead to discomfort, loss of concentration and other symptoms.

CO₂ concentration in workplaces can vary and depends on many factors, including the type of activity, production processes, ventilation level, number of employees and other environmental factors. Measurements taken in school and university rooms reached up to 0.7% by vol. Increased CO₂ concentrations may also occur in areas of the economy such as the chemical, metallurgical, food and agricultural industries, but also in construction and offices.

Laboratory of CIOP-PIB investigated the impact of changes in CO₂ concentration on the comfort of using filtering half masks of various designs.



Methods



Increased CO₂ concentration in the environment can double the time required to safely use a filtering half-mask

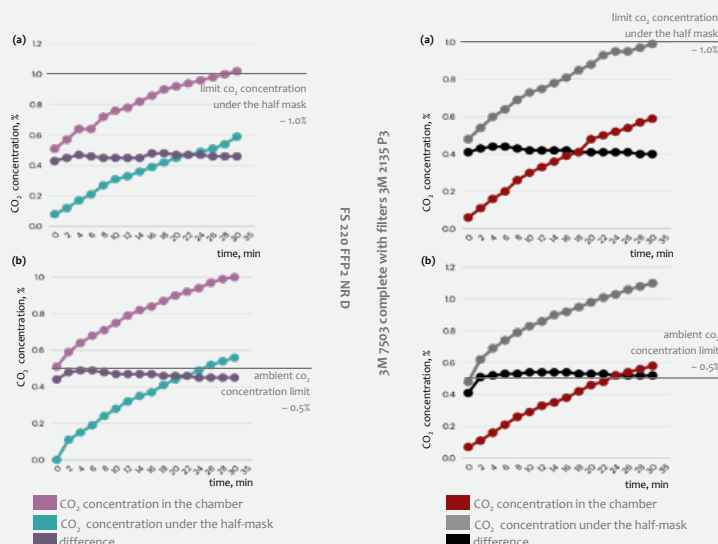
- 01 In order to minimize the impact of CO₂ growth on the comfort of using the filter seal, you should choose the appropriate half-mask model and provided its good fit to the face.
- 02 The need to regularly control and replace the filter half-mask due to the potentially dangerous "dead space" formed under the facial part.
- 03 In high humidity conditions, the time of safe use of filtering half-mask is shortened.
- 04 Taking care of air quality in workplaces and the use of appropriate respiratory protection measures is of great importance to ensure the comfort and safety of employees.

Results

The charts show exemplary test results for a filtering half-mask and a rubber half-mask complete with filters. The increase in the content of CO₂ concentration under the facial part of the half-mask is constant and proportional to the increase in CO₂ concentration in the environment.

The influence of an increase in ambient CO₂ concentration on the CO₂ concentration under the face part of filtering half masks was examined:

(a) high humidity conditions (T=22.0°C, Rh=100%), (b) ambient conditions (T=24.4°C, Rh=67.8%)



Conclusions

ENVIRONMENTAL CONDITIONS

increased air humidity affects the fit of the half-mask to the head model (especially a rubber half-mask, where higher air humidity results in better adhesion of the material from which the half-mask body is made) and on the safe use of the half-mask.

FIT OF THE FILTERING HALF-MASK

ensures low CO₂ concentration values under the face part, which is associated with greater comfort of using the half mask and work safety during professional activities.

SAFE USE TIME

it has been shown that in conditions of high CO₂ concentration in the work environment, the safe use of filtering half masks is short.

The effectiveness of disinfection and its impact on the protective parameters of filtering half masks

Krzysztof Makowski, Małgorzata Gołofit-Szymczak, Jacek Kubica, Andrzej Pawlak
Central Institute for Labor Protection – National Research Institute (CIOP-PIB), Poland
krmak@ciop.lodz.pl

The outbreak of the COVID-19 pandemic resulted in a significant part of society being forced to use filtering half masks repeatedly at work and in everyday life. Hygienic negligence committed by users during repeated use of half masks resulted in the multiplication of microorganisms in the filtering material which were inhaled when half masks were reused. As a result, this could lead to the development of viral, bacterial and fungal infections.

Therefore, it was deemed advisable to undertake research related to the disinfection of filtering half-masks. It was checked how the most popular disinfectants affect the protective and functional parameters of filtering half masks. Microbiological purity tests were carried out for new half masks and confirming the effectiveness of the proposed disinfection methods after using filtering half masks. Based on the test results, it was found that the use of the proposed methods of disinfection of the tested half masks does not result in the loss of their protective and functional properties. Therefore, the safety of using half masks and providing protection at the required level was confirmed. It has been shown that the most effective method of disinfection and maintenance of filtering respiratory protective devices is ozonation.

Acknowledgements

This poster was created on the basis of results of a research task carried out within the scope of the 6th stage of the National Programme “Governmental Programme for Improvement of Safety and Working Conditions”, funded by state services of the Ministry of Family, Labour and Social Policy (under the name of the Ministry of Family and Social Policy prior to December 12th, 2023). The Central Institute for Labour Protection – National Research Institute is the Programme’s main co-ordinator.

THE EFFECTIVENESS OF DISINFECTION AND ITS IMPACT ON THE PROTECTIVE PARAMETERS OF FILTERING HALF MASKS

Krzysztof Makowski¹

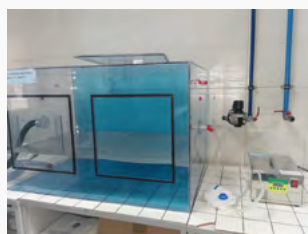
Aleksandra Nowak¹
Małgorzata Golofit-Szymczak²
Jacek Kubica³
Andrzej Pawlak³

Central Institute for Labour Protection – National Research Institute
1 Department of Personal Protective Equipment,
2 Department of Chemical, Biological and Aerosol Hazards,
3 Department of Physical Hazards
Poland

INTRODUCTION

In the spread of harmful biological agents in the environment, the air-dust and air-droplet routes are of greatest epidemiological importance. Therefore, the most important role in protection against such threats is played by respiratory protective equipment, including filtering half masks. Negligence in the hygienic, repeated use of filtering half masks resulted in the multiplication of microorganisms in the filter material, which were inhaled by users when the equipment was reused. As a result, this could lead to the development of viral, bacterial and fungal infections. Therefore, it was considered advisable to address the topic of disinfection of filtering half masks. It was checked how the most popular disinfectants affect the protective and functional parameters of filtering half masks.

TEST EQUIPMENT



Chamber for chemical disinfection of filtering half masks with ozonator



Chamber for physical disinfection of filtering half masks - UV-C radiation

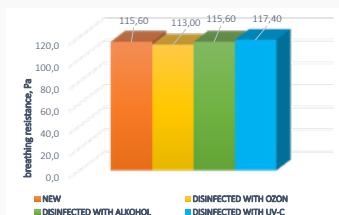
TESTED SAMPLES



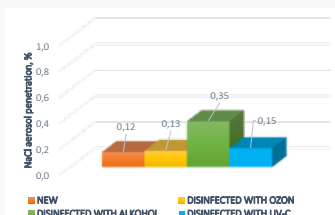
SCOPE OF WORK

As part of the scope of work carried out, a chamber for chemical disinfection of filtering half masks was designed and built, shown in the first drawing from the left, and a chamber for physical disinfection using UV radiation sources was purchased. 10 types of filtering half masks in protection classes FFP2 and FFP3 with different designs were selected for testing. Then, laboratory tests were carried out on the resistance to selected disinfectants (UV radiation, 70% ethyl alcohol and ozone) and the basic protective parameters (breathing resistance, penetration with NaCl aerosol and paraffin oil mist) of filtering half masks. Microbiological purity tests were carried out according to the EN 14683 standard, confirming the effectiveness of the proposed disinfection methods after using filtering half masks. Microbiological purity tests of new filtering half masks were also carried out.

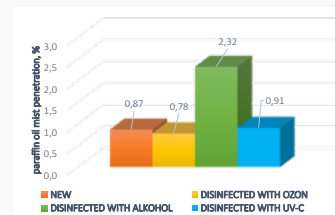
DISINFECTION EFFECT ON FILTERING HALF MASKS PROTECTION PARAMETERS



The effect of disinfection on breathing resistance of FFP2 filtering half masks

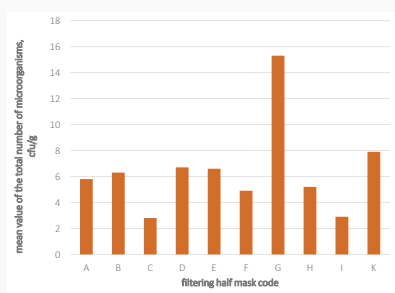


The effect of disinfection on NaCl aerosol penetration of FFP3 filtering half masks

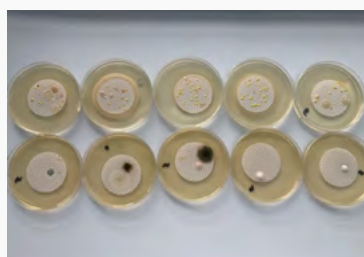


The effect of disinfection on paraffin oil mist penetration of FFP2 filtering half masks

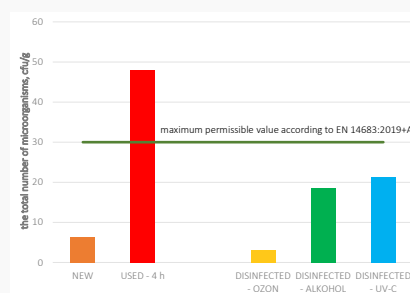
MICROBIOLOGICAL PURITY AND EFFECT OF DISINFECTION



Results of biological purity of tested new filtering half masks.
Average value of the total number of microorganisms – colony-forming units/gram (cfu/g)



Growth of colonies of bacteria, molds and yeasts on the filters – example



The total number of microorganisms cfu/g (colony-forming unit per gram) - bacteria, molds and yeasts in the filtering half mask – new, used and after disinfection. Medium values for tested half masks are presented on the graph.

CONCLUSIONS

- The use of disinfection on tested filtering respiratory protection devices does not result in the loss of its protective and functional properties, which ensures the safety of its use after carrying out disinfection procedures with ozone, alcohol or UV-C.
- The statistical analysis carried out confirmed the repeatability of the disinfection methods. It was found that all new filtering half masks met the requirements of the EN 14683:2019+AC standard for Type I, Type II and Type IIR medical masks and can also be safely used in healthcare.
- It has been shown that the most beneficial method of disinfecting filtering respiratory protective devices is ozonation.
- A 70% solution based on ethyl alcohol, which is an easily available and leading disinfectant available on the market, also has good antimicrobial activity.
- Physical disinfection using UV-C radiation was the least effective.

ACKNOWLEDGMENTS

This poster was created on the basis of results of a research task carried out within the scope of the 6th stage of the National Programme "Governmental Programme for Improvement of Safety and Working Conditions", funded by state services of the Ministry of Family, Labour and Social Policy (under the name of the Ministry of Family and Social Policy prior to December 12th, 2023).

contact information:

Krzysztof Makowski
e-mail: krmak@ciop.lodz.pl
phone: (+48) 42 648 02 27

Innovative technical solutions in the field of respiratory protection

Oliwia Owczarek, Agnieszka Brochocka, Krzysztof Makowski, Aleksandra Nowak, Mateusz Wojtkiewicz
Central Institute for Labour Protection – National Research Institute (CIOP-PIB), Poland
olowc@ciop.lodz.pl

The volatile chemical and dust substances in the work and living environment contribute to the loss of people's health and life. Innovative solutions have been developed to improve respiratory protection.

A half-mask was created to protect against all pollutants contained in smog. The innovation was the development of a technology for producing filtering-sorption material using the melt-blown method and developing a method of introducing a carbon sorbent into the filtering material except for high temperature zones at the stage of its production.

In the case of gas-filters completed with masks or half-masks, the period of safe use is not precisely specified. In order to determine the time of use, a real-time monitoring system was developed for the consumption of the gas-filter against ammonia vapors. The system consisting of a sensor with a chemosensitive layer and an electronic device helps determine the protective effect of the gas-filter by measuring the concentration of ammonia vapors.

The „Size 4 Face” mobile application was created to support the correct adjustment of half-masks to the individual dimensions of the user's face. This is a tool that helps users of respiratory protection equipment and occupational health and safety services in correct selection of half masks.

Acknowledgements

This poster is published and based on the results of a research task carried out within the scope of the 5th stage of the National Programme “Improvement of Safety and Working Conditions”, supported from the resources of the National Centre for Research and Development and supported within the scope of state services by the Ministry of Family and Social Policy. The Central Institute for Labour Protection – National Research Institute is the Programme's main co-ordinator.

INNOVATIVE TECHNICAL SOLUTIONS IN THE FIELD OF RESPIRATORY PROTECTION

Autors: Eng. Oliwia Owczarek, PhD(Eng.)D.Sc.(Eng.) Agnieszka Brochocka, M.Sc. Krzysztof Makowski, M.Sc.(Eng.) Aleksandra Nowak, Eng. Mateusz Wojtkiewicz

Institution: Central Institute for Labour Protection- National Research Institute, Department of Personal Protective Equipment Poland

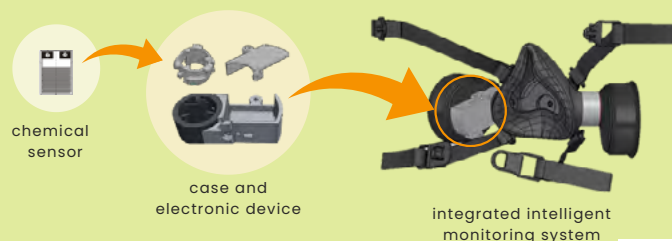
INTRODUCTION

New inhalation hazards arise with the development of industry and technology. Many of them are not yet identified. Health consequences may occur many years after exposure to inhalation hazards. The hazards occur in the air in the form of vapors and gases, as well as liquid and solid particles.

Innovative techniques have been developed to improve the quality and effectiveness of respiratory protection.

AN INTELLIGENT SYSTEM TO MONITOR THE CONSUMPTION OF THE GAS FILTERS IN REAL TIME

The main objective: informing the user about the consumption of the gas filter before smelling ammonia.



The most important quality:

- the sensitivity of the sensor to **ammonia vapor is 1 ppm**,
- connection via Bluetooth to a mobile device,
- dedicated application,
- reusable,
- for use with a facepiece with one or two gas filters,
- alarm systems – sound and light,
- the design does not affect the comfort of use.

How to use?

Assembling equipment with a consumption monitoring system.

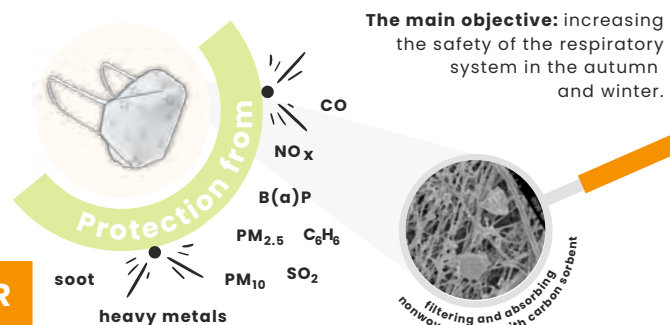
Connecting the monitoring system to the mobile device and setting a safe limit value.

Starting to work in an environment contaminated with ammonia vapors.

Exceeding the limit value, triggering an audible and visual alarm on the monitoring device and in the mobile application.

Leaving the contaminated environment and replacing the gas filters with new ones.

ANTI-SMOG HALF MASK



The most important quality of the anti-smog half mask:

- **filtering and absorbing properties** – use of carbon sorbent,
- **visible after dark** – outer layer has a fluorescent pattern,
- resistance at the first protection class (FFP1) – up to 210 Pa,
- aerosol filtration at the third protection class (FFP3) – **filtration efficiency 99%**,
- total inward leakage at the second protection class (FFP2),
- protection time **against cyclohexane vapors** for up to 2h at a test substance concentration of 81 ppm,
- protection time **against benzene vapors** for up to 1h at a test substance concentration of 1 ppm,
- protection time **against sulfur dioxide vapors** for up to 8h at a test substance concentration of 5 ppm,
- protection time **against toluene vapors** for up to 8h at a test substance concentration of 24.6 ppm.

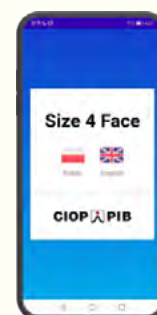
MOBILE APPLICATION "SIZE 4 FACE"

The main objective: making it easier for users to adjust facepieces to their face dimensions.

The application is used to quickly recognize the size of a human head based on its anthropometric facial dimensions. Based on the face photo, the application assigns the head size according to 5 specific sizes in ISO standards: small, short/wide, medium, long/narrow, large.

The quality of the mobile application:

- use of the ARCore tool,
- use of the front camera,
- **application algorithm created based on the ISO ISO/TS 16976-2:2015 and ISO 16900-5:2016 standards,**
- 91% correct recognition of face size in accordance with anthropometric measurements,
- 95% correct selection of the equipment ensuring a fit to the face.



ACKNOWLEDGMENTS

This paper is published and based on the results of a research task carried out within the scope of the 5th stage of the National Programme "Improvement of safety and working conditions" supported from the resources of the National Centre for Research and Development and supported within the scope of state services by the Ministry of Family and Social Policy. The Central Institute for Labour Protection – National Research Institute is the Programme's main co-ordinator.

contact information:
Agnieszka Brochocka
e-mail: agbro@ciop.lodz.pl

Enhancing Safety in AI-Based Applications in Machinery: A Comprehensive Risk Assessment Approach

Stefan Voß, Silvia Vock, Franziska Wolny
Federal Institute for Occupational Safety and Health (BAuA), Germany
voss.stefan@baua.bund.de

AI-based applications are increasingly prevalent in various industries, including machinery and work equipment, where they have the potential to influence safety. They can either replace traditional safety functions or improve the safety of applications lacking adequate risk mitigation measures, particularly in dynamic and flexible environments such as robotics and safety zone monitoring. We aim to ensure the safe integration of AI into safety-critical functions by addressing risk assessment through quantitative and qualitative metrics along the AI lifecycle. This comprehensive assessment considers AI properties like robustness, accuracy, explainability, uncertainty, and runtime behavior, which are crucial in assembling a safety case to demonstrate their contribution to the required safety level. To validate our assessment methods, we test AI models trained on real-world safety-critical data. Our focus includes assessing various AI properties, particularly robustness testing and runtime monitoring. Our poster aims at providing an overview of AI risk assessment elements, insights into developed methods, and application examples.

BEST POSTER AWARD CERTIFICATE

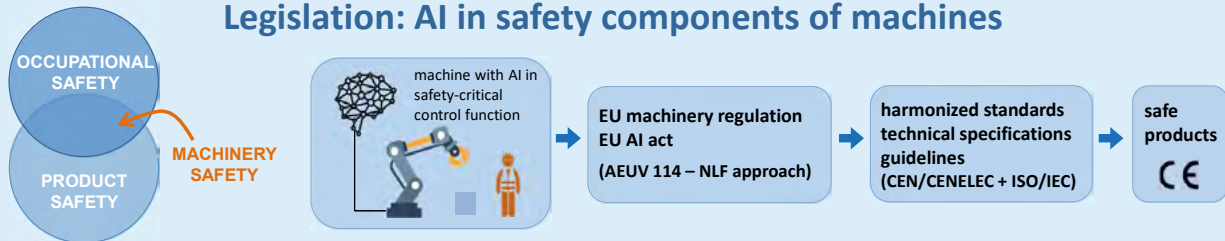


Enhancing Safety in AI-Based Applications in Machinery

A Comprehensive Risk Assessment Approach

Stefan Voß, Silvia Vock, Franziska Wolny
BAuA - Federal Institute for Occupational Safety and Health, Dresden, Germany

Legislation: AI in safety components of machines



machinery regulation:

safety components with fully or partially self-evolving behavior using machine learning approaches ensuring safety functions
↓
third-party conformity assessment procedure required

AI act:

AI system intended to be used as a safety component AND required to undergo a third-party conformity assessment
↓
high risk, special requirements, e.g.
- Implementation of **risk management** system
- Appropriate level of **accuracy, robustness and cybersecurity**
- Consistent performance in those respects throughout **lifecycle**

Probability of occurrence: important component of risk analysis



32 x 32 pixel, RGB in 256 gradations each

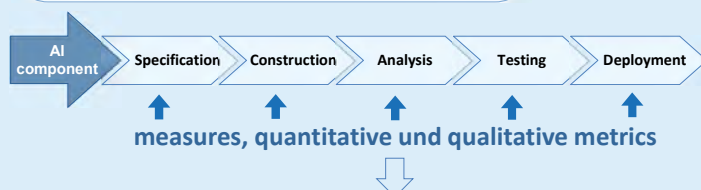
$$n = 256^{(3 \times 32 \times 32)}$$

Number of possible combinations: $\sim 10^{7400}$
Number of atoms in the universe: $\sim 10^{85}$

→ Impossible to test all possibilities
→ **Probabilities of occurrence cannot be determined conventionally**

Resulting questions:

- How can the **risk assessment** of an AI System be performed?
- Which qualitative and quantitative performance **metrics** can be used?
- How can safety **threshold values** be defined?
- How can safety be ensured throughout the systems **lifecycle**?



- e.g.
- Explainability methods
 - Robustness: training and metrics
 - Uncertainty estimation
 - Data augmentation strategies
 - Test data generation

Selected topics are explored by BAuA AI junior research group

basis for risk assessment, e.g. via structured argument in assurance case

Testing measures and metrics on data from real industrial scenarios

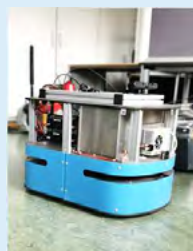
BAuA cooperations with universities, institutes & companies:



Reversing monitoring of construction machines: person detection



Autonomous guided vehicles in factory logistics: person and object detection



Person detection in collaborative human-robot interaction



Time series for anomaly detection in robotic applications



Machine tools: hand detection in safety zones, condition monitoring (e.g. kickback)



Selected Publications:

Siedel, G.; Shao, W.; Vock, S. & Morozov, A.: *Investigating the Corruption Robustness of Image Classifiers with Random p-norm Corruptions*, In Proceedings of the 19th International Joint Conference on Computer Vision, VISAPP, Rome, Italy, Vol. 2, pp. 171-181, **2024**
Siedel, G.; Vock, S.; Morozov, A. & Voß, S.: *Utilizing Class Separation Distance for the Evaluation of Corruption Robustness of Machine Learning Classifiers*, In Proceedings of ICAI-ECAI-22 Workshop on Artificial Intelligence Safety (AISafety), Vienna, Austria, **2022**
Siedel, G.; Voß, S. & Vock, S.: *An overview of the research landscape in the field of safe machine learning*, In Proceedings of ASME International Mechanical Engineering Congress and Exposition, Vol. 85697, p. V013T1-4A045, **2021**
Ding, S.; Morozov, A.; Vock, S.; Weyrich, M.; & Janschek, K.: *Model-based error detection for industrial automation systems using LSTM networks*. In Proceedings of IMBSA 7th International Symposium, Lisbon, Portugal, pp. 212-226, **2020**

Research on health and safety at work www.baua.de

Contact | Dir. u. Prof. Dr. Stefan Voß | Federal Institute for Occupational Safety and Health (BAuA),
Fabricstr. 8, 01099 Dresden, Germany | E-Mail: fb2.6@baua.bund.de Internet: www.baua.de

baa:
Federal Institute for Occupational
Safety and Health

A Preliminary Study on Temporal Auditory Threshold Shifts Resulting from Exposure to Ultrasonic Noise

Jan Radosz

Central Institute for Labour Protection – National Research Institute (CIOP-PIB), Poland

jarad@ciop.pl

Airborne ultrasound is commonly used in various industrial and public settings, often emanating unintentionally from multiple sources. The International Radiation Protection Association (IRPA) in 1984 provided provisional guidelines to limit exposure based on earlier research from the 1970s and 1980s. However, these studies often lack independent validation, and recent analyses highlight significant discrepancies in the historical measurement techniques, affecting the comparability of findings.

This pilot study investigates the auditory impacts of ultrasonic noise exposure using pure tone audiometry (PTA). It aims to identify temporal shifts in hearing thresholds (TTS) pre- and post-exposure. The study included 20 participants exposed to noises from an ultrasonic cleaner and welder, with their audible components filtered out. The results indicated significant bilateral threshold shifts at 8 kHz and 16 kHz, with no significant difference in the impact between the two noise sources. These findings suggest that both types of ultrasonic equipment can similarly affect auditory function.

Acknowledgements

This poster was created on the basis of results of a research task carried out within the scope of the 6th stage of the National Programme “Governmental Programme for Improvement of Safety and Working Conditions”, funded by state services of the Ministry of Family, Labour and Social Policy (under the name of the Ministry of Family and Social Policy prior to December 12th, 2023), task no. 3.ZS.01 entitled “Revision of permissible ultrasonic noise values in the workplace”. The Central Institute for Labour Protection – National Research Institute is the Programme’s main coordinator.



CENTRAL INSTITUTE FOR LABOUR PROTECTION
National Research Institute

A PILOT STUDY ON TEMPORAL HEARING THRESHOLD SHIFTS DUE TO ULTRASONIC NOISE EXPOSURE

Jan RADOSZ

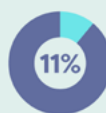
Department of Physical Hazards

ABSTRACT

Airborne ultrasound is used in various industrial and public applications and is often produced unintentionally

In 1984, the International Radiation Protection Association (IRPA) recommended limits on human exposure to airborne ultrasound, based on research from the 1970s and 1980s. However, many studies from that era lack independent validation, and discrepancies in measurement methods hinder comparisons.

This study investigates the effects of ultrasonic noise on hearing, using pure tone audiometry (PTA) to measure temporary hearing threshold shifts (TTS) from exposure. Hearing thresholds were tested before and after exposure at frequencies from 1 to 16 kHz in 20 participants (10 women and 10 men, aged 23-38). The study used ultrasonic signals from an ultrasonic washer and welder, filtering out the 'audible' noise components. Results showed significant hearing threshold differences at 8 kHz (3.8 dB for the washer, 2 dB for the welder) and 16 kHz (5.8 dB for the washer, 3.5 dB for the welder). Despite smaller differences with the welder, statistical analysis found no significant impact difference between the two noise sources.



Hearing Loss

On average, 11% of the population of the European Union, Norway, Switzerland, and UK, or 59 million people, will self-report hearing loss. Among the population of 65+ year-olds, this proportion rises to 20.7%.

MATERIAL AND RESEARCH METHODS

Participants

Twenty participants (10 women, 10 men, aged 23-38) were selected based on criteria excluding significant hearing impairments, chronic ear conditions, head injuries, or medications affecting auditory function.

Ultrasonic Noise Sources

The study used ultrasonic signals from an ultrasonic washer and welder. These were captured in an industrial setting and replicated in a lab, filtering out 'audible' noise components to focus on ultrasonic frequencies.

Equipment

- **Pure Tone Audiometry (PTA):** Interacoustics AD629 audiometer and Sennheiser HDA 200 headphones.
- **Noise Generation and Measurement:** RME Babyface PRO FS audio interface, DPA 4007 microphone, Scan Speak Revelator R2904/700009 loudspeakers, and Lab Gruppen LAB300 amplifier.
- **Exposure Setup:** A test stand with loudspeakers controlled exposure time and sound pressure levels.

Procedure

Hearing thresholds were measured using PTA before and after exposure to ultrasonic noise across 1-16 kHz. Participants were exposed for a set duration, with levels not exceeding permissible exposure values for an 8-hour workday. Post-exposure thresholds were reassessed with the same PTA method.

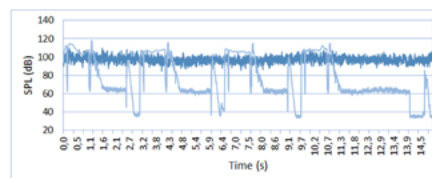


Figure 1: Time history of test signals

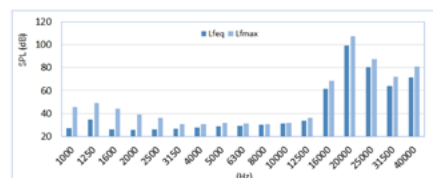


Figure 2: Sound pressure levels at the test stand

OBJECTIVES

The main objective of this study was to assess the impact of ultrasonic noise exposure on auditory function. Using pure tone audiometry (PTA), the study aimed to examine temporal shifts in hearing thresholds (TTS) caused by exposure to ultrasonic noise from industrial sources.

The secondary objective was to provide background information to support the revision of the International Radiation Protection Association (IRPA) guidelines on human exposure to airborne ultrasound.



DATA PRESENTATION

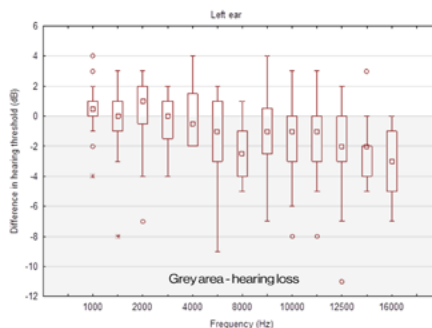


Figure 3: Difference in hearing threshold ΔHL before and after exposure to ultrasound from the ultra-sonic cleaner for left ear.

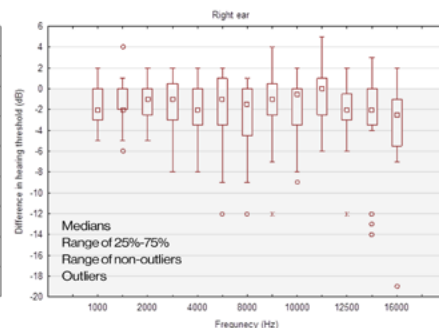


Figure 4: Difference in hearing threshold ΔHL before and after exposure to ultrasound from the ultra-sonic cleaner for right ear.

CONCLUSIONS

Significant Hearing Threshold Shifts: The study demonstrated statistically significant changes in hearing thresholds at 8 kHz and 16 kHz frequencies for both ears following exposure to ultrasonic noise. The average threshold shifts were up to 2.5 dB at 8 kHz and 3.5 dB at 16 kHz for the left ear, and 1.5 dB at 8 kHz and 2.5 dB at 16 kHz for the right ear. While both the ultrasonic cleaner and welder caused shifts in hearing thresholds, the ultrasonic cleaner had a more pronounced effect. Despite smaller differences in pre- and post-exposure hearing thresholds for the ultrasonic welder, statistical analysis found no significant disparity in terms of the impact of the noise source type.

Comparison with Previous Studies: These findings contradict earlier studies from the 1960s, which suggested no TTS due to ultrasonic exposure. However, they align with more recent studies indicating that exposure to ultrasonic noise leads to poorer hearing thresholds compared to exposure to audible noise alone at similar sound pressure levels.

Nonlinear Effects and Subharmonics: The results suggest that ultrasonic exposure induces nonlinear effects in the ear, generating subharmonic frequencies that affect hearing sensitivity within the audible range.

Need for Updated Guidelines: The study underscores the necessity for updated safety protocols and health regulations in workplaces utilizing ultrasonic devices. It may be imperative to revise current standards, including those by the International Radiation Protection Association (IRPA), to include safety measures against the impacts of ultrasonic noise on hearing.

Future Research: Further research is needed to explore the long-term consequences of ultrasonic noise exposure, the potential for recovery from hearing sensitivity shifts, and the cumulative effect of repeated exposure. Comprehensive laboratory and field studies are required to reevaluate acceptable levels of ultrasonic noise in workplaces.

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- J. Radosz and D. Pleban, *Ultrasound measurements in the work environment*, The Journal of the Acoustical Society of America, vol. 143, no. 3, Supplement, p. 1864, Mar. 2018

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The Central Institute for Labour Protection – National Research Institute is the Programme's main co-ordinator.

A Systematic Review and Evaluation of Measurement Tools for Health Culture in Knowledge-Based Enterprises

Agata Basińska-Zych
WSB Merito University in Poznan, Poland
agata.basinska-zych@poznan.merito.pl

The study addresses the importance of fostering a „culture of health” within knowledge-based enterprises, integral to the knowledge economy’s dynamics. It aims to analyze existing tools for measuring health culture in enterprises, particularly their applicability to knowledge-based contexts. A systematic literature review of SCOPUS - 894 and PUBMED - 172 databases was undertaken for articles that devoted to the concept of the culture of health, its components and utilized measurement tools to measure worksite health environment and culture. These tools were evaluated by further searching of the literature to assess: reliability; validity; responsiveness; length; use in cross-cultural settings; health environment assessment, health culture elements assessment; subject; clarity and cost. Of 1066 abstracts that were screened, 35 articles were extracted, from which 19 scales were selected and assessed. Notably, the Workplace Culture of Health Scale (COH) stands out for its comprehensive assessment capability and reliability. However, adaptation to the specificities of knowledge enterprises is deemed necessary. To address this, qualitative research via focused group interviews with experts from various sectors within knowledge-based enterprises (e.g. IT, banking, e-commerce, pharmaceutical, biotechnology, high-tech, and academic institutions) is proposed. This approach aims to refine COH and enhance its relevance and effectiveness in assessing health culture within knowledge-based enterprises.

Acknowledgments

This research was financed by the National Science Centre Poland as project titled „The role of organizational culture as a factor determining the effectiveness of health promotion in knowledge based enterprises” (2021 - 2023).

A Systematic Review and Evaluation of Measurement Tools for Health Culture in Knowledge-Based Enterprises

Agata Basińska-Zych

WSB MERITO University in Poznań, Department of Finance and Economics, Poznań, Poland

Introduction

- Workplace health culture can play a pivotal role in employee well-being^{1,2}.
- OECD nad Eurostat data show that workers spend approx. 36h per week are spent at work on average³.
- Companies that achieve the highest profits in the world are characterized by employees who demonstrate low-risk health behaviors, have a low incidence of chronic disease and are low cost employees⁴.
- The research pertains to the global trends of the knowledge-based economy, where a significant portion comprises enterprises, also referred to as intelligent or learning organizations⁵.
- Their distinctive features include a crucial capital in the form of knowledge workers and a diverse, ever-changing work environment, such as in distributed conditions, often within virtual, hybrid teams and on-site.
- The COVID-19 pandemic has underscored the importance of employees' needs in shaping health and well-being in enterprises.
- The primary objective of the research was to analyze and evaluate existing tools for measuring health culture in enterprises, particularly their applicability to knowledge-based contexts in Poland.

Methods

- The research methodology (fig. 2) in the initial stage was based on a systematic literature review in two areas:
 - 1) research findings dedicated to the concept of health culture and its components,
 - 2) a review and assessment of the utility of health culture measurement scales for the specific context of knowledge enterprises in Poland (fig. 1).
- Out of 1066 screened abstracts from the SCOPUS and PUBMED databases, 35 articles were selected for review, leading to the assessment of 19 scales/tools.

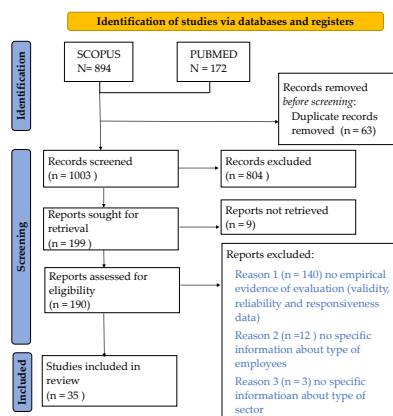


Fig 1. Prisma flow diagram of study selection. Source: own elaboration.

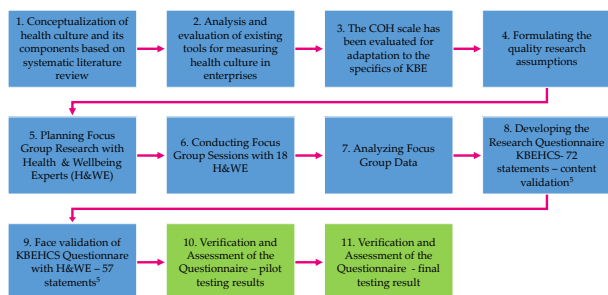


Fig 2. Flow diagram of research process.

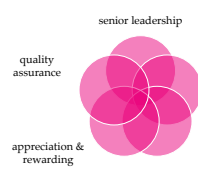
Source: own elaboration.

Comments: Stages completed marked in blue, planned stages marked in green.

Results

- Subsequently, based on a review of prior research and evaluation, 19 scales for measuring workplace health culture were identified, evaluated and compared.
- These tools were evaluated by examining their reliability, validity, responsiveness, length, cross-cultural applicability, health environment and culture assessments, subject of study, clarity, and cost.
- As a result, elements of **workplace health environment** and **workplace culture of health** were identified and characterised (fig. 3).

WORKPLACE ENVIRONMENT OF HEALTH



WORKPLACE CULTURE OF HEALTH

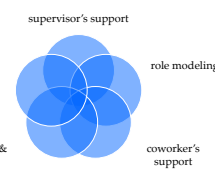


Fig 3. Workplace environment and workplace culture of health framework. Source: own elaboration adapted from Kwon et al. 2015.

- Scales that did not account for: 1) the employee's individual perspective, 2) cultural factors, or 3) lacked fully validated data were excluded from further investigation.
- The scales varied in the degree to which they allow for examining the health culture of the workplace; at the same time, they had different definitions of the elements of health culture⁶.
- The review conducted suggests that among the research instruments presented, those most valuable are those enabling a **multi-faceted assessment of health culture, characterized by high reliability and validity coefficients, and capable of determining the developmental level of organizational health culture.**
- Scoring of each criterion was used in conjunction with colour-coding (green for 'high applicability', yellow for 'average applicability' or red for 'low applicability'), to assist with an overall assessment of each tool, and ready identification of any weaknesses and strengths on the selected tool properties.
- Only one scale meets these stringent criteria. **The Workplace Culture of Health Scale (COH) proposed by Kwon, Marzec & Edington** emerged as particularly noteworthy for its comprehensive assessment capabilities and reliability (average applicability).

Conclusion

- As a result of a systematic literature review, 19 tools/scales for measuring health culture in enterprises were identified and evaluated for their applicability to knowledge-based enterprises in Poland.
- Following the evaluation of the usefulness of these tools, one - **Workplace Culture of Health Scale (COH)** requires updating and adaptation to the specific functioning of knowledge-based enterprises (fig. 4).
- However, adaptation to the specificities of knowledge enterprises is deemed necessary.
- To address this, qualitative research via focused group interviews with experts from various sectors within knowledge-based enterprises (e.g. IT, banking, e-commerce, pharmaceutical, biotechnology, high-tech, and academic institutions) is proposed.
- This approach aims to refine COH and enhance its relevance and effectiveness in assessing health culture within knowledge-based enterprises.
- The tool can also be instrumental in identifying 1) gaps between offered resources and their availability, 2) assessing factors that can enhance the efficacy of health promotion initiatives, and 3) diagnosing existing barriers in the working environment to improve employee health



Fig 4. Factors influencing the functioning of knowledge enterprises. Source: own elaboration.

References

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Agata Basińska-Zych, PhD

Email: agata.basinska-zych@poznan.merito.pl



Finnish Institute of
Occupational Health



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