

PEROSH 2023 5th RESEARCH CONFERENCE STOCKHOLM

Book of Abstracts



6-8 September 2023, Stockholm, Sweden

ABF-huset, Cirkeln
Sveavägen 41, Stockholm, Sweden

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INTRODUCTION

PEROSH, the Partnership for European Research in Occupational Safety and Health, organises bi-annual research conferences, exclusively for its members since 2015. The main objectives of these conferences are to allow both early-stage and experienced researchers to share their latest findings with colleagues from the other PEROSH institutes and to give opportunities for networking and a platform for potential collaborations for international research projects.

The first conference took place in Warsaw, Poland in 2015, followed by a second conference in Sankt Augustin, Germany in 2017. The third one was held in Copenhagen, Denmark in 2019 and the fourth in Madrid, Spain in 2021. On 6-8 September 2023, we are organising PEROSH 2023, in Stockholm at the occasion of the PEROSH 20th anniversary with a record attendance: 160 people registered with a record number of abstracts, 70. It is noticeable that early-stage researchers are important contributors, they submitted 27 abstracts.

We are also pleased to announce that to celebrate the PEROSH 20th anniversary, guests from various institutions involved in OSH joined us, former directors, national stakeholders, representatives of ILO, EU OSHA and the European Commission.

We warmly thank our kind host, SAWEE which took up the challenge of organizing such an event.

The conference has three parallel sessions on the following themes:

1. **Work organization and OSH**

Following the pandemic, but also based on preexisting trends, various changes have impacted work organizations (telework, hybrid work, increased use of digital tools, new types of companies). Many researchers try to understand the effects of these mutations which may result in new risks, especially psychosocial ones, but also offer new opportunities to promote health and safety in diverse groups throughout working life (self-employed, migrants, gender-related)

2. **OSH questions and new techniques for exposure and hazard identification**

Within PEROSH, there is substantial activity dedicated to the development of new techniques for exposure assessment and hazard identification for chemical, biological, physical risks and also for combined exposure (for instance chemical/physical activity). Other research is related to the development of effective interventions and improved prevention measures, sometimes borrowed from other fields such as environmental health. Some of these new methods from instrumentation to statistics lead to significant improvements.

3. **Anticipating future questions**

The workplace is being affected by a significant number of technological innovations (artificial intelligence, virtual reality, cobots, exoskeletons) which rise new challenges for



occupational safety and health but also may offer opportunities. Additional evolution is foreseen related to the transition to a greener economy or the effect of climate change (Net Zero and consequences, circular economy).

In this book of abstracts, one can find the final program and all names and contributions of the speakers.

We invite you all to enjoy the conference and the networking.

[Louis Laurent](#)

Chair PEROSH Steering Committee

[Margrethe Schønning](#)

Chair PEROSH Scientific Steering Group

[Jan Michiel Meeuwssen](#)

PEROSH Manager International Affairs



WELCOME

A good work environment is central to social and economic sustainability in society where not only individuals thrive and develop but also companies are prosperous and competitive. If employees feel good in their workplaces, they perform better. Workplaces that work consciously to develop their work environment reduce risk of ill-health and thus the negative consequences for those affected, as well as the costs for society and companies.

Knowledge of the nature of the work environment, its challenges and opportunities need to be constantly developed. It needs to cover important areas such as occupational health and risks in the workplace, but also how to work with factors that promote health, wellbeing and efficiency in the workplace. Workplaces of Europe must be environments where employees and managers feel greater well-being at the end of the working day. This requires the emergence of a new culture and a new way of thinking, which, in addition to risks and challenges, sees opportunities, health factors and what is salutogenic in the work environment. It is now obvious that many issues that have hitherto been the subject of national working life and work environment policies today extend beyond the nation state. The world is, always has been and will remain a closed and interconnected system, whether we like it or not. The well-being and concerns of other workplaces, other industries, other countries, and other people are part of our daily lives.

To my opinion, this is where PEROSH can and will play a crucial role, not least, by connecting OSH researchers throughout Europe, facilitating their research, and disseminating their results. We at the Swedish Agency for Work Environment Expertise (SAWEE) are very happy to host this fifth PEROSH scientific conference. This is a very special event, as it coincides with the PEROSH twentieth anniversary and also with our own agency's 5th anniversary. Therefore, we organize a major event over three days, in the presence of our stakeholders. I do hope that this conference which encompasses a wide variety of research activities will be the occasion of fruitful exchanges.

The Swedish Agency for Work Environment Expertise (SAWEE) is a government agency under the Ministry of Employment, which was established on June 1st 2018. Commissioned by the Swedish government SAWEE collects, compiles and spreads existing research-based knowledge about working life and work-environment, but also carries out research under its own auspices, evaluate, and analyses effects of implemented reforms and government initiatives. SAWEE is also in charge of developing expertise and competencies within occupational health care agencies. SAWEE joined PEROSH on the 1st of January 2020 and has been since an active member.

Professor Dr. Nader Ahmadi
Director-General, SAWEE



Swedish Agency for Work
Environment Expertise



PROGRAM

PEROSH 2023 – 5th Research Conference & Anniversary Event Stockholm

Venue: ABF-huset, Cirkeln

Sveavägen 41, Stockholm, Sweden

The names in red are of those competing for the early-stage researcher award

September 6th 2023 Anniversary event

13:00-13:10	Welcome by Nader Ahmadi, Director of SAWEE
13:10-13:20	Welcome by the Swedish Minister for Gender Equality and Deputy Minister for Employment, Mrs. Paulina Brandberg
13:20-13:30	'PEROSH today' by PEROSH chair, Louis Laurent, scientific director INRS, France
13:30-14:00	Keynote 1: 20 years of PEROSH , Frank Pot, first chair of PEROSH, former director of TNO Work and Employment, The Netherlands
14:00-14:10	Address from Stefan Olsson, Deputy Director-General, Directorate-General for Employment, Social Affairs and Inclusion
14:10-14:40	Keynote 2: PEROSH; an effective regional network , Claude Donald Loiselle, ILO
14:40-15:10	Keynote 3: Injecting OSH-research into policy and practice , Ole Henning Sørensen, Ph.D. Chief Consultant, NFA, Denmark
15:10-15:40	Break
15:40-17:30	Networking at the PEROSH gallery of impact; researchers are present to explain their results and impacts broadcasted on a gallery of flat screens
20:00	Networking Dinner Venue: Mr French, Tullhus 2, Stockholm

September 7th 2023 Research Conference

08:30-09:00	Registration
	Moderator of the day: Sten Haage
09:00-09:10	Welcome by Nader Ahmadi, Director of SAWEE
09:10-09:20	Welcome by Martin Andreasson, Swedish State Secretary for Gender Equality and Employment
09:20-09:30	Welcome by Margrethe Schøning, Chair of the Scientific Steering Group
09:30-10:00	Keynote 1: Characteristics of trustworthy Artificial Intelligence , Dietmar Reinert, Director Institute for Occupational Safety and Health of the German Social Accident Insurance, Germany
10:00-10:30	Keynote 2: Work environment and gender equality in the green and digital industrial transition. How to navigate between utopia and dystopia? , Lena Abrahamsson, Professor in Human Work Science and Scientific Leader of Creaternity, Luleå University of Technology, Sweden
10:30-11:00	Coffee and tea break

11:00-13:00	Work Organisation and OSH	OSH questions & Techniques (biological risk)	Anticipating future questions
	<i>Chair: Andrew Curran</i>	<i>Chair: Peter Paszkiewicz</i>	<i>Chair: Diana Gagliardi</i>
	Worker job satisfaction and perceived work-related stress. How did this change over the COVID-19 pandemic? <i>David Fishwick (HSE)</i>	Viruses as harmful contaminants in occupational environment <i>Agata Stobnicka-Kupiec (CIOP-PIB)</i>	The German Social Accident Insurance's Risk Observatory: Future trends and their impact on OSH <i>Angelika Hauke, Eva Flaspöler (IFA)</i>
	Trends in mental health complaints of Dutch young workers and potential causes <i>Malte van Veen (TNO)</i>	Bioaerosol exposure in waste sorting plants in Norway <i>Pål Graff (STAMI)</i>	Buildings of the future. What challenges for OSH? <i>Marc Malenfer (INRS)</i>
	Office design and medically certified sickness absence: Mediating and moderating roles of work interruptions and job control <i>Randi Hovden Borge (STAMI)</i>	Our waste – their disease? The airborne virus exposure of wastewater treatment plant <i>Anna Jacobsen Lauvås (STAMI)</i>	The use of virtual reality to simulate the work of high-power robots on a construction site <i>Andrzej Grabowski (CIOP-PIB)</i>
	Growth of healthy and good work in the Swedish business sector until the COVID-19 pandemic & Learning at work, alongside the number of OSH areas, explains the company OSH management <i>Annette Nylund (SAWEE)</i>	On the opportunities and challenges for taking into account poly-exposures to chemical and biological agents in prevention: teaching from some examples in the food processing and waste treatment industries in France <i>Philippe Duquenne, Patricia Battais (INRS)</i>	Toward measuring sustainability transitions at working life – Results from a novel survey of wage earners' perceptions <i>Fanni Moilanen (FIOH)</i>

11:00-13:00	Work Organisation and OSH <i>Chair: Andrew Curran</i>	OSH questions & Techniques (biological risk) <i>Chair: Peter Paszkiewicz</i>	Anticipating future questions <i>Chair: Diana Gagliardi</i>
	Work less, feel better? Evidence on working time changes and wellbeing in Germany <i>Johanna Nold (BAuA)</i>	Closing data gaps on natural toxins effect on human health: Immunotoxic effects of Alternaria toxins using reporter cell lines and a co-culture lung exposure model <i>Solveig Krapf (STAMI)</i>	Artificial Intelligence for Occupational Health and Safety: Prospects and Challenges to 2035 - A prospective study <i>Jennifer Clerté (INRS)</i>
	Inhalativ Heroin exposure of workers at supervised drug consumption facilities in Germany <i>Daniel Köster (IFA)</i>	A COVID-19 outbreak in a large meat processing plant in England: transmission risk factors and controls <i>Yiqun Chen (HSE)</i>	Prevention-through-design for risk anticipation in nano and advanced materials production <i>Fabio Boccuni (INAIL)</i>
	Hybrid working toolbox: The development of a toolbox to support organizations in Hybrid working <i>Carlijn Brouwer (TNO)</i>	Determination of proteins in air – New specific marker of airborne exposure in the food industry <i>Christine Darbakk (STAMI)</i>	Influence of clothing adjustment value (CAV) index on the heat load <i>Joanna Orysiak (CIOP-PIB)</i>
	A literature review: Managing occupational safety and health, meanings of company size and work organization <i>Maria Johansson (SAWEE)</i>		Study of fabric's sun protective properties <i>Silvia Torres (INSST)</i>

13:00-14:00	Buffet Lunch
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14:00-16:00	Work Organisation and OSH <i>Chair: Noortje Wiezer</i>	OSH questions & Techniques (chemical risk) <i>Chair: Agnès Aublet-Cuvelier</i>	Anticipating future questions <i>Chair: Mary Trainor</i>
	Conditions for working remotely from home <i>Johan Stenmark (SAWEE)</i>	Canister sampling of ethylene oxide - validation of a new sampling and measurement method and first field measurements in working areas <i>Benedikt Thomas (IFA)</i>	Contemporary Gloves Protection <i>Natalia Litwicka (CIOP-PIB)</i>
	In response to climate and environmental emergencies, do mission-based companies improve workers' well-being or enhance conflicts amongst workers? <i>Vincent Grosjean (INRS)</i>	Occupational Oral Exposure: Data and Knowledge Base for Assessment and Modelling <i>Marlene Dietz (BAuA)</i>	Diffusion of responsibility in adaptive human-robot interaction and system transparency <i>Susanne Niehaus (BAuA)</i>
	Work: a tailored intervention program for prevention of work stress <i>Luuk Bouwens (TNO)</i>	Development of an in vitro human liver model as a New Approach Methodology for hepatotoxicity assessment <i>Graciela Lopez Soop (STAMI)</i>	Impact of back supporting exoskeletons on kinematics and joint loading of the lower body during gait <i>Omar El-Edrissi (IFA)</i>

14:00-16:00	Work Organisation and OSH <i>Chair: Noortje Wiezer</i>	OSH questions & Techniques (chemical risk) <i>Chair: Agnès Aublet-Cuvelier</i>	Anticipating future questions <i>Chair: Mary Trainor</i>
	Psychological contracts in platform work - The nature of "fair deal" in diverse control structures <i>Jere Immonen (FIOH)</i>	A reference material for non-volatile PAHs – development, production and analysis <i>Julia Linke (IFA)</i>	Influence of the characteristics of active back-support exoskeletons on muscle activity during a lifting task <i>Mathilde Schwartz (INRS)</i>
	Psychosocial risks at digital platform work: Main factors related to stress in Spain <i>Jorge Martín González (INSST)</i>	How occupational safety benefits from digitization - OMEGA one <i>Manuel Kühn (IFA)</i>	The impact of new technological developments on various aspects of work for Dutch employees <i>Liza van Dam (TNO)</i>
	Night Work in Cold Environment <i>Phong Chau (STAMI)</i>	Targeted cadmium species analysis in blood for occupational exposure evaluation: a feasibility study <i>Mathieu Melczer (INRS)</i>	Building awareness of safe work during additive manufacturing <i>Elżbieta Dobrzyńska (CIOP-PIB)</i>
	Mechanistic evidence for shiftwork-mediated cardiovascular disease: a systematic review <i>Mrinal Kumar Das (STAMI)</i>	Design and characterisation of a methodology for spatio-temporal mapping of exposures at the workplace <i>Narech Houessou (INRS)</i>	Risk assessment of safety-critical AI-applications in work equipment <i>Stefan Voss (BAuA)</i>
	Low back pain among eldercare workers: What is the occupational physical activity Sweet-Spot? <i>Stavros Kyriakidis (NFA)</i>	Metabolic disruptions following gestational exposure to organophosphorus flame retardants using blood biochemistry and fatty acids profiles <i>Sarah Valentino (INRS)</i>	Prevention of slip, trip and fall accidents using machine learning <i>Moritz Schneider (IFA)</i>
16:00-16:30	Break		
16:30-17:00	Keynote 3: Advanced techniques for hazard and exposure assessments in occupational health , by Sophie Ndaw, Head of toxicology department INRS, France		
17:00-17:30	Keynote 4: Discovering Safety Program, the world risk poll , Ruth Boumphrey, Chief Executive of Lloyd's Register Foundation		
19:00	Dinner for invited stakeholders and PEROSH Steering Committee members		

September 8th 2023 Research Conference

08:30-10:30	Work Organisation and OSH <i>Chair: Dietmar Reinert</i>	OSH questions & Techniques (dust, fibres and particles) <i>Chair: Paulien Bongers</i>	Anticipating future questions <i>Chair: Steffen Bohni</i>
	Joint contribution of psychosocial and mechanical work factors on medically certified sick leave due to musculoskeletal or common mental disorders in home care employees <i>Rigmor Knutsen (STAMI)</i>	Development of high-volume personal aerosol samplers <i>Hendrik Sakowsky (IFA)</i>	Potentials of Artificial Intelligence for Occupational Safety Risk Analysis <i>Martin Westhoven (BAuA)</i>
	How to promote mental health at social and health care workplaces <i>Risto Nikunlaakso (FIOH)</i>	XRD and Rietveld Refinement - are we missing out by focusing on one component? <i>Johanne Ø. Halvorsen (STAMI)</i>	OSH questions & Techniques (chemical risk) <i>Chair: Steffen Bohni</i> Guidance for the quantification of substance-specific exposure-risk relationships after exposure to carcinogenic hazardous substances at the workplace <i>Dirk Pallapies (IFA)</i>
	OSH questions & Techniques <i>Chair: Dietmar Reinert</i> Advances in noise control - sonic crystals as acoustic barriers <i>Jan Radosz (CIOP-PIB)</i>	Biomonitoring for respirable crystalline silica in UK workers: the determination of Si-containing particles in exhaled breath condensate using single particle inductively coupled mass spectrometry <i>Jackie Morton (HSE)</i>	Improving Occupational Safety and Health when Working with Diisocyanates <i>Chloé Charlotte Schröder (BAuA), Kristina Witzler (IFA)</i>
	Going forward in prevention of job-related skin cancer – Collecting knowledge on occupational UV-exposure <i>Sandra Breuer (IFA)</i>	Technical developments to support on-site workplace measurements for respirable crystalline silica using portable Fourier transform infrared instruments <i>Peter Stacey (HSE)</i>	Validation of measurement methods and their uncertainty especially for gases and vapours <i>Kristina Witzler (IFA)</i>
	Improving the Understanding of Low Frequency Magnetic Field Exposure with Augmented Reality <i>Christian Werner (IFA)</i>	Novel sampling and real-time measurement of workplace silica exposures. <i>Michael Hemingway (HSE)</i>	“MUST” – A tool for the determination of measurement uncertainty and more <i>Cornelia Wippich (IFA)</i>

08:30-10:30	OSH questions & Techniques <i>Chair: Dietmar Reinert</i>	OSH questions & Techniques (dust, fibres and particles) <i>Chair: Paulien Bongers</i>	OSH questions & Techniques (chemical risk) <i>Chair: Steffen Bohni</i>
	Estimating hazards of pulling-in zones in transportation process of flexible foils on roller in foil machines. - Literature research and conception of a measurement <i>Matthias Clermont (IFA)</i>	Measurements of airborne asbestos fibres during abatement of asbestos containing materials <i>Torunn Ervik (STAMI)</i>	Occupational Exposure to Organotin Substances: Speciation of 11 Organotin Compounds in Workplace Air Samples via HPLC-ICP-MS <i>Carina Cläsgens (IFA)</i>
	New ASSIST-IoT approach for a real-time risk assessment and management concerning UV light exposure at the construction site <i>Małgorzata Okrasa (CIOP-PIB)</i>	Occupational exposure to airborne micro- and nanoplastics <i>Øyvind Pernell Haugen (STAMI)</i>	Understanding the mechanisms of inflammatory responses of titanium dioxide nanoparticle exposure using an ALI inhalation model <i>Susann Wolf (STAMI)</i>
	Inflammation in firefighters <i>Joanna Orysiak (CIOP-PIB)</i>	Long-term occupational exposure to PM10 and respiratory health of Parisian subway workers <i>Romain Freund (Unisanté)</i>	

10:30-11:00	Coffee and tea break
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	Moderator of the day: Sten Haage
11:00-11:30	Keynote 5: Smart sensors for a healthy and safe working environment , by Eelco Kuijpers, TNO, The Netherlands
11:30-12:00	Keynote 6: Thriving Together: The Importance of Leadership in Creating a Culture of Well-Being, Health and Learning for Sustainable Competence Supply Management , by Andreas Wallo, Senior Associate Professor in Education at the Department of Behavioural Sciences and Learning at Linköping University, Sweden
12:00-12:15	Announcement winner of the early-stage researcher award
12:15-12:30	Conclusion and closing of the conference

KEYNOTE SPEAKERS



Frank Pot

frank.pot@ardan.demon.nl

TNO innovation
for life

Radboud Universiteit



Bio sketch

Emeritus professor of Social Innovation of Work and Employment, Radboud University Nijmegen, honorary advisor of the European Workplace Innovation Network, former director of TNO Work and Employment, first chair of PEROSH and former professor by special appointment of Work and Technology, Leiden University.

“20 years of PEROSH”

PEROSH emerged from the global Sheffield Group of directors. The purpose of the Sheffield Group was to keep each other informed about programmes and policy positions of the institutes and to stimulate occasional collaboration. The personal contacts turned out to be very helpful for this. At the end of the nineties the idea grew that the institutes representing EU member states should collaborate more closely. In 2003 it was decided to create PEROSH.

The 12 founding members were AMI, Denmark; NIWL, Sweden; BIA (of HVBG), Germany; BAuA, Germany; HSL, United Kingdom; INRS, France; INSHT, Spain; ISPEL, Italy; Prevent, Belgium; STAMI, Norway; FIOH, Finland and TNO Arbeid, The Netherlands. All countries except Norway were members of the EU at the time. Norway could become a member of PEROSH because of its association with the EU through its membership of the European Economic Area (EEA). Institutes of the Sheffield Group in European countries that were not members of the EU at the time (CIOP-PIB, Poland; MKK, Hungary; VÚBP, Czech Republic) could not be part of the agreement. They had to wait until the enlargement of the EU in 2004.

The members agreed to co-operate in order:

- To create an appropriate EU network of OSH institutes to facilitate:
 - Collaboration on EU research and development projects and programmes.
 - Promotion of knowledge transfer between institutes.
- To avoid inappropriate and expensive duplication of effort by the sharing of results.
- To act as an expert forum in the development of ideas in support of EU and national policies.

In the period that followed, names of institutes changed, sometimes an institute was closed (NIWL, Sweden in 2006) or left the network (MKK, Hungary; VÚBP, Czech Republic), and new members were added (Unisanté, Switzerland in 2019; SAWEE, Sweden in 2020).

Cooperation has intensified over the years, as has involvement in EU strategies. The joint activities were promoted at many conferences, including PEROSH’s own research conferences and the biennial conferences on wellbeing at work.

The PEROSH institutes are ready to individually and collectively contribute to knowledge and policies for the digital and green transitions to ensure that they lead to a healthier, longer and more productive working life.



Claude Donald Loiselle

ILO HQ Geneva
loiselle@ilo.org



Bio sketch

Mr Loiselle is a senior official with the International Labour Organization in Geneva. He cumulates a vast experience of OSH development work at the international level, primarily in less economically advanced countries. Beyond modernizing and managing ILO OSH knowledge and information assets since taking duty as Coordinator of CIS a decade ago, he has notably led a global survey on the functioning of OSH knowledge agencies, institutions, and organizations, and studied existing regional cooperation in OSH with a view of proposing an innovative ILO support strategy and programme. He's currently leading ILO policy work in strategic OSH workforce planning and development, while also developing large-scale partnership-based initiatives to enhance OSH research and educational capacities in low- and middle-income countries.

"PEROSH; an effective regional network"

The ILO engaged the overdue modernization of its international networking practices in OSH some years ago with a view of enhancing international collaboration with and among OSH knowledge agencies, institutions, and organizations (AIO) worldwide. The intention was to identify priority needs to inform the formulation of new and better suited support strategies, programmes, and projects for advancing prevention globally. The initial goals were to understand how OSH research is organized thru a global survey and understand how and why OSH knowledge AIO collaborate internationally. A multiple case-study analysis of regional OSH networks was undertaken, including PEROSH. The overall process and results provided data and knowledge for use by a vast diversity of stakeholders, networks, and development partners. PEROSH is of inspiration for ILO efforts in addressing capacity gaps in OSH research and development in other parts of the world as it meets key conditions identified for successful collaboration.



Ole Henning Sørensen

NFA
ohs@nfa.dk



Det Nationale Forskningscenter
for Arbejdsmiljø



Bio sketch

Dr. Ole Henning Sørensen, Ph.D, is chief consultant at Denmark's National Research Centre for the Working Environment (NFA). As the main architect, he spearheaded NFA's strategic project to develop an instrument to measure institution-level societal impact in 2020. In 2022, he co-created a new method to evaluate NFA's societal impact through high-level decision makers. He has extensive research experience in various sectors such as industry, waste collection, consultancy, call centres, public administration and pre-schools. In addition, he has facilitated workplace development in over 100 public workplaces as an OSH consultant.

“Injecting OSH-research into policy and practice”

PEROSH institutes are tasked with conducting applied research and development to improve health and safety. Injecting research outcomes into policy and practice to achieve societal impact is, therefore, an essential activity. The presentation illustrates how institutional impact capacity can be strengthened by presenting useful impact frameworks, illustrating typical impact pathways, and explaining how impact activities can be initiated and evaluated. The presenter will inspire new ways forward for PEROSH institutes to inject OSH research into policy and practice, securing a safe, health-promoting, and sustainable working life.





Dietmar Reinert

IFA/DGUV
dietmar.reinert@dguv.de



Bio sketch

Dietmar Reinert got his PhD in molecular physics in 1987 at Bonn University. He is professor of computer science at University of Applied Sciences Bonn-Rhein-Sieg since 2003. Since 2013 he is director of the Institute for OSH of the German Social Accident Insurance. He was PEROSH president between 2015 and 2018.

“Characteristics of trustworthy artificial intelligence”

Artificial intelligence (AI) is currently on everyone's lips. A rough distinction is made between weak and strong AI. Using examples, the presentation shows that strong AI is currently still a utopia, but that weak AI is also very important for safety and health at work. It is not only deep neural networks that can be used, but also different machine learning tools, depending on the problem. The particular difficulties in the use of neural networks are discussed. The golden rule can help to obtain an initial assessment of the AI used. Trustworthy AI focuses on the weak points of machine learning and provides means and tools to evaluate ethical aspects as well as reliability and robustness. For this purpose, the keynote gives hints on how to deal with the content. The possible use of AI at the German Institute for Occupational Safety and Health is explained by means of an example.



Lena Abrahamsson

Luleå University of Technology
lena.abrahamsson@ltu.se



Bio sketch

Lena Abrahamsson is professor in Human Work Science and scientific leader of the strategic university-wide area “Creaternity” at Luleå University of Technology. Current research projects deal with the work of the future in the green and digital industrial transition, many of them with a focus on gender and organisation, in the mining and steel industry.

“Work environment and gender equality in the green and digital industrial transition. How to navigate between utopia and dystopia?”

In the north of Sweden, the green and digital industrial transformation of today is manifesting itself in large investments, innovations, and neo-industrialisation. Although development will not be as technology-deterministic, rapid, or unambiguous as both the common dystopian and utopian visions predict, there will be quite large changes and new conditions for industrial work, that also probably will affect the gender patterns. New complex situations are emerging. There is a need of research, not only of the work and workplaces of the future but also of the management of occupational safety and health of the future. There is a need of research that includes knowledge about humans, work and organisation and other cultural and societal aspects. There is a need of research that places people (all types of women and men) in the centre of technological development – to support the functionality of the green and digital technology and to develop inclusive, attractive, and safe workplaces.



Sophie Ndaw

INRS
sophie.ndaw@inrs.fr

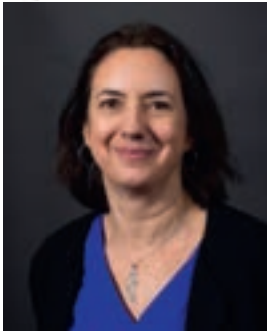
Bio sketch

Sophie Ndaw has a degree in pharmacy and a doctorate in analytical toxicology, with a primary focus on occupational human biomonitoring and chemicals risks assessment. She is currently head of the Division of Toxicology and Biomonitoring at Institut National de Recherche et de Sécurité (INRS), the French Research and Safety Institute for the Prevention of Occupational Accidents and Diseases. She is also involved in various expert groups like the OECD-Occupational Biomonitoring activity of Working Party of Hazard and Exposure Assessment.



“Advanced techniques for hazard and exposure assessments in occupational health”

Chemical risk assessment of the exposure to mixture is complex and laborious, due to the large number of chemicals (known and unknown) to which people are exposed. Therefore, there is a need for emerging reliable methods, tools and approaches to better understand the adverse effects caused by hazardous chemicals in real-life scenarios and beyond the conventional approach based on evaluating chemicals on a one-by-one basis. In this presentation, advanced techniques as a toolbox for hazard and exposure assessments in occupational health will be discussed. These methods may include the use of computational models as well as new in vitro and “omics” methodologies.



Ruth Boumphrey

Lloyd's Register Foundation
ruth.boumphrey@lrfoundation.org.uk



Bio sketch

Ruth is Chief Executive of Lloyd's Register Foundation, a global charity with a mission to 'Engineer a Safer World'. See <https://www.lrfoundation.org.uk/>. The Foundation supports work to enhance the safety of life and property and to support safety skills and education. She has a background in research, development, and regulation primarily in the Space and Environmental sectors. She is a trustee of the National Oceanography Centre and Non-Executive Director at the UK Centre for Environment, Fisheries and Aquaculture Sciences. She is on the Board for Engineering X; the advisory board for Resilience Rising; and is a commissioner with the National Preparedness Commission.

“Feeling safe and being safe? Data-driven approaches to safety for all”

Ruth will present highlights of Lloyd's Register Foundation's World Risk Poll - the first global study of perceptions and experiences of risk to people's safety. This unique work gives voice to people in over 120 countries and provides a global map of how people think and feel about risks to their safety, their lived experience of harm, and gives an insight into who they trust to provide them with guidance.

Ruth will also provide an overview of *Discovering Safety* - an innovative programme funded by the Foundation and led by Health and Safety Executive (HSE) of Great Britain. It aims to embed a data driven approach to health and safety and improve performance globally by using data and analytical techniques to provide new insights. The programme develops tools and applications for industry, exploring and creating innovative ways of understanding how new technologies can enhance health and safety performance and compliance. It supports organisations to be more proactive in exploiting data that they routinely collect to create intelligence to support health and safety decision making, contributing to lowering incident rates and improving health and safety risk management.



Eelco Kuijpers

TNO
eelco.kuijpers@tno.nl



innovation
for life

Bio sketch

Eelco Kuijpers PhD (M) is a senior scientist at the Netherlands Organisation for Applied Scientific Research {TNO} with main fields of interest on exposure assessment in the context of risk assessment and risk management, epidemiology, exposome studies and sensor applications. He is involved/coordinates studies related to sensor applications and exposome research, and is instrumental in establishing the international collaboration for occupational exposome and sensing together with NIOSH (USA) and HSE (UK). Eelco has ~30 peer-reviewed publications in this research domain.

“Smart sensors for a healthy and safe working environment”

Occupational diseases are a huge burden on society. Despite significant control efforts, yearly thousands of (former) workers die from occupational exposures and even more are injured or suffer from health effects. To further prevent occupational diseases, we need a way to monitor our working environment more continuously and in (near) real-time.

Until now, the prevention of occupational diseases has largely involved the use of traditional measuring methods. Generally speaking, readings are taken only a few times a year and results become available long after the exposures occur. New technologies, like sensors and new types of models, offer new solutions.

That is why we at TNO have launched a Virtual Occupational Hygiene Assistant, or VOHA for short. This digital support tool measures the quantity of certain chemical substances, the amount of noise, and other aspects. It automatically analyses the information and gives feedback to various relevant end-users. Our vision for the future is that monitoring will be continuous, with the help of sensors integrated on work clothing, helmets, and equipment.

In this presentation I look back at 10 years of research on sensors at the workplace. How we started with evaluating the value of these low-cost sensors, how we collaborate scientifically to generate guidelines for the right use of these sensors and how we move to implementation research with the end-users playing a central role in the development of solutions.



Andreas Wallo

Linköping University
andreas.wallo@liu.se



Bio sketch

Andreas Wallo is a Senior Associate Professor in Education at the Department of Behavioural Sciences and Learning at LiU. His research focuses on competence supply management, workplace learning, hybrid work, well-being, managerial work, and human resource management. A recurring question in his research projects is how conditions for learning and development can be created in organizations.

“Thriving Together: The Importance of Leadership in Creating a Culture of Well-Being, Health and Learning for Sustainable Competence Supply Management”

In this keynote, Andreas Wallo will highlight the critical role of managerial leadership in fostering employee well-being, health, and learning for a sustainable competence supply chain. Drawing on empirical research and systematic literature reviews, Andreas will offer insights into how organizations can address the growing shortage of competence in many sectors by prioritizing social sustainability issues. He will discuss strategies for creating a culture of well-being and learning essential for long-term success in today's rapidly evolving business landscape.

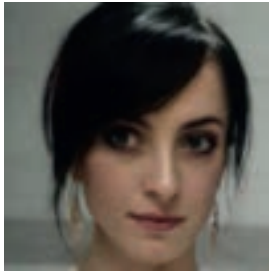


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**Swedish Agency for Work
Environment Expertise**

PARALLEL SESSION SPEAKERS



Agata Stobnicka-Kupiec

CIOP-PIB
agsto@ciop.pl

Bio sketch

Agata Stobnicka-Kupiec, Ph.D. (Eng.) is a researcher at the Department of Chemical, Aerosol and Biological Hazards, Central Institute for Labour Protection – National Research Institute in Poland. Her main scientific interests are focused on exposure to biological agents in the occupational environment. The author of publications regarding detection and identification of harmful biological agents at the workplaces.



“Viruses as harmful contaminants in occupational environment”

Detection and identification of viral contaminants in occupational environment (OE) is a procedure relatively rarely conducted, thus the occupational risk of many occupational groups in the overwhelming majority of cases is underestimated.

Viral infectious diseases affect both healthcare and non-healthcare workers. They can be exposed to viral particles either via inhalation of bioaerosol emitted during technological processes or deglutition after direct hand contact with contaminated surfaces, clothes or tools. Due to the fact that many occupational activities generate aerosols of different sizes and all airborne biological agents can be subsequently deposited on surfaces, the proper approach of monitoring viral contaminants should cover the analyses of both bioaerosol and surface swab samples collected on workplaces. Even though the studies examining the presence of viruses in bioaerosols and on fomites are available in the scientific literature, the knowledge about potential infectious viruses (PIVs) in OE is still scarce. In our recent research, the prevalence of PIVs in the air and on surfaces in wastewater treatment plants (WWTPs) was assessed. The novelty in this study was application of PMA dye pretreatment before PCR procedure to discriminate potentially infectious and disintegrated viral particles in collected samples. Our study showed that the highest concentrations of PIVs in the air and on the surfaces were observed at the initial wastewater treatment processes. The concentrations of PIVs in bioaerosol and swab samples ranged between 10^1 – 10^4 gc/m³ and 10^2 – 10^6 gc/m³, respectively, depending on the workplace and the type of virus. The highest concentrations of PIVs were observed for adenoviruses, rotaviruses and noroviruses. Thus, both identification and quantification of PIVs in WWTPs and other occupational environments with high abundance of microbial contaminants should be an immanent part of safety work management allowing proper health risk assessment.



Andrzej Grabowski

CIOP-PIB
anra@ciop.pl

Bio sketch

Andrzej Grabowski is head of the Virtual Reality Laboratory at the Central Institute for Labour Protection - National Research Institute. Currently, he is focused on the use of virtual reality in various fields, including OSH, training, cognitive functioning, telepresence, and support for upper limb rehabilitation. In the VR laboratory, they are developing simulators of vehicles and machines, remotely controlled mobile robots, or powered exoskeletons for the upper limb.



“The use of virtual reality to simulate the work of high-power robots on a construction site”

Mobile robots are increasingly used in various industries, such as construction, to perform tasks that are dangerous, repetitive, or require high precision. However, operating mobile robots in complex and dynamic environments poses significant challenges for human operators, who need to have adequate skills and knowledge to ensure safety and efficiency. One way to address this issue is to use interactive simulations in virtual reality (VR) as a tool for training and testing operators before they use real robots on site. VR simulations can provide realistic and immersive scenarios that mimic the conditions and constraints of a construction site, such as obstacles, weather, noise, and communication issues. Operators can interact with the simulated robots using natural interfaces, such as gestures, voice commands, or controllers, and receive feedback on their performance and errors. VR simulations can also be used to evaluate the usability and functionality of different robot designs and interfaces and to identify potential hazards and risks associated with using mobile robots on-site. By using interactive simulations in VR as a tool supporting the safety of using mobile robots, operators can improve their skills and confidence, reduce accidents and costs, and enhance productivity and quality.



Angelika Hauke

IFA/DGUV
angelika.hauke@dguv.de



Bio sketch

Angelika Hauke is a diploma psychologist and scientific researcher at the Institute for Occupational Safety and Health of the German Accident Insurance since 2004. After carrying out and leading several European projects of the European Agency for Safety and Health at Work, she has mainly taken part in installing the risk observatory of the German Social Accident Insurance since 2011 which aims at searching for future trends related to occupational safety and health.

“The German Social Accident Insurance’s Risk Observatory: Future trends and their impact on OSH”

The German Social Accident Insurance’s Risk Observatory (RO) aims at identifying changes that will influence the world of work, universities, schools, and children-daycare-centres in the near future. Which developments will change where, how and to what extent the working and educational world over the next five to ten years? What are the risks and opportunities associated with these developments regarding occupational diseases, the prevention of occupational accidents, and work-related health hazards and where are special prevention efforts required?

The RO continuously identifies new trends and developments by research in online and print media and via an online reporting system. 117 such new developments form the basis of the latest online survey. They are assigned to ten global trends:

- digitalisation and connectivity
- new technologies
- globalisation
- economy
- new work
- climate change, nature and resource conservation, decarbonization
- infrastructure
- mobility
- demographic change and diversity
- social affairs and health

In spring 2023, one online survey per global trend was launched by the RO to assess the future impact of the 117 developments on the working and educational world in general and to further investigate their potential effects on OSH. For the surveys more than 1200 researchers and other experts were consulted. The results of their assessments provide first insights on particularly relevant developments and are the basis for interviews and in-depths-research by the RO to gather a deeper understanding of future challenges and opportunities for OSH.

Our presentation will start with a brief overview on the methodological approach of the RO and its trend collection. Then we will focus on the major survey results, such as the most relevant developments per global trend, information on impacts on OSH, and affected sectors for a selected number of developments as well as possible prevention efforts.



Anna Jacobsen Lauvås

STAMI
anna.lauvas@stami.no

Bio sketch

Anna Jacobsen Lauvås is a Ph.D. student at the National Institute of Occupational Health in Norway. Her research focus is currently on assessing the microbiological health risks in workers in wastewater treatment plants.



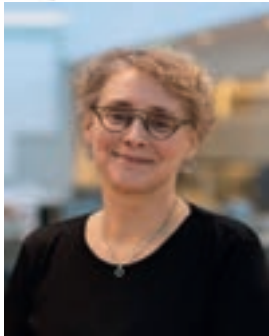
“Our waste – their disease? The airborne virus exposure of wastewater treatment plant workers”

Background During the Covid-19 pandemic, screening of wastewater was implemented as a surveillance tool for population viral infections. Viruses and other microorganisms in the wastewater can aerosolize into the wastewater treatment plant (WWTP) air, where they may pose a risk to workers' health. Working in direct contact with sludge has been shown to increase the risk of developing respiratory and gastrointestinal symptoms in Scandinavian WWTP workers, but the viral contribution is not fully known. Although human pathogenic viruses have been detected in WWTP air, most studies have used high-volume, stationary sampling methods that are not directly relevant to human exposure. Microbiological exposures in Norwegian WWTPs are poorly studied and there is a need to characterize the potential exposure to airborne viruses of Norwegian WWTP workers.

Aims Detect and quantify airborne viruses and microorganisms in Norwegian WWTPs and elucidate temporal and spatial variation.

Methods Full-shift personal and stationary air samples were collected in summer and winter at three WWTPs in the Oslo region using GSP samplers for microorganisms and PAS6 for endotoxin at an airflow rate of 3.5 or 2 L/min. Workstation-related exposure was also assessed with the Coriolis μ at 200 L/min. Nucleic acid and endotoxin were extracted from the air samples and bacteria and relevant viruses were analyzed with ddPCR and endotoxin was quantified with the LAL assay.

Results Measurements of pepper mild mottle virus (PMMoV) in WWTP air showed the potential for aerosolization of viruses from wastewater. Quantification of aerosolized human pathogenic viruses, bacteria, and endotoxin are ongoing, and results will be presented at the conference.



Annette Nylund

SAWEE

annette.nylund@mynak.se

 Swedish Agency for Work
Environment Expertise

Bio sketch

Annette Nylund her major employment experiences before the Swedish Agency for Work Environment Expertise, SAWEE, were as a senior analyst at the Swedish Work Environment Authority the Department for Statistics and Analysis, and previously, the former Swedish Institute for Growth Policy Analyses, ITPS, and the former National Board for Industrial and Technical Development, NUTEK. Education: Ph. Dr. studies in work science at Luleå University, Ph. Lic. in industrial work science at KTH Royal Institute of Technology, BSc. in economics and political science.

“Growth of healthy and good work in the Swedish business sector until the COVID–19 pandemic”

This report follows up on the healthy and good work with indicators on the organisational level in the Swedish business sector over ten years.

An index shows a slow growth of healthy and good work in the Swedish business for at least ten years until the COVID–19 pandemic. The index is also divided into three sub-indicators showing the development in more detail:

- individual learning;
- structural conditions for learning at work;
- participation/decentralisation of work responsibilities.

The indicator for structural conditions for learning contributed to a large extent to the increase (before the pandemic). The indicator for participation/decentralisation shows successive growth throughout the ten years, i.e., has a small growth at the latest measurement point, 2019–2020.

Individual learning shows a significant drop during the last measurement, 2019–2020. Many companies stopped investing in employees’ learning during the pandemic. A similar pattern is visible for most EU countries and worldwide by official statistics and OECD. The result alerts the companies and authorities that the agenda now must be to reinvest and bridge the investment fall in individual learning and to prevent future declines.

The patterns of the indicators are reflected by company size and most of the industries in Sweden’s business sector. The service and knowledge-intensive manufacturing companies have slightly higher levels than the other commodity-producing companies.

Finally, the analysis shows that the company’s human capital level also indicating the technology level is a primary driver for healthy and good work, and society’s economic level has some impact.

Data are from four Swedish Surveys (2009, 2012, 2015, and 2019–2020), including 6500 companies. The surveys follow the EU Meadow Guidelines for data (www.meadow-project.eu) and reflect the Swedish OSH Act (SFS 1977:1160); the survey questions measure learning organisations. The questionnaire data is matched with registered data. Independent stratified sampling is used, and non-response analyses show representativeness.

The report is part of the Swedish SAWEE project Healthy and Good Work: Latest Ten Years of Healthy and Good Work (theme 1) and Work Environment Management, i.e., Managing of OSH (theme 2).

The indicators are used in several other studies concerning good work organisations, work environment management (OSH), and employment equality according to gender, age, and family situation, as well as in studies of productivity and innovativity.

“Learning at work, alongside the number of OSH areas, explains the company OSH management”

This study shows the relationship between managing occupational safety and health (OSH) and company production conditions in the Swedish business sector. The focus is on two explaining conditions: learning organisation and company size. Other conditions also included in the study are the type of industry, the staff composition, the number of OSH areas and incidents, and the use of external experts on OSH.

The results show that the degree of learning at work stands out in explaining what conditions impact the company’s OSH management, alongside the number of OSH areas. The learning organisation is also broken down into three indicators showing the relationship in more detail: individual learning, structural conditions for learning, and participation/decentralisation of work responsibilities.

Also, there is a mutual impact between a learning organisation and the OSH management, but the impact of learning is higher and more robust than the other way around. The impact of OSH management on learning is situational and dependent on the company’s context. Further, a learning organisation also explains the number of identified OSH areas.

The conclusion is that the more learning organisation, the more developed OSH management; Learning influences OSH directly and indirectly by contributing to identifying OSH areas, which impacts OSH management. In addition, the work organisation itself is an essential part of good OSH align the Swedish OSH Act (SFS 1977:1160).

The size and industry show some impact. The study elaborates on all results, external experts, OSH incidents, and staff.

The data is from the Swedish Survey 2019–2020, with 3000 companies matched with registered data. Survey questions about learning organisations follow the EU Meadow Guidelines (<http://www.meadow-project.eu/>). The Swedish Work Environment Authority developed the survey questions about OSH management. Both align with the Swedish OSH Act (SFS 1977:1160). Independent stratified sampling is used, and non-response analyses show representativeness.

The report is part of the Swedish SAAWE project Healthy and Good Work: Latest Ten Years of Healthy and Good Work (theme 1) and Managing of OSH (theme 2).



Benedikt Thomas

IFA/DGUV
benedikt.thomas@dguv.de



Bio sketch

Benedikt is a Ph.D. student at the Institute for Occupational Safety and Health of the German Social Accident Insurance in Germany. The studies of Forensic Science (B.Sc.) and Analytical Chemistry (M.Sc.) and practical experience in forensic toxicology and pharmaceutical analysis paved his way for his doctoral studies in the sampling and analysis of hazardous substances at workspaces.

“Canister sampling of ethylene oxide - validation of a new sampling and measurement method and first field measurements in working areas”

Ethylene oxide is a hazardous gas found in a variety of workplaces, such as medical device sterilisation facilities. It is classified as carcinogenic and mutagenic (1B, 1B). In Germany, risk-based limit values have been derived according to the ERB concept (AC 0.2 mg/m³; TC 2 mg/m³). There are several methods for the analysis of ethylene oxide in ambient air, the main one being derivatisation on a solid sorbent followed by gas chromatographic analysis of the derivatisation product. For environmental analysis, canister methods have been established, e.g. by the EPA (methods TO 15 and TO 15A). This methodology has been transferred to workplace measurements of hazardous substances. There are many advantages to canister sampling, such as ease of use and the absence of other technical aids such as pumps at the sampling site, which workplace air measurement can benefit from.

Using a test gas facility to produce dynamic test gases, a GC analysis method was developed and further validated. The canisters were tested for suitability and influencing factors such as stability, reproducibility and robustness were examined. The suitability was demonstrated, successful measurements were carried out using test gas facilities and further method development was performed. Subsequently, measurements at industrial workplaces were carried out as a field study in the context of validation. More than 100 samples taken at industrial workplaces showed that the concentrations measured exceeded the limit values. With this new information, companies can take steps to prevent or reduce exposure to hazardous substances such as carcinogenic ethylene oxide.



Carina Cläsgens

IFA/DGUV
carina.claesgens@dguv.de



Bio sketch

Carina Cläsgens is a research officer in the department of chemical and biological hazards at the German Institute for Occupational Safety and Health. She focusses on the development of new analytical methods to determine hazardous substances in workplace air. Her special research interest is the analysis of metal species and organometallic compounds.

“Occupational Exposure to Organotin Substances: Speciation of 11 Organotin Compounds in Workplace Air Samples via HPLC-ICP-MS”

Organotin compounds (OTCs) are largely regulated due to their recognized human and ecotoxicity. Owing to their excellent physicochemical properties, they still rank among the most used organometallic compounds in various industrial sectors. At workplaces (e.g. plastics processing) OTCs can be released as particles, or mixed phases and be incorporated by inhalation or skin contact. In Germany occupational exposure limits (OELs) are specified for 23 OTCs in Technical Rules for Hazardous Substances (TRGS).

OELs for metals most often refer to the total content of a metal in a certain particle fraction in workplace air. In the case of organometallic compounds bioavailability and adverse effects do not only depend on the penetration depth of particles into the respiratory tract and content of a metal but significantly on bonding form.

Compound specific analytical methods for monitoring workplace air exposure to multiple OTCs currently do not exist. In other fields, for example environmental and product analysis, gas- (GC) and liquid chromatography (HPLC) applications can be found for various matrices. While GC methods offer a higher peak resolution of more compounds, HPLC methods excel due to minimal sample preparation without the need of an error-prone derivatization. The coupling to mass spectrometry with inductively coupled plasma (ICP-MS) stands out due to its particularly high sensitivity. Previously published HPLC-ICP-MS methods describe a separation of maximum six compounds using a simple binary gradient.

This work presents the development of a method for the determination of eleven regulated OTCs in workplace air via HPLC-ICP-MS. The method allows the separation of Monomethyltin (MMT), Monobutyltin (MBT), Mono-octyltin (MOT), Monophenyltin (MPhT), Dimethyltin (DMT), Dibutyltin (DBT), Diphenyltin (DPhT), Trimethyltin (TMT), Tributyltin (TBT), Triphenyltin (TPhT) and Tetramethyltin (TTMT) within 22 minutes by means of a C18 reversed phase column and a ternary solvent and flow rate gradient using methanol, acetonitrile, and ultrapure water + acetic acid + α -tropolone.

Author and co-authors

Carina Cläsgens, Tobias Schwank
Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA/DGUV)



Carlijn Brouwer

TNO
carlijn.brouwer@tno.nl



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for life

Bio sketch

With an background in social psychology Carlijn Brouwer is focussed on different subjects concerning work, health & technology: hybrid working, mental wellbeing at work, health interventions at work and social innovation in health technology development.

“Hybrid working toolbox: The development of a toolbox to support organizations in Hybrid working”

Introduction The pandemic acted as a catalyst for the shift to hybrid working in the Netherlands. This rapid change raised the question: what bottlenecks and success factors do managers and employees experience with hybrid working? And how can we avoid the adverse effects? In this presentation, we describe the research into the main bottlenecks and the development of a toolbox that will help us avoid these bottlenecks. In this study by TNO in cooperation with the Ministry of Social Affairs, 11 organizations were followed in their transition to hybrid working.

Methods 11 organizations were followed from February to September 2022. These organizations all differed in size and sector to get the broadest possible picture of hybrid working. Through a diary study, literature review, interviews and focus groups, we mapped the effects of hybrid working on employees and managers. In total, 281 participants took part in the digital diary study, and this resulted in 36.377 data points. To understand this data even better we interviewed 25 employees and 7 managers and had 21 employees and 11 managers divided into 3 focus groups.

Results The results show the potential bottlenecks of hybrid working. Hybrid working brings the disadvantage of feeling a little less connected to colleagues and work itself on work-at-home days, sometimes ineffective hybrid meetings, more worries from the manager about the health of employees, an increase in the use of communication tools, and less focus on team goals as the desires of the individual have gained more importance. For these challenges we made eight tools for employees and managers. These eight tools deal with conducting a team discussion about hybrid working, cooperation and connection, incentivize employees to return to the office, effective execution of hybrid meetings, healthy hybrid working, tips for and by managers, stories of experience and the results of the study itself.

Conclusion The results from the study were incorporated into an online toolbox published on a public website of the Ministry of Social Affairs. The toolbox contains eight easy-to-use online tools that give both employees and managers guidance on how to organize hybrid working as optimally as possible. Since the launch of the toolbox in the end of January there were approximately 10.000 Dutch employees, employers and managers that visited the toolbox. A follow-up study is currently being conducted to test the applicability of the toolbox in SMEs.

Author and co-authors

Carlijn Brouwer, Lidewij Renaud, Jenny Huijs, Noortje Wiezer, Liza van Dam, Amber Vernooij
Netherlands Organisation for Applied Scientific Research (TNO)



Chloé Charlotte Schröder

BAuA
schroeder.chloecharlotte@baua.bund.de

Bio sketch

Chloé Charlotte Schröder did her bachelor's degree in Public Health at the University of Bremen and her master's degree in Epidemiology at the Johannes Gutenberg University Mainz. Since June 2022, she has been working as a research associate in the unit Toxicology at the BAuA in Dortmund within the presented project. Previously she worked in the department of Occupational Health Science at the University of Wuppertal from 2018-2022.



Bundesanstalt für Arbeitsschutz
und Arbeitsmedizin



Kristina Witzler

IFA/DGUV
kristina.witzler@dguv.de

Bio sketch

Kristina Witzler did her bachelor's degree in "Chemistry and Material Science" in 2013 and her master's degree in "Analytical Chemistry and Quality Assurance" in 2015, both at the University of Applied Sciences Bonn-Rhein-Sieg, Germany. There she has worked for another two years on an European project regarding border security and detection of explosive devices. Since 2017 Kristina is an analytical chemist and research officer at the Department of Chemical and Biological Hazards, Liquid Chromatography Section, at the Institute of Occupational Safety and Health (IFA). Her focus points are the analysis of isocyanates and quality assurance topics.



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Deutschen Gesetzlichen Unfallversicherung

"Improving Occupational Safety and Health when Working with Diisocyanates"

Diisocyanates (DI) are indispensable industrial substances for the manufacturing of polyurethane (PU) products, but exposure can induce obstructive respiratory diseases. Thus, the EU implemented mandatory trainings to improve employees' health and safety when handling DI. The study's aim is to scientifically monitor and evaluate this new regulation.

With a feasibility study, conducted by the Institute for Prevention and Occupational Medicine (IPA) in cooperation with the German Federal Institute for Occupational Health and Safety (BAuA), Institute for Occupational Safety and Health (IFA) and other cooperation partners, participating companies with DI exposed employees were recruited and the main study designed. A 5-year prospective cohort study will now further assess exposure to DI and related respiratory changes while an embedded cluster-randomized trial with wait-listed control groups will test the effectiveness of the training measures in terms of exposure reduction. 35 companies with >1300 exposed employees agreed to participate. These employees work with MDI (52%), HDI (8%), IPDI (6%), TDI (2%) or multiple DI in the industrial sectors of flexible (30%) and rigid foam production (20%) or the adhesive and sealant (17%), coatings (6%), elastomers (6%) and binder industries (3%). The rest either produce DI or apply PU-based products. At the beginning and the end of the cohort study participating employees are medically examined determining health related endpoints. The internal exposure will be recorded by DI specific haemoglobin adducts in blood and a universal method for DI-metabolites in urine (aromatic and aliphatic amines). The external exposure will be determined by workplace air monitoring and improved description of peak exposures. A photo documentation and questionnaire survey are planned.



Altogether this study considerably adds to the assessment of DI related health risks and the effectiveness of the EU-implemented restriction and preventative measures.

Author and co-authors

Chloé Charlotte Schröder¹, Kristina Witzler², Stefanie Kösling³, Heiko Käfferlein³, Claudia Drossard¹

¹ German Federal Institute for Occupational Safety and Health (BAuA)

² Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA/DGUV)

³ Institute for Prevention and Occupational Medicine (IPA/DGUV)





Christian Werner

IFA/DGUV
christian.werner@dguv.de



Bio sketch

Christian Werner has been working at the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA) for almost 10 years. He is the section manager of the department "Machinery Safety, Industrial Security and Implants", and is also a member of various national and international standardization committees dealing with machinery safety, electrical safety and industrial security. Before joining the IFA, he completed a Master of Science degree in physical engineering with a special focus on microsystem electronics. After that, he worked for four years as a hard- and software developer in a company that produces rotary encoders. Then he spent more than two years as a project manager for the automotive sector, supporting the world's largest manufacturer of fully automatic transmissions for medium and heavy-duty commercial vehicles.

“Improving the Understanding of Low Frequency Magnetic Field Exposure with Augmented Reality”

Low frequency magnetic fields are often present in our everyday life due to the multitude of electronic devices. High magnetic fields can occur in the workplace from a wide variety of machines and systems, which must be measured and evaluated from the point of view of occupational safety. Such an assessment of electromagnetic fields can be an input to the risk assessment that should be prepared for each piece of work equipment. To facilitate the understanding of magnetic fields by supervisors and employees in the workplace, an augmented reality (AR) application has been developed to visualize the measured flux densities and the resulting safety distances. The application was deployed on two smartphones, allowing for the simultaneous viewing of the same scene without the use of additional markers. Whether the application creates a better understanding of the exposure situation was evaluated with the help of an online survey.

In this survey, participants received either a classic measurement report or a report enhanced by augmented images. The evaluation shows that it subjectively felt less difficult for participants with the augmented report to answer questions about the exposure situation. Furthermore, they also objectively performed better in answering the questions than did the group with the classic report. Therefore, this work shows that AR enhanced images can improve the understanding of an exposure situation, and it describes how such images and videos can be created.



Christine Darbakk

STAMI

christine.darbakk@stami.no



Bio sketch

Christine Darbakk completed her master's degree in molecular biology at the University of Bergen in 2019. Following her graduation, Christine worked as an engineer at the Mohn Cancer Research Laboratory in Norway before starting her doctoral degree at STAMI, the Norwegian Institute of Occupational Health in 2021.

“Determination of proteins in air – New specific marker of airborne exposure in the food industry?”

Workers in the food industry are exposed to a wide range of substances that might elicit immunological reactions leading to occupational diseases such as rhinitis and asthma. It's challenging to regulate the occupational exposure due to the wide variety of components present in these work environments.

Therefore, gravimetric measurements have served as the foundation for the occupational exposure limits (OEL) for these exposures. However, gravimetric measurements do not consider which compounds that are present in the dust and will thus also include harmless substances such as sugar dust. A more precise OEL for the food industry to better describe exposure and enable evidence-based risk assessments is therefore needed.

This project will provide new knowledge about the relationship between the amount of inhalable dust and the amount of total inhalable protein present in air in connection with various types of food production. The study's findings will make it easier for companies to prioritize where exposure-reducing measures should be implemented. In the long term, the findings may help to replace the current unspecified exposure limits in the food industry with better and more specific limits for this type of dust.

Author and co-authors

Christine Darbakk, Pål Graff and Raymond Olsen
STAMI, National Institute of Occupational Health, Oslo, Norway



Sandra Breuer

IFA
sandra.breuer@dguv.de



Bio sketch

Sandra Breuer studied at the Bonn-Rhein-Sieg University of Applied Sciences and graduated in 2023 with a master's degree in Biomedical Sciences. She is working as a research associate at the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA) since June 2023. The department radiation focuses on artificial and natural optical radiation in the workplace.

“Going forward in prevention of job-related skin cancer – Collecting knowledge on occupational UV-exposure”

Solar UV-induced non-melanoma skin cancer (NMSC) is a major risk for outdoor workers. Since many years, the link between solar UV exposure and NMSC incidence is well known. To address the constantly rising incidences of occupational skin cancer throughout the world efforts in primary prevention are of utmost importance.

Although the medical and scientific discussion about disease mechanisms, numbers and legal classification (occupational disease) has been intense, a valid, detailed database on exposure has been lacking. Especially in the occupational context, the identification of the professions that are particularly affected is important. Nevertheless, a holistic approach is recommended as affected people collect solar UV both during work and leisure time. During the GENESIS-UV measurement campaigns occupational as well as leisure time UV exposure was measured for a wide range of occupational settings and leisure activities.

Currently, the data are used in the context of epidemiological and medical research to reveal sound dose response relationships of NMSC and UV radiation. Here, we want to present our exposure registries for occupational and leisure time exposure, as well as details of the data collection and evaluation process. Details and benefits, as well as use-cases are also shown. Another focus will be on new methods and developments of skin cancer prevention.

Author and co-author

Claudine Strehl, Sandra Breuer

Claudine Strehl (claudine.strehl@dguv.de) is managing the Section Radiation at the Institute for Occupational Safety and Health of the German Social Accident Insurance located at Sankt Augustin in Germany. The section focuses on artificial and natural optical radiation in the workplace. One of her main topics is UV induced skin cancer and its prevention especially for outdoor workers.



Cornelia Wippich

IFA/DGUV

cornelia.wippich@dguv.de



Bio sketch

- 2014 – 2016: Master of Science in Analytical Chemistry and Quality Assurance (University of Applied Sciences Bonn-Rhein-Sieg, Germany)
- 2016 – 2019: PhD (Dr. rer. Sec.) at the school of safety engineering (Issue: “Discussion of the ratio between inhalable and respirable dust fractions and their constituents in a range of working areas”; University of Wuppertal, Germany)
- 2019 – 2022: Research officer section metal analysis of IFA
- From 2022: Section manager metal analysis of IFA

Master of Science degree in analytical chemistry and quality assurance. Finished in 2019 PhD at the University of Wuppertal. Started working at IFA as research officer in the metal analysis section and from 2022 working as the section manager of metal analysis at IFA.

“MUST” – A tool for the determination of measurement uncertainty and more

What is measurement uncertainty in the context of measurement methods for workplace air? Why does measurement uncertainty need to be calculated for these methods? How is the expanded measurement uncertainty calculated? These questions are an important part of the quality assurance in terms of the validation of methods for workplace air measurement of chemical agents. The “Guide to the Expression of Uncertainty in Measurement” (GUM) has basically laid the foundations for uncertainty calculation, but the application of these mathematical methods is often obstructed by misunderstandings and interpretations by several standards. The laboratories at the Institute for Occupational Safety and Health (IFA) of the German Social Accident Insurance have targeted to solve the misunderstandings and create a mathematical framework for different measurement methods to achieve a state where the declaration of uncertainty is a benefit: one can show compliance, improve the methods, and rely on results based on quantitative data. For this purpose, influence factors on the result of a measurement, their systematic and random effects, as well as their sensitivity coefficients must be determined for both: sampling and analytical methods. The quantitative data for the calculation of analytical influence factors can be derived from the measurement method validation. In the laboratories of IFA the validation and the calculation of measurement uncertainty are harmonized with each other. When influence factors are designated, a mathematical model must be created. Models for three different measurement methods of air monitoring (sampling with subsequent thermodesorption, extraction or metals in different dust fractions) were calculated and are now conveniently dealt with in the background of a user-friendly open-source software. With this software the expanded measurement uncertainty can be calculated for various concentrations and determined how strongly the individual effects of influence factors are involved.



Daniel Köster

IFA/DGUV
daniel.koester@dguv.de



Bio sketch

Daniel Köster (Ph.D.) works at the Institute for occupational safety and health of the German Social Accident Insurance as a research chemist for HPLC applications in the department for Chemical and Biological Hazards. He has a background in instrumental analytical chemistry and the development of instrumentation for compound-specific stable isotope analysis.

“Inhalativ heroin exposure of workers at supervised drug consumption facilities in Germany”

In supervised drug consumption facilities, illicit drugs, such as heroin, cocaine, and amphetamine can be consumed under the supervision of trained staff. The main aim of these facilities is the reduction of the disease transmission risk by offering hygienic conditions and supplies, the prevention of deaths by drug overdoses, and the connection of drug users to health and social services. The consumed substances themselves are typically supplied by the drug users, whereas clean equipment for the injection or inhalation of the drugs can be obtained in the facilities. Initially, most of the drug consumption rooms only targeted users injecting substances like heroin. Adapting to a general change in the use patterns towards increased inhalation of illicit drugs, many facilities now offer additional areas for the supervised smoking of crack and heroin.

With rising numbers of drug consumption by smoking, the risk of inhalative passive exposure of employees is increasing. In a cooperation with the Institute for Forensic Medicine in Düsseldorf, a method for the monitoring of heroin concentrations in air has been developed. Field measurements have been carried out in multiple drug consumption facilities. Depending on the actual conditions on-site, worst-case measurements in the room used for smoking, the area for the injection of drugs, as well as adjacent areas were performed. Personal air samplers were used for employees with direct contact to drug users (inhalation and injection).

Trace levels of heroin could be detected in air samples from many areas of the drug consumption facilities. Highest concentrations were obtained directly in the smoking room. Depending on the number of consumption processes and the installed ventilation system, major differences in the heroin concentration could be observed. In addition to heroin, cocaine and various opium related alkaloids could be identified in the air samples.



David Fishwick

HSE

david.fishwick@hse.gov.uk



Bio sketch

David is the Chief Medical Adviser for the Health and Safety Executive, GB and also for HSE Northern Ireland. He worked until very recently as a consultant respiratory physician in the NHS in Sheffield, and his main research interest is occupational diseases. He has for many years, until recently, chaired the PEROSH Wellbeing Group. He was heavily involved in the UK National Core Study work during the COVID 19 pandemic, and worked across organisational boundaries to produce this and other similar work.

“Worker job satisfaction and perceived work related stress. How did this change over the COVID-19 pandemic?”

Methods In collaboration with UK based NatCen, a social research organisation, we carried out a panel study of participants in work during the week running up to UK national lockdown in 2020. A questionnaire was administered in March 2022 to reflect the previous 24 months.

Results Of a total of 5884 participants, 5387 were in employment in March 2022. Overall (from a scale of 0 (least) to 10 (most satisfied)) job satisfaction was rated as a median and mode of 8.0. Whilst clearly skewed, 1031 (19.1%) rated their job satisfaction as 5 or below. Using an identical scale, participants noted a median of 8 and mode of 10.0 for feeling that things they did in their job were worthwhile. Most, 87.3% felt their employer had put “any measures” in place to help reduce the risk of COVID-19 infection in the workplace.

Of all 5877 participants, most found their main job over the pandemic to be moderately stressful (n=2063, 35.1%), but 675 (11.5%) felt it was not at all stressful and 677 (11.5%) felt it to be extremely stressful. Perceived stress at work in general increased over the pandemic period; the vast majority identified that stress related to work was either unchanged (30%) or more marked (54.6%) in comparison to the pre pandemic era. Of concern, 1451 participants felt that work was a lot more stressful.

Whilst being able to work from home ($p<0.001$), not working with the public ($p<0.001$), not working with cases of known COVID-19 and not being a key worker were associated with less increase in stress at work, perceptions of various employer actions were variably associated with perceived stress change. For example, reporting of employers putting any measures in place to help reduce the risk of COVID-19 infection in the workplace was associated with higher levels of stress worsening. The latter may reflect the array of jobs associated with this requirement.

Author and co-authors

David Fishwick, Chris Barber, Gillian Frost, Luke Munford, Martie van Tongeren, Curtis Jessop, Zsolt Kiss, Charles Wilson, Andrew Curran
UK HSE science and research centre, Buxton, S17 3NT, UK



Dirk Pallapies

IPA/DGUV
dirk.pallapies@dguv.de



Bio sketch

Dirk Pallapies is a physician and European Registered Toxicologist and holds a Master of Science degree in Epidemiology from the Harvard School of Public Health.

Since 2008 he is head of the Unit Regulation at the Institute for Prevention and Occupational Medicine of the German Social Accident Insurance. He is member of the Permanent Senate Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area of the German Research Foundation, head / member of working groups advising the German Federal Ministry of Labour and Social Affairs and international expert of the Joint FAO/WHO Expert Committee on Food Additives.

“Guidance for the quantification of substance-specific exposure-risk relationships after exposure to carcinogenic hazardous substances at the workplace”

A guidance has been developed for establishing exposure–risk relationships for carcinogenic substances without a threshold for carcinogenic effects. The air concentrations at the workplace corresponding to defined risk levels are the basis for the implementation of risk management measures. A tolerable concentration and an acceptable concentration associated with risk levels of 4:1,000 and 4:10,000 (target 4:100,000; additional lifetime cancer risk after exposure throughout the whole working life) define three workplace concentration ranges - “red”, “yellow”, “green” area, corresponding to high (not tolerable), medium (transiently tolerable), low (acceptable) risk, respectively.

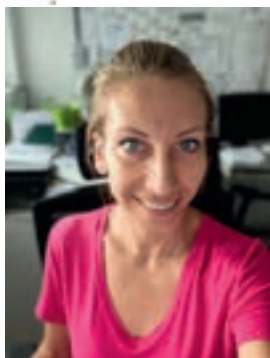
As animal or epidemiological studies do not directly cover the low-dose (and low-risk) range, scientific and methodological conventions are proposed for the extrapolation from observational data into the range of acceptable or temporarily still tolerable risks and corresponding inhalational exposure concentrations.

A key step is the identification of a starting point for risk extrapolation using both human and animal data from the observed range.

The extrapolation and modelling principle (data-based, linear, sublinear, threshold) from observational data into the low-dose range is determined based on all available data and requires the consideration of the mode of action of carcinogenesis, particularly direct or indirect genotoxicity.

Author and co-author

Dirk Pallapies, Peter Welge
Institute for Prevention and Occupational Medicine of the German Social Accident Insurance



Elżbieta Dobrzyńska

CIOP-PIB
eleki@ciop.pl

Bio sketch

Elżbieta Dobrzyńska, Ph.D. (Eng.) is a researcher at the Department of Chemical, Aerosol and Biological Hazards, Central Institute for Labour Protection – National Research Institute in Poland. The author of various publications including peer-reviewed articles in scientific journals. Her main scientific interests are focused on exposure to chemical substances at the workplace, particularly CMR and endocrine disruptors. She is also involved in trainings on chemical risk assessment methods and the development of CHEMPYL knowledge database.



“Building awareness of safe work during additive manufacturing”

The opportunities and progressive development of additive manufacturing technology is associated with an increasing demand for new materials which may pose health risk to their users. One example is, the printer's operator who may be exposed to the emission of particles and harmful chemical substances.

In CIOP-PIB, we have conducted research focused on the identification and analysis of the risks associated with the use of different types of materials in one of the best-known 3D printing technologies, i.e. FDM (fused deposition modelling). We have also initiated research on the effects of components used in 3D printing on the respiratory system on the blood-brain barrier cells. Measurements of particles and chemical emissions were carried out at selected workplaces and in a test chamber during the printer operation. Among the emitted compounds, mainly filament monomers, their degradation products and potential additives were identified. Thus, the measurements were carried out for different types of compounds like volatile organic compounds (VOCs), aldehydes and ketones, phthalates and particles. The work carried out so far, has shown that more than 90% of the particles emitted are at the nanoscale (< 115.6 nm). The emissions of ultra-fine particles may be of concern due to their negative health effects. The average number concentration of particles emitted during the operation of the 3D printer was measured to range from 482 - 60466 particles/cm³. The calculated TVOC values, depending on the filament used at the individual workplaces ranged from 673 - 4452 µg/m³. The total PAE concentration both in the inhalable fraction and in the gaseous phase did not exceed 5 µg/m³. Nevertheless, phthalates, as endocrine disruptors measured in air samples, increase the risk estimated at the printer operator's workplace. This research will contribute to increase the knowledge and understanding of both manufacturers and printer users regarding exposure to chemical agents and particles at workplaces.



Eva Flaspöler

IFA/DGUV
eva.flaspoeler@dguv.de



Bio sketch

Eva Flaspöler is a diploma psychologist and scientific researcher at the Institute for Occupational Safety and Health of the German Accident Insurance since 2004. After carrying out and leading several European projects of the European Agency for Safety and Health at Work, she has mainly taken part in installing the risk observatory of the German Social Accident Insurance since 2011 which aims at searching for future trends related to occupational safety and health.

“The German Social Accident Insurance’s Risk Observatory: Future trends and their impact on OSH”

The German Social Accident Insurance’s Risk Observatory (RO) aims at identifying changes that will influence the world of work, universities, schools, and children-daycare-centres in the near future. Which developments will change where, how and to what extent the working and educational world over the next five to ten years? What are the risks and opportunities associated with these developments regarding occupational diseases, the prevention of occupational accidents, and work-related health hazards and where are special prevention efforts required?

The RO continuously identifies new trends and developments by research in online and print media and via an online reporting system. 117 such new developments form the basis of the latest online survey. They are assigned to ten global trends:

- digitalisation and connectivity
- new technologies
- globalisation
- economy
- new work
- climate change, nature and resource conservation, decarbonization
- infrastructure
- mobility
- demographic change and diversity
- social affairs and health

In spring 2023, one online survey per global trend was launched by the RO to assess the future impact of the 117 developments on the working and educational world in general and to further investigate their potential effects on OSH. For the surveys more than 1200 researchers and other experts were consulted. The results of their assessments provide first insights on particularly relevant developments and are the basis for interviews and in-depths-research by the RO to gather a deeper understanding of future challenges and opportunities for OSH.

Our presentation will start with a brief overview on the methodological approach of the RO and its trend collection. Then we will focus on the major survey results, such as the most relevant developments per global trend, information on impacts on OSH, and affected sectors for a selected number of developments as well as possible prevention efforts.



Fabio Bocconi

INAIL
f.bocconi@inail.it



Bio sketch

Fabio Bocconi is graduated in Engineering at the University of Rome "La Sapienza" in 2003. At present he is a senior researcher at the Department of Medicine, Epidemiology, Occupational and Environmental Hygiene (DiMEILA) of INAIL, for which he carries out research on emerging risks for health and safety in the workplace, with particular reference to the assessment and management of risks associated with new technologies and innovative materials. Since 2021 he is part of the Italian Delegation at OECD Working Party on Manufactured Nanomaterials and in charge for the Exposure Working Group. He was speaker at over 30 conferences and seminars of national and international interest in the field of health and safety at work and is the author of over 100 publications including peer-reviewed articles in scientific journals, book chapters, monographs and abstracts for conference proceedings.

“Prevention-through-design for risk anticipation in nano and advanced materials production”

The growing development of nanomaterials (NMs) and advanced materials calls for a responsible approach to anticipate health and safety risks for workers. Since many knowledge gaps still remain about their health effects, and as long as occupational exposure limits will not be enforced by law, Prevention-through-Design (PtD) approach has been proposed as a framework aimed at mitigating risks, taking into account health and safety aspects starting from the design stages of new materials production processes. PtD principles could be applied to NMs, including the design of strategies to eliminate exposures and minimize risks related to the manufacturing processes. In the present study, this approach has been successfully developed in three different case studies of graphene based NMs production at the Research and Development stage, with promising application to the transition towards the industrial scale. The methodology includes the integration of the ISO/TS 12901-2:2014 Control Banding (CB) tool and the OECD multi-metric and tiered approach for exposure assessment by inhalation. Average background and standard deviation values of real-time particle number concentration (PNC) have been measured in order to calculate the significant levels (i.e. the PNC values beyond which NMs emission may be supposed). Evidence obtained by off-line morphological and elemental characterization of airborne NMs sampled in the workplace confirmed that workers' exposure can occur during powders handling and cleaning phases. Based on data analysis, CB levels have been identified for each production phase and primary risk management measures are proposed. In conclusion, our methodology supports the complementary use of qualitative models and quantitative data to introduce proper risk mitigation measures integrated with the design of production processes, also giving the opportunity to evaluate their cost-effectiveness.

Author and co-authors

Fabio Bocconi, Riccardo Ferrante, Francesca Tombolini

Italian Workers' Compensation Authority (Inail) - Department of Occupational and Environmental Medicine, Epidemiology and Hygiene (Dimeila), Via Fontana Candida 1, I-00078 Rome, Italy



Fanni Moilanen

FIOH
fanni.moilanen@ttl.fi

**Finnish Institute of
Occupational Health**

Bio sketch

Fanni Moilanen works as a researcher at the Finnish Institute of Occupational Health. She is also a PhD candidate in social and public policy at the University of Helsinki. Fanni's research interest relates to sustainability transitions, work communities and eco-social policy, to name a few. In her PhD research project, she investigates sustainability transitions from the workers' perspectives and their experiences of climate actions at their workplaces.

“Toward measuring sustainability transitions at working life – Results from a novel survey of wage earners' perceptions”

In working life research, environmental sustainability has remained a neglected topic, and work has been a blind spot in the field of sustainability transitions. This PhD project combines concepts and theories from both working life and sustainability transitions research and explores workers' and work organizations' opportunities to initiate change and hasten transition toward an environmentally sustainable society. Sustainability transitions are urgently needed at working life since it is an essential part of unsustainable production and consumption systems which currently maintain degradation of the environment. This project presents a novel survey targeted at employees to gather information on employees' perceptions of sustainability transition at work. Data (n=1917) was gathered with information on all employees, regardless of economic sector. The results spotlight the forerunner sectors of sustainability, but also fields, such as health care and social services, where workplace climate action is scarce. The survey data provides the voice for the employees to express their views and expectations toward sustainable working life. In addition, the results can guide policymakers in the fair creation of low-carbon economy and in providing support for the employees and work organizations in sustainability transitions processes.

Author and co-authors

Fanni Moilanen^{1,2}, Arho Toikka²

¹ Finnish Institute of Occupational Health

² University of Helsinki



Graciela Lopez Soop

STAMI
graciela.soop@stami.no



Bio sketch

Graciela Lopez Soop is a molecular and cellular biologist working as a postdoctoral researcher at STAMI, the Norwegian Institute of Occupational Health. Her current research is aimed towards the advancement of Next Generation Risk Assessment. Her research experience spans multiple biomedical fields including neuroscience and developmental biology. She obtained a PhD in nuclear biology and epigenetics from the University of Oslo.

“Development of an in vitro human liver model as a New Approach Methodology for hepatotoxicity assessment”

Classical toxicity testing of chemical compounds has relied on animal models ranging from small invertebrates to non-human primates. Animal testing is, however, resource intensive and can show limited human relevance as it can fail to accurately predict the toxic effects that may occur in humans. It is estimated that there are around 70 000 chemical substances for which toxicological information is lacking. Given the intrinsic limitations of toxicity testing using animal models, the large number of chemical compounds lacking toxicological information as well as the need to reduce testing in animals, New Approach Methodologies (NAMs) are being developed for safe, accurate and animal-free chemical risk assessment. As part of the Partnership for the Assessment of Risks from Chemicals (PARC), which aims to develop and implement Next Generation Risk Assessment methodology in Europe, we are developing an in vitro human liver multilayer model that recapitulates the key events of human liver fibrosis; supporting the proposed Adverse Outcome Pathways (AOPs) related to liver fibrosis. We will co-culture, in physiologically relevant conditions, the key human cell types involved in the development of liver fibrosis using a transwell system mimicking hepatic tissue architecture. We will expose the multilayer culture to occupationally relevant hepatotoxic chemical substances to evaluate the model. The experimental data obtained from this model will cover some of the key events described in the proposed AOP: cell injury/death, tissue resident cell activation, increased pro-inflammatory mediators, hepatic stellate cell activation and collagen accumulation. We envision to develop NAMs that ensure healthy occupational environments while replacing chemical risk assessment performed in animals.



Hendrik Sakowsky

IFA/DGUV
hendrik.sakowsky@dguv.de



Bio sketch

After completing his bachelor's degree in Forensic Science and working as a research assistant at the Institute of Detection Technology, Hendrik Sakowsky started his master's degree in Analytical Chemistry and Quality Assurance. In the process, he discovered the topic of occupational safety and aerosol measurement technology, which is why he started as a research assistant at the IFA in 2022 and is now writing his master's thesis there.

“Development of high volume personal aerosol samplers”

In recent years a number of occupational exposure limit values have been decreased. This is the case for workplace aerosols and in particular metal species that are associated with more serious health effects according to recent toxicological assessments.

These changes in occupational limit values impact sampling methods (larger volumes must be collected) as well as analytical methods (lower quantification limits). Personal sampling methods used today (as a set of sampler, filter and pump) cover air flows of up to 10 l/min. In order to collect larger quantities of aerosols, a new set of samplers for the inhalable and respirable dust fraction has been developed aiming at an airflow of 20 l/min. This attempt also allows shorter sampling times, e.g. for task-based exposure assessment.

A small set of prototypes was designed for testing. A filter size of 47 mm was chosen to achieve a higher dust load and an acceptable pressure drop for a personal air sampling pump which has already recently been developed and is now available.

Samplers for the inhalable fraction with different numbers, orientations and sizes of orifices are tested in a still air dust chamber and a wind tunnel according to EN 13205 in the particle size range up to 100 µm. A cyclone sampler was designed for the respirable fraction. Preliminary test results are presented, either in comparison with validated samplers or in terms of sampling efficiency as a function of aerodynamic diameter.

Author and co-authors

Hendrik Sakowsky, Carsten Möhlmann
Institut für Arbeitsschutz, Sankt Augustin, Germany



Jackie Morton

HSE
jackie.morton@hse.gov.uk

Bio sketch

Dr Jackie Morton is a principal scientist working at the HSE Science and Research Centre in the Biological Monitoring Team. She has wide experience and expertise in the biological monitoring of inorganic elements and their species using ICP-MS and LC-ICP-MS. This experience is used to better assess workplace exposures to a wide range of analytes.

Jackie's current research projects include analysing exhaled breath samples to determine workplace exposures to silica and metal particles, optimising blood spot analysis to reduce sampling burdens and population exposures to metals and their species.



“Biomonitoring for respirable crystalline silica in UK workers: the determination of Si-containing particles in exhaled breath condensate using single particle inductively coupled mass spectrometry”

The aim of this research is to explore the utility of exhaled breath condensate (EBC) as a biomonitoring matrix for exposure to respirable crystalline silica (RCS). The research presented here describes recent advances in methodology and the results from EBC samples collected from a range of UK workers with possible RCS exposures. Control samples were also collected for comparison. Static air/bulk samples were collected on the post-shift sample day and subsequently the airborne concentration and particle size distribution of RCS in each workplace was determined.

The analytical advances include the use of spICPMSMS to measure Si-containing nanoparticles with a modified sample introduction system facilitating a lower limit of detection. In addition, the EBC sample collection was improved by standardising the collection of the same volume of exhaled air (50 L) from each volunteer.

In total 30 workers, from three different workplaces, provided EBC samples pre shift and post shift. The results showed that whilst the RCS content varied between workplaces, the highest number of Si-containing particles in EBC was observed in the workplaces with the highest RCS concentrations.

This improved methodology offers a viable biomonitoring method for a range of workplaces and has the potential to inform about the efficacy of respiratory protective equipment and control measures in the workplace, complementing occupational hygiene measurements.

Author and co-authors

Jackie Morton, Elizabeth Leese, Samantha Hall, Graeme Hunwin, Delphine Bard
HSE Science and Research Centre, Buxton, UK



Jan Radosz

CIOP-PIB
jarad@ciop.pl

Bio sketch

Jan Radosz, leading the Laboratory of Noise at the Central Institute for Labour Protection in Poland, earned his M.S. in vibroacoustics from AGH University and Ph.D. from CIOP-PIB. His studies focus on health impacts of noise, room acoustics, and technical noise control, resulting in over 30 published papers. Since 2011, he has participated in TAIEX program, and from 2012, he joined the Technical Working Group on Physical Factors in Work Environment in Poland. He currently chairs the Technical Committee No.157 for Physical Hazards at the Polish Committee for Standardization. In 2021, he became a Member of the ICNIRP Scientific Expert Group.



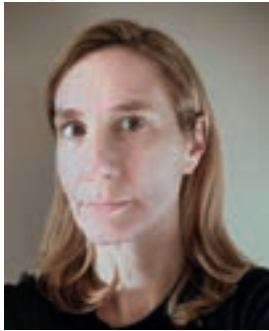
“Advances in noise control - sonic crystals as acoustic barriers”

The need for innovative noise control solutions to achieve sustainable working life has become increasingly evident in recent years. Excessive noise exposure not only deteriorates the quality of life for individuals, but it also poses significant risks to health, including hearing loss, cardiovascular diseases, and cognitive impairment. Therefore, the development of advanced and sustainable noise control solutions is essential for fostering healthier working environments and promoting the well-being of individuals.

The increasing demand for efficient noise control in urban environments and industrial applications has led to the development of innovative materials for sound attenuation. Sonic crystals, which are periodic arrangements of elastic scatterers in a homogeneous medium, have emerged as promising solution for acoustic barriers due to their unique ability to manipulate sound waves. Recent studies show that sonic crystals as acoustic barriers can significantly reduce noise levels in a wide range of applications, including transportation, architectural acoustics, and industrial machinery.

The study presents one of the most promising advances in sonic crystal research; the development of multi-layered sonic crystal structures. These multi-layered configurations enhance sound attenuation by exploiting the cumulative effect of multiple bandgaps and exhibiting a broader range of effective frequency attenuation. Additionally, the combination of different materials and geometries in the multi-layered structure allows for more efficient absorption of a wide range of frequencies.

The adaptability of multi-layered sonic crystals allows for the development of application-specific acoustic barriers, as their properties can be tailored to target specific noise sources and frequency ranges. This enables the design of efficient and customized noise control solutions for various industries, addressing the growing need for improved acoustic environments.



Jennifer Clerté

INRS
jennifer.clerte@inrs.fr



Bio sketch

Jennifer Clerté has a dual background in European geopolitics and information sciences. She has more than twenty years' experience in the field of strategic and economic intelligence. She joined INRS in 2017 as manager of the information service. Since 2022 she joined the Watch and Foresight mission where she dealt with various topics (new forms of organization, artificial intelligence, etc.).

“Artificial Intelligence for Occupational Health and Safety: Prospects and Challenges to 2035 - A prospective study”

The introduction of artificial intelligence systems in workplaces is a reality that raises questions about risk prevention. INRS has conducted a foresight exercise to identify the challenges and prospects for the development of the use of these technologies in the field of occupational health and safety by 2035. The scope of this multidisciplinary study is therefore focused on areas of use that could have an impact on occupational risk prevention.

The aim of the study was to explore the range of possible futures via contrasting scenarios. These scenarios focus in particular on the consequences of developments in terms of working conditions and OHS.

A second phase of the exercise consisted of seminars devoted to three types of possible applications of AI in OHS (use cases), and to confront them with the possible futures described in the scenarios. These use cases are:

- Possible uses of AI tools in epidemiology and accidentology
- Technologies for securing working environments using AI
- Advanced robotics using AI

The group concluded its work by drafting 22 ‘key messages’ that can be criticised amended or used as a basis for reflection initiated by others. These messages can be classified into four headings:

- A growing market
- Promises in OHS
- Limitations and points of vigilance on the use of AI in OHS
- Courses of action

Author and co-authors

Jennifer Clerté, Marc Malenfer

Foresight mission, French Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (INRS)



Jere Immonen

FIOH
jere.immonen@ttl.fi

**Finnish Institute of
Occupational Health**

Bio sketch

Jere Immonen is a researcher at the Finnish Institute of Occupational Health, where he is currently working on the "Fair Work on Platforms" project. He is also a doctoral student at the University of Jyväskylä majoring in Social and Public Policy. His dissertation focuses on control models of online labour platforms and how control activities influence the fairness perceptions of both platform managers and workers.

“Psychological contracts in platform work - The nature of ‘fair deal’ in diverse control structures”

Digital online labour platforms (OLPs) act as intermediaries for labour exchanges (i.e., platform work). Although platform work has gained media attention mainly through food delivery, and ride-hailing services such as Uber, it encompasses various forms of work across multiple sectors. One significant difference between OLPs is the extent of control they exercise over often self-employed workers and their work, including compensations and work intermediation. This has raised concerns about workers' legal classifications and fair treatment. However, as control varies across OLPs, worker experiences of fairness are expected to differ as well.

This study explores the experiences of 32 platform workers from differently controlled OLPs by analysing thematic interviews conducted between 2019 and 2022. The study examines workers' expectations of a ‘fair deal’ between themselves and OLPs using psychological contract theory. The aim is to determine what kind of support, freedom, responsibility, and interaction workers expect from OLP companies. Due to the observed diversity of workers' financial dependencies and life situations, the motivations for doing platform work are analysed to see if they influence the nature of psychological contracts.

Preliminary results suggest that control structures influence the nature of psychological contracts and thus what is considered fair in different OLP contexts. The challenge lies in the diversity of workers' situations and motivations for doing platform work which also impacts their expectations towards OLPs. For example, workers have different degrees of income dependencies on the same OLPs. By offering workers' perspectives on platform work issues, this study contributes to current discussions of fair arrangements for platform work. While the challenges of platform workers have been critical themes in discussions and research, many questions remain unanswered about who should be responsible for addressing financial security and well-being issues.



Joanna Orysiak

CIOP-PIB
joanna.orysiak@ciop.pl



Bio sketch

Joanna Orysiak, PhD, works at the Laboratory of Thermal Loads, Department of Ergonomics, Central Institute for Labour Protection – National Research Institute (CIOP–PIB) in Warsaw, Poland. In her research, she focuses on the influence of various thermal conditions and their consequences on the human body, in particular the immune system and health. She participated in many research projects and is the author of scientific publications on the impact of physical exertion on the immune system and the frequency of infections, mainly in a cold environment.

“Influence of clothing adjustment value (CAV) index on the heat load”

The heat load of workers in a hot environment is determined using the WBGT index. Depending on the value of the above index, performing 8-hour work in a hot environment may or may not be acceptable.

According to the PN-EN ISO 7243 standard, when assessing the heat load of an employee in a hot environment, the clothing correction factor CAV should be taken into account. It reflects the impact of wearing clothing other than standard workwear.

A different type of clothing, especially with a different moisture permeability index, can have a significant impact on the heat load (heat stress) of a worker in a hot environment. CAV is also affected by factors such as radiant heat, air velocity, body movements and, indirectly, the humidity of clothing.

The aim of the work was to present the CAV value of various types of clothing and the impact of including or not the above-mentioned coefficient on the assessment of the heat load. The problem showed in the research task was to illustrate the importance of appropriately determining the value of the CAV index in order to protect the employees against exposure to a hot environment in the most effective way.

This paper is published and based on a research task carried out within the scope of the sixth stage of the National Programme “Governmental Programme for Improvement of Safety and Working Conditions” supported within the scope of state services by the Ministry of Family and Social Policy. Task no. 3.ZS.13 entitled “Determination of Clothing Adjustment Value (CAV) including cooling garments for assessing worker's heat load in hot environments”. The Central Institute for Labour Protection – National Research Institute is the Programme’s main co-ordinator.

Author and co-authors

Magdalena Młynarczyk¹ and Joanna Orysiak¹

Ph.D. Eng. Magdalena Młynarczyk (m.mlynarczyk@ciop.pl) is Head of the Laboratory of thermal load at Ergonomics Department. She deals with the issues of heat exchange between humans and the environment, the impact of the parameters of the external environment on humans, in terms of physiological changes and the possibility of experiencing thermal comfort.

¹ Laboratory of Thermal Load, Department of Ergonomic. Central Institute for Labour Protection – National Research Institute (CIOP-PIB), Czerniakowska 16, 00-701 Warsaw



Joanna Orysiak

CIOP-PIB
joanna.orysiak@ciop.pl



Bio sketch

Joanna Orysiak, PhD, works at the Laboratory of Thermal Loads, Department of Ergonomics, Central Institute for Labour Protection – National Research Institute (CIOP-PIB) in Warsaw, Poland. In her research, she focuses on the influence of various thermal conditions and their consequences on the human body, in particular the immune system and health. She participated in many research projects and is the author of scientific publications on the impact of physical exertion on the immune system and the frequency of infections, mainly in a cold environment.

“Inflammation in firefighters”

The work of a firefighter is very demanding in terms of health, both mentally and physically, due to, for example exposure to air pollution, different sources of stress (heat, mental), as well as extreme physical exertion and a changing circadian rhythm. These factors may have a negative impact on immunity. In certain studies firefighters had elevated levels of a few inflammatory markers, which can lead to development of local, acute inflammation, that can result in a systemic inflammation (Barros et al. 2021 Environ Int; Orysiak et al. 2022 Environ Sci Pollut Res Int). It has been observed, that inflammation is one of the main hallmarks of cancer, cardiovascular and respiratory diseases (Barros et al. 2021 Environ Int; Greten and Grivennikov 2019 Immunity; Orysiak et al. 2022 Environ Sci Pollut Res Int). Last year, The International Agency for Research on Cancer (IARC) classified occupational exposure of a firefighter as carcinogenic to humans (Demers et al. 2022 Lancet Oncol). Therefore, it is very important to know the factors which may contribute to the development of an inflammatory response in firefighters.

This paper is published and based on a research task carried out within the scope of the sixth stage of the National Programme “Governmental Programme for Improvement of Safety and Working Conditions” supported within the scope of state services by the Ministry of Family and Social Policy. Task no. 3.ZS.12 entitled “Hydration status and immune system dysfunctions among officers of selected uniformed services”. The Central Institute for Labour Protection – National Research Institute is the Programme’s main co-ordinator.

Author and co-authors

Orysiak J.¹, Młynarczyk M.¹, Piec R.²

¹ Central Institute for Labour Protection – National Research Institute, Czerniakowska St. 16, 00-701 Warsaw, Poland

²The Main School of Fire Service, Słowackiego St. 52/54, 01-629 Warsaw, Poland



Johan Stenmark

SAWEE

johan.stenmark@mynak.se



Swedish Agency for Work
Environment Expertise

Bio sketch

Johan Stenmark is working as an analyst and project manager at the Swedish agency for work environment expertise. He has been working for the agency for the last three and a half years and before that he worked at the Swedish energy agency. He has also a background in operational development for municipalities and did some work as a resilience consultant. His educational background has an interdisciplinary focus with a bachelor in sociotechnical systems and a master's in sustainable development.

“Pros and cons of remote work under different conditions”

During the first wave of the COVID-19 pandemic in early spring 2020, most countries, including Sweden, chose to recommend or require employees, when it was possible, to work remotely from home to reduce the spread of infection. This review encompasses research literature in three areas, work environment and health, work–life balance and productivity in relation to remote work.

The review consists of two parts. The first one is a review of research reviews of remote work before the pandemic (published 2005–2021), while the second part is a review of original studies of remote work during the pandemic (2020–2021). The searches were conducted in the databases, Social Science Citation Index (SSCI), Psycinfo, Web of Science and Scopus.

The two parts of the review complement one another by identifying the pros and cons of remote work under different conditions. They also provide a basis for conclusions about what must be in place for remote work to work better in the future. The review shows that remote work overall is positive, but it seems to strengthen the effects of both problematic and good working conditions. The results of the studies during the pandemic consistently demonstrate a negative impact on both work–life balance and self-assessed productivity for families with young children. Sweden, which unlike essentially all other countries did not shut down childcare or primary schools during the pandemic, differs significantly from this negative picture.

For individuals to successfully be able to work remotely, they must obtain or be equipped with adequate resources for working independently, which includes, experience in the position, ability to make judgements, personal expertise, ability to act on one's own, possibility for support and help if needed and regular contact with colleagues and managers.

The long-term effects for businesses regarding creativity and innovation remain unknown and require more observation time and more experience with remote work.

Author and co-authors

This work is an external research project managed by Johan Stenmark¹.

The authors of the report are Gunnar Aronsson² and Ulf Lundberg².

¹ Swedish agency for work environment expertise

² Stockholm university



Johanna Nold

BAuA
nold.johanna@baua.bund.de

Bio sketch

Johanna Nold is a research associate in the unit "Working Time and Flexibilisation" at the Federal Institute for Occupational Safety and Health (BAuA) at the Dortmund site. She works on the BAuA Working Time Survey, a biennial panel survey, monitoring activities in the field of working time and well-being. Her research mainly focuses on working time flexibility and reduction, as well as on social inequalities.

"Work less, feel better? Evidence on working time changes and wellbeing in Germany"

Despite predictions that technological advances would lead to a reduction in working hours (Kamerāde et al. 2020), the reality today includes overtime work and long working days (e.g. Li et al. 2020). The issue of working time and its impact on health has long been a concern for researchers and policy makers. Long working hours have been found to be associated with a number of adverse health outcomes (Ervasti et al. 2021). There is also empirical evidence that individual changes in working hours significantly affect health and well-being in a causal manner, e.g. by exploiting exogenous variation in working hours (e.g., Ahn 2016; Cygan-Rehm and Wunder 2018; Lepinteur 2019).

Against this background, this paper examines how individual changes in working time are related to well-being. We address three research questions. First, we ask about the relationship between changes in working time and wellbeing. Second, we ask about differences in the relationship between working hours and health between different groups. Third, we examine the role of flexible working arrangements.

For the analyses, we draw on unique panel data representative of the German working population, the BAuA Working Time Survey. Exploiting the panel structure of the data (four waves: 2015, 2017, 2019, and 2021) by estimating fixed effects regressions allows us to explore intra-individual differences and thus account for time-constant unobserved heterogeneity. We consider different well-being outcomes i.e. self-reported health status, psychosomatic complaints, and work-life balance. The results indicate that a reduction in working hours relates to a better subjective health status and work-life balance as well as less psychosomatic complaints. Psychosomatic complaints seem to be greater among women and childless individuals.

The conclusion of this paper, that working time reductions might have a positive impact on employees' health, which is largely consistent with previous research findings.

Author and co-authors

Johanna Nold, Sophie-Charlotte Meyer
German Federal Institute for Occupational Safety and Health (BAuA)



Johanne Ø. Halvorsen

STAMI

johanne.halvorsen@stami.no



Bio sketch

PhD Research Fellow in the Research Group for Chemical Work Environment at STAMI, the Norwegian National Institute of Occupational Health. Her PhD project is about investigation and characterization of PM generated in the construction industry during demolition and renovation of buildings.

“XRD and Rietveld Refinement - are we missing out by focusing on one component?”

X-ray powder diffraction (XRD) is a well-known technique in occupational chemistry and are amongst other used for quantitative and qualitative determination of respirable silica and metal oxides. The Rietveld refinement is a simultaneous multicomponent analysis that includes all the crystalline components within a sample. The method is standard-less and produces a theoretical diffractogram by minimizing the sum of weighted squared difference between the observed and theoretical peak patterns. There has been little work conducted to test the suitability of Rietveld Refinement for occupational purposes, and this research is meant to highlight the opportunities and obstacles of using Rietveld Refinement in comparison to traditional standardization methods.

Lab samples were produced with a variable quartz to matrix proportion and total mass loadings, ranging from 1-20 wt% quartz and 0,10 mg to 40 mg, respectively. All samples were treated similarly to the NIOSH 7500 method for respirable crystalline silica, to compare results with an external-standard method. XRD with Rietveld was applied to lab-made and respirable field samples collected from demolition of brick and concrete buildings. Initial results show that the field samples contain a mix of silicas such as quartz, feldspars, micas, and clays, in addition to calcite.

Exposures to a complex mix of inorganic components require evaluation of more than specific areas of a XRD diffractogram. By using a full-pattern method and viewing diffractograms as a whole, rather than focusing on specific exposure limits, can help better understand the workers' exposures in terms in content and source.

Author and co-authors

Johanne Ø. Halvorsen^{1,2}

Torunn Kringlen Ervik²

Pål Graff^{1,2}

Elin Lovise Folven Gjengedal¹

Peter Stacey³

¹ STAMI

² NMBU - Norwegian University of Life Sciences

³ HSE



Jorge Martín González

INSST
jorge.martin@insst.mites.gob.es



Bio sketch

Jorge Martín is a social psychologist from the Complutense University of Madrid (UCM). His professional career has focused on consultancy and research. Since 2020, he has been working in the psychosocial risks unit of the Machinery Verification Centre of the Spanish National Institute for Safety and Health at Work (INSST). He has specialized in the subject of digitalization, specifically in the domains of platform work, algorithmic management, and artificial intelligence. He is also part of the digital transition technical team for the implementation of the Spanish Occupational Safety and Health Strategy (2023-2027).

“Psychosocial risks at digital platform work: Main factors related to stress in Spain”

In recent years, interest in the impact of digitalization on Occupational Safety and Health (OSH) has increased, especially related to its effects on work organization. One field of research has been digital platform work, in which several studies and reports have highlighted the relevance of its psychosocial implications. On the one hand, platform work has been defined as an atypical form of employment, which is why usually it is associated with precarious working conditions. On the other hand, other publications have focused on its technological dimension or the “algorithmic management”. They pointed out that digital ‘rating systems’, used to evaluate platform workers (semi) automatically, boost different problems linked with job insecurity and discrimination, and that it could also be associated with increasing emotional job demands, because of the need to gain reputation with client’s five stars ratings. Likewise, another related prominent issue is ‘digital surveillance’ or the constant monitoring of worker activity, which generates consequences for personal privacy, but also is linked with a perception of being controlled that can considerably increase time pressures and the pace of work. Additionally, it is necessary to consider that some of the best-known platform work services are carried out in activities with a higher prevalence of psychosocial risks, such as transportation or delivery. Although the literature on platform work has been expanding, there remains a scarcity of data and the only use of qualitative methods in this research domain (e.g. interviews, ethnographic studies) is also a constraint leading to a lack of evidence-based data analysis. For these reasons, the presentation aims to show statistical evidence about the aforementioned factors that are related to the probability of experiencing stress by platform workers, using the Spanish sample of the COLLEEM survey conducted by the Joint Research Centre (JRC) of the European Commission.



Julia Linke

IFA/DGUV
julia.linke@dguv.de



Bio sketch

Julia works as a Ph.D. student at the Institute for Occupational Safety and Health in the Department of Chemical and Biological Hazards. After finishing her Bachelor's degree in forensic sciences and her master's degree in analytical chemistry, Julia focused her research on environmental chemistry in the context of occupational safety and health. Her scientific interests include chromatographic techniques, chemistry & health, and research oddities.

“A reference material for non-volatile PAHs – development, production and analysis”

The analysis of polycyclic aromatic hydrocarbons (PAHs) has been a topic in environmental and occupational health for decades as they occur in our everyday life e.g. in foodstuffs, cigarette smoke and car exhaust as well as at different workplaces like coking plants and tar distilleries. The analysis of the 16 priority PAHs selected by the US Environmental Protection Agency (EPA) has become a standard procedure in environmental laboratories, given their well-known carcinogenic and mutagenic properties. However, the question arises whether the EPA list should be expanded to include high-molecular-weight (HMW) PAHs, which have a higher carcinogenic potential.

While single laboratories already analyse HMW PAHs routinely, a common ground in the form of a reference material (RM) needs to be established to be used as a quality assurance measure. With this need in mind, our lab aimed towards the development and validation of an RM for non-volatile PAHs for use in round-robin tests. The selection of HMW PAHs was based on their carcinogenicity, focusing on six- and seven-ring systems, along with a representative for alkylated PAHs and benzo[a]pyrene.

The presentation will outline the production process of the RM and how its high reproducibility was verified by internal testing. In three preliminary test series, sets of filters were distributed to several national and international laboratories to examine the accuracy and comparability of the RM. The presentation focuses on the results of these test series, highlighting factors contributing to analytical differences between the participating laboratories and discussing how these differences affect the results. Furthermore, the presentation will outline the next steps of the project, which include the implementation of the RM into the proficiency testing scheme at the IFA.



Kristina Witzler

IFA/DGUV
kristina.witzler@dguv.de



Bio sketch

Kristina Witzler obtained her bachelor's degree in "Chemistry and Material Science" in 2013 and her master's degree in "Analytical Chemistry and Quality Assurance" in 2015, both at the University of Applied Sciences Bonn-Rhein-Sieg, Germany. There she has worked for another two years on an European project regarding border security and detection of explosive devices. Since 2017 Kristina is an analytical chemist and research officer at the Department of Chemical and Biological Hazards, Liquid Chromatography Section, at the Institute of Occupational Safety and Health (IFA). Her focus points are the analysis of isocyanates and quality assurance topics.

"Validation of measurement methods and their uncertainty especially for gases and vapours"

For the air monitoring of hazardous substances, the validity of the sampling process and the analytical method are essential. Critical uncertainty parameters and influencing factors must be determined with validation experiments. For the sampling process, these experiments include the selection of a suitable sampling head and sampling carrier and determination of volume flow rate stability. Analytical validation steps include the determination of the limit of quantification, storage stability, recovery rate and precision. Those experiments are mandatory for all hazardous substances, others may vary depending on the state of aggregation as laid out in different norms. The effect of humidity is to be determined with respect to vapours and gaseous substances (ISO 22065) and particle vapour mixtures (ISO 23861) but not for purely particulate samples (ISO 21832).

The general requirements for measuring methods for hazardous substances with limit values are regulated in the DIN EN 482 standard. Hazardous substances with limits according to the German national exposure-risk related concept are regulated by the TRGS 402 (Technical Rule for Hazardous Substances). The minimum measuring range is specified within these two sets of regulations.

In addition to sampling and sample preparation, the results from the validation tests are also included in the measurement uncertainty consideration, since the results are only determined on a random basis and vary from sample to sample. Each component provides a random and a systematic deviation. Systematic deviations have a direct impact on the measured value, while random deviations are included in the expanded measurement uncertainty. The Institute for Occupational Safety and Health (IFA) of the German Social Accident Insurance has developed a tool to calculate the measurement uncertainty in a convenient way using the outcomes of the validation experiments described in this presentation.



Liza van Dam

TNO
liza.vandam@tno.nl

TNO innovation
for life

Bio sketch

As a researcher at the department of Work Health Technology at TNO, Liza focuses on both quantitative and qualitative research. Her research interests are very diverse but centre mostly around working conditions. She is involved in projects focussing on the monitoring programme at TNO (including the Netherlands Working Conditions Survey), digitalization, forecasting, and risk assessment and evaluation. In addition, Liza likes to show her creative side in her work, by making factsheets, infographics and even animations.

“The impact of new technological developments on various aspects of work for Dutch employees”

Technological developments have the potential to affect our work in different ways. To provide a first insight into the impact on Dutch employees, TNO and Statistics Netherlands developed eight questions on the impact of technological developments relating to different aspects of work to be included in the Netherlands Working Conditions Survey 2022 (NWCS; TNO|CBS, 2023), one of the largest periodical surveys in the Netherlands about work. Due to its large sample size and weighing of the data, the NWCS provides a reliable representation of all employees in the Netherlands.

In this abstract, some first insights are presented relating to efficiency, information processing and the mental and physical load of the work. Firstly, when asked about efficiency, 38% of employees indicate that they are able to do more work in the same amount of time, 8% thinks that they can do less. As for information processing, 6% of employees think that they are able to process less information due to new technological developments, whereas 45% indicates they can process more.

When asked about the mental load of their work, 23% of employees indicate that it has increased, as opposed to 13% who thinks their mental load has decreased. As for the physical load, 3% of employees think their physical demands at work have increased, whereas 18% thinks the work is physically lighter.

In addition, the results indicate that the perceived impact of new technological developments differs between age groups. Younger employees (between 15 – 25 years) report more often than other employees that their work has become easier and that both the mental and physical loads have decreased. Older employees (between 55 - 65 years) report more often than other employees that their work has become more difficult, less fun, and that the mental load has increased.

Further analyses are necessary, but these findings provide a valuable first insight into the impact of technological developments on Dutch employees.

Author and co-authors

Liza van Dam, Swenneke van den Heuvel, Paul Couzy, Merel In der Maur
Netherlands Organisation for Applied Scientific Research (TNO)



Luuk Bouwens

TNO
luuk.bouwens@tno.nl



Bio sketch

Luuk Bouwens is a researcher at TNO in the field of mental health of employees. In his PhD research at Amsterdam UMC, he focuses on the prevention of mental health issues among employees using a tailored intervention program.

“Vital@Work: a tailored intervention program for prevention of work stress”

Work stress is a serious problem among workers in various work settings. To prevent for work related stress, effective interventions should be implemented in the workplace. However, effective interventions frequently fail to work if applied in a different (work) setting. This is partly due to lack of evidence for interventions tailored to behavioural, organizational & contextual (BOC) determinants of individuals and populations at risk. In the present study we develop and evaluate effectiveness of a participatory approach (PA) to tailor interventions to BOC-determinants of individuals and populations at risk, directed at prevention of work stress.

In this presentation, more information about the research design of this cluster randomized controlled trial (RCT), the importance of BOC determinants in the implementation of interventions and the operationalization of participation and mental well-being will be provided. Additionally, preliminary results from focus group interviews can presumably be reported at the time of the conference. These results provide insight into relevant BOC determinants of successful implementation of interventions in different organizations.

Author and co-authors

Luuk Bouwens^{1,2}, Roos Schelvis², Trees Juurlink², Allard de Smalen², Aartjan Beekman², Han Anema²

¹ Netherlands Organisation for Applied Scientific Research (TNO)

² Amsterdam UMC



Małgorzata Okrasa

CIOP-PIB
maokr@ciop.lodz.pl



Bio sketch

Małgorzata serves as the Head of the Eyes and Face Protection Laboratory at CIOP-PIB. Her engagement spans an array of safety research and environmental engineering domains, with particular emphasis on occupational exposure to hazardous airborne substances such as bioaerosols. Her work also encompasses the development and testing of personal protective equipment (PPE), ensuring their optimal design and performance relative to present hazards and specific working conditions.

“New ASSIST-IoT approach for a real-time risk assessment and management concerning UV light exposure at the construction site”

According to scientific research, prolonged exposure to solar ultraviolet radiation can cause skin damage and contribute to the growth of malignant melanoma and non-melanoma skin cancer in humans. These include basal cell carcinoma and squamous cell carcinoma. Occupational groups that involve outdoor work, such as construction, carry a potential risk of exposure to solar ultraviolet radiation. The impact of this type of occupational exposure is affected by various factors, including geography, climate, genetics, and behaviour of workers.

Assessing hazards for outdoor work is typically a semi-quantitative process, which involves combining qualitative observations and quantitative data. The UV Index provides an initial baseline exposure value. Further information can be obtained through a study of the worksite and tasks, which can help to provide an indication of individual worker exposure. As a component of the ASSIST-IoT project, an algorithm was devised to perform UV hazard evaluation and risk assessment for outdoor workers in real-time at a construction site. The algorithm considers factors such as the worker's location, season, duration of exposure, and initial protection levels.

The developed algorithm was seamlessly integrated with the ASSIST-IoT system and tested under actual field conditions. This paper presents the initial research findings, including an analysis of the implications for occupational health and safety of workers on the construction site. Moreover, the discussion highlights the potential for expanding the system's capabilities to include additional environmental factors and its suitability for deployment in various outdoor work settings.

Author and co-authors

Małgorzata Okrasa¹, Grzegorz Owczarek¹, Monika Kobus¹, Anna Dąbrowska¹, Georgios Stavropoulos², Anastasia Kassiani Blitsi², Konstantinos Flevarakis²

¹ Central Institute for Labour Protection – National Research Institute, Czerniakowska St. 16, 00-701 Warsaw, Poland

² Centre for Research and Technology Hellas – CERTH, 6th km Charilaou-Thermi Rd, GR 57001 Thermi, Thessaloniki, Greece



Malte van Veen

TNO
malte.steinhoff@tno.nl



Bio sketch

Malte van Veen is a researcher at TNO Healthy Living and Work and PhD-student at Amsterdam UMC. He has a background in social and organizational Psychology and Epidemiology. His research focus is on mental health of young workers.

“Trends in mental health complaints of Dutch young workers and potential causes”

Based on earlier analyses, which showed that burnout-related complaints were increasing more in young workers compared to the general working population, the Dutch Ministry of Ministry of Social Affairs and Employment called on research to analyse trends within this group. The goal was to identify potential risk groups and underlying reason for this observed increase.

We conducted secondary data analyses on the Netherlands Working Conditions Survey (NWCS) and focus-groups with young workers. For the secondary data analysis the two outcomes were burnout-related complaints, measured as emotional exhaustion and absenteeism from work with psychological or stress complaints, which were at least partly caused by work. We analysed NWCS-waves from 2015 up to and including 2022. We conducted four focus-groups with in total 27 young workers. In these focus-groups we mixed open and closed questions and asked for stressors within and beyond work.

When grouping young workers on severity of burnout-related complaints within each year, there is a robust increase in complaint severity over the years in the group with most complaints. For young workers with fewer burnout-related complaints on the other hand, the scores were stable. When analysing the distribution of burnout-related complaints and how they changed over the years, we found that there were fewer female young workers with little complaints. For absenteeism we also found a general increase over the years. This increase was highest in university-educated women. Focus-group participants ranked performance pressure, uncertainties in life, and social pressure as the top three causes of stress. Young workers reported a lack of perspective concerning what they are working for, a negative effect of seeing others succeed on social media, and that they feel pressure to always appear happy.

Further research is needed to better understand the origins of stress perceptions of young workers.



Manuel Kühn

IFA/DGUV
manuel.kuehn@dguv.de



Bio sketch

Manuel Kühn has been an employee at the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA/DGUV) since 2016. He is currently head of "Exposure Monitoring – Measurement System for Exposure Assessment" at the IFA. He is an expert in the field of workplace exposures and has extensive knowledge and experience in the assessment and documentation of hazardous substance exposures in the workplace. Additionally, he has experience as a project manager in IT projects and has been instrumental in the implementation and deployment of OMEGAone. He is a dedicated employee who always strives to contribute to the success of the German Social Accident Insurance.

“How occupational safety benefits from digitization - OMEGA one”

The digital ambitions of the German Social Accident Insurance (DGUV) are decisive for the digitalization of the MGU (Measurement System for Exposure Assessment of the German Social Accident Insurance Institutions): The right balance must be found between digital process optimization, networking, end-to-end relationships, and transformational zeal. Since there was no uniform understanding of digitization in the MGU to date, the OMEGA redevelopment resulted in a separate definition of the term and its facets. These include, in particular, digitization of the technological basis of DGUV products, in-house cultural change in the use of digital tools, and topics of collaboration and data management. While the improvement of existing business processes through digital optimization brings short-term benefits in particular, the long-term benefits of investments in digitization are particularly evident in the networking of systems and data of the MGU, which enable holistic evaluations of the exposure of today and for tomorrow. This also justifies the social relevance of the MGU. Through the competencies bundled there and its work, the MGU is anchoring itself as a reference system of globally recognized research. The prevention concept of protecting employees against hazards in the workplace is to be taken to the next level by using digital processes to generate greater added value from existing and future information. Accordingly, the MGU's claim is not limited to one-dimensional digital optimization. Rather, a product-encompassing, networked, knowledge- and value-creating vision is the foundation of any further digitalization of the MGU.

This presentation will show what users can expect from the new system and what requirements OMEGA must meet in the digitalized future of the MGU.



Marc Malenfer

INRS
marc.malenfer@inrs.fr

Bio sketch

Marc Malenfer is in charge of the watch and foresight unit of INRS. He has a dual background in history and risk management. He joined INRS in 2005, where he worked in communication and in a mission for occupational risk prevention in small and medium-sized enterprises. He is a member of the watch and foresight unit since 2017 where he has dealt with various topics: uberization, circular economy, artificial intelligence, etc.



“Buildings of the future. What challenges for OSH?”

INRS conducted in 2021 a foresight exercise, entitled ‘Tomorrow's buildings what are the occupational health and safety issues?’

The constructed scenarios highlighted drivers of change in the construction industry which will be decisive in the years to come. They break down into three fields:

- Digitisation: two particular issues were examined, the BIM (Building Information Modelling) and the development of the platform economy in the construction sector;
- Environmental transition: with two main drivers of change for the sector that are energy-efficiency renovation and the circular economy;
- Industrialisation: construction processes are increasingly similar to those of industry. This issue is addressed through the development of off-site construction and the emergence of robotisation.

These factors will be the decisive drivers of change in construction industry in the next few years and will each have an impact on occupational safety and health.

The possible futures explored are hopeful but also a cause for concern for different risks including:

- musculoskeletal disorders and lower back pain: e.g. the development of re-use in the sector requires more manual handling;
- falls: e.g. the use of drones can help reduce work at height;
- exposure to chemical contaminants: e.g. recycling operations can generate new exposure to hazardous substances;
- psychosocial risks: e.g. the digitization and industrialisation of processes can lead to an increase in certain PSR factors.

The last part of this exercise was devoted to the exploration of cross-cutting challenges which appear as particularly decisive in terms of work conditions and safety both for construction workers and for future players and professional users of the buildings:

- coordination among players: the changes mentioned, such as new technologies, could significantly impact the management of the various coordination and prevention plans. A fair balance will have to be found between what technology allows and the need to maintain human contact, which is often necessary to update and resolve specific situations at the limits of what is possible;



- consideration of subsequent operations: measures must be taken at the design stage of tools like BIM to incorporate technical rules to facilitate the maintenance and deconstruction of the building's components and avoid a lack of traceability of hazardous materials;
- repurposing of buildings for new professional uses: the limitations inherent in the architecture and type of construction of the original building must not constitute obstacles to a redevelopment that allows workers to carry out their activity under good conditions.

Author and co-authors

Marc Malenfer, Michel Héry

French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (INRS)





Maria Johansson

Luleå University of Technology
maria.4.johansson@ltu.se

Bio sketch

Maria Johansson is an associate senior lecturer in Human Work Sciences at the Department of Social science, Technology, and Arts at Luleå University of Technology in Sweden. Her research interest concerns occupational safety and health as well as gender and equality in working life.



“A literature review: Managing occupational safety and health, meanings of company size and work organisation”

Joint project: Swedish Agency for Work Environment Expertise & Luleå University of Technology

This study aims to identify scientific articles about how occupational safety and health (OSH) is handled in companies, focusing on company size and work organisation. It is investigated through the following research questions:

1. How is the handling of OSH described in relation to company size? What possible differences between small companies and large companies are identified?
2. How is the handling of OSH described in relation to work organisation? Does the way the work is organised create different conditions for the handling of OSH?

Search strings were designed to capture articles that dealt with the questions. A total of 53 scientific articles are included, of which 31 concern company size and the rest, that is, 22 articles, concern work organisation. The included articles were published in scientific journals from 2000 to 2022 and underwent a scientific review process before publication. The articles are in English.

The conclusions of the literature review are that company size is important for the handling of OSH but that it is not a decisive aspect. In addition to company size, other aspects also emerge as important. However, company size is important for the choice to invest in healthy workplaces, where large companies are described as investing more resources in health promotion than small and medium-sized ones. Further, the tendency to implement OSH legislation is less in small companies than in large companies. Small companies also tend to use services from occupational health to a lesser extent than large companies. Furthermore, learning processes at the group and organisational levels are highlighted as important for strengthening the handling of OSH. Also, safety culture development emerged as an important aspect for strengthening learning processes, contributing to the handling of OSH. Furthermore, the results show that staff involvement at all organisational levels strengthens the handling of OSH.

This work has been financed by the Swedish Agency for Work Environment Expertise. The report is part of the Swedish SAWEE project Healthy and Good Work: Latest Ten Years of Healthy and Good Work (theme 1) and Managing of OSH (theme 2).

Author and co-authors

Maria Johansson, Anna Berg Jansson, Leif Berglund, Lena Abrahamsson, Saila Piippola
Department of Social science, Technology, and Arts, Luleå University of Technology



Marlene Dietz

BAuA
dietz.marlene@baua.bund.de

Bio sketch

Marlene Dietz is a research assistant at the Federal Institute for Occupational Safety and Health. Her main scientific interest is the oral exposure in the workplace. The development of a model describing this exposure route is the subject of her doctoral thesis.

“Occupational Oral Exposure: Data and Knowledge Base for Assessment and Modelling”

Assessing inhalation and dermal exposure to chemicals in the workplace according to European chemical legislation and OSH legislation helps to protect workers. Oral exposure as a potential third route of exposure has not been the focus of research in the scientific community or of risk assessment in regulatory frameworks. However, the relevance of unintentional ingestion of chemicals in the workplace is indicated by parallel measurements of inhalation exposure, dermal exposure and biomonitoring campaigns.

The current data and knowledge base for occupational oral exposure measurement and modelling will be presented.

A review of the literature providing evidence on the role and relevance of oral exposure in workplaces was conducted. Existing measuring and modelling approaches as well as mechanisms leading to oral exposure were identified.

Preliminary results suggest a relevance of oral exposure in the workplace. A small number of modelling approaches describe the transfer of the substance between contaminated surfaces and the mouth as the main mechanism. This transfer is influenced by the frequency of contact, e.g. between hands and mouth, and thus by human behaviour. Therefore, behavioural studies on adults play an important role. However, current modelling approaches do not yet include existing dermal exposure data as a starting point for oral transfer.

Finally, there is a need to estimate occupational oral exposure, as the data collected indicate its relevance compared to dermal and inhalation exposure. The next steps towards efficient oral exposure modelling are considered to be the identification of further parameters of occupational oral exposure and the further development of modelling approaches.



Martin Westhoven

BAuA
westhoven.martin@baua.bund.de

Bio sketch

Martin Westhoven obtained a diploma in Computer Science at the University of Bonn and a Bachelor degree in Psychology at the Fernuniversität in Hagen. After eight years in various projects on Human Computer Interaction, from 2020 on, his work focuses on the intersection of Artificial Intelligence and Occupational Safety and Health at the German Federal Institute for Occupational Safety and Health (BAuA).

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“Potentials of Artificial Intelligence for Occupational Safety Risk Analysis”

In this work, we study the possibilities of using artificial intelligence as a tool for occupational safety and health. To narrow down the field of application, we focus the safety management or respectively the risk management in regards to occupational safety. In this domain, heterogeneous and complex data build up, which are not easily accessible in terms of analysing their dependencies. In parts, they also consist of rather rare events (e.g. accidents), which are typically not handled well by artificial intelligence approaches. With the approach of few shot learning, however, this hindrance could be overcome and thus open a way to analyse and model less apparent dependencies and to thus identify risks.

We approached this rather large topic with work on requirements elicitation, by studying the possibilities to gain relevant data access, and by outlining requirements and possible solutions for a fitting interaction design.

As interviews with occupational safety experts yielded the insight that most of the relevant data exists in more or less structured text documents, we currently focus on applying natural language processing to the problem.

In summary, there are several challenges to master before a meaningful deployment can be done in a real-world context: Heterogeneous and high-dimensional data, few labelled data points, missing data, and an adequate UI design including such points as Explainability and maintaining human competencies.

For each of these challenges, there exist solutions or at least outlines of solutions. The core of this work is thus rather to fuse all these approaches together and to adjust them to the target domain. This includes the integration of the different functionalities, the implementation of the UI, and finally to evaluate the application in a real-world or near real-world environment regarding performance as well as usability.

From the insights gained in the process, we can draw conclusions regarding a more generalized approach.



Mathieu Melczer

INRS
mathieu.melczer@inrs.fr



Bio sketch

Mathieu Melczer began a PhD in 2022 on the speciation of cadmium in blood at the French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (INRS), where he has been working for 13 years. With 18 years of expertise in analytical chemistry, he contributes in carrying out research with a primary focus on occupational exposure and human biomonitoring. His specialty is the analysis of inorganic substances among workers, including inorganic species and protein complexes.

“Targeted cadmium species analysis in blood for occupational exposure evaluation: a feasibility study”

Cadmium is widely present in companies, even though it is toxic at low doses. Today, biological monitoring of exposed employees is mainly performed by analysis of total cadmium in urine. However, a recent INRS study in the battery recycling sector revealed the difficulties of interpreting urine results: although the employees were exposed to high amounts of cadmium, their urinary cadmium levels were still below the biological limit value (BLV) set by Anses at 2 µg/g creatinine. The reason is that the cadmium concentration in urine samples does not represent the cadmium stored in the body and therefore health risks incurred by employees exposed to cadmium.

However a more comprehensive analysis based on speciation and fractionation of cadmium in blood could allow to distinguish cadmium stored in the long-term in the body from cadmium absorbed following a recent exposure. Indeed, considering the toxicokinetics of cadmium, we believe that the establishment of a profile of the species present in the blood could give this information. The developed analytical tools will make possible to separate and quantify cadmium species of interest in plasma and red blood cells (erythrocytes).

Concerning erythrocytes, the quantities of various elements, notably cadmium, will be measured in each cell by single cell inductively coupled plasma (SC-ICP-MS). For now, we have developed this analysis from samples provided by the French Blood Establishment (EFS). Next, we will consider blood plasma in order to analyse metalloproteins with cadmium as metal ion binding by chromatography linked to ICP-MS (LC-ICP-MS). Finally, both techniques will be applied to blood samples from employees of the battery recycling sector. A robust protocol will be defined and optimized in order to produce simple and usable analytical tools for laboratories.



Mathilde Schwartz

INRS

mathilde.schwartz@inrs.fr

Bio sketch

Mathilde Schwartz is a researcher in physiology and biomechanics in the field of physical assistance robots, exoskeletons at INRS (French National Research and Safety Institute) in the Working Life Department.



“Influence of the characteristics of active back-support exoskeletons on muscle activity during a lifting task”

Context In order to prevent musculoskeletal disorders (MSDs), such as low back pain, companies have turned to occupational exoskeleton solutions. Numerous studies have shown that during manual handling tasks, the activity of the back muscles could be reduced when using a back-support exoskeleton. However, it appears that many factors can influence these benefits such as the characteristics of the exoskeleton, of the task but also the interactions between them. The objective of this study was to analyse the consequences of two different active back-support exoskeletons on the electromyographic (EMG) activity of back extensor muscles.

Method Fifteen men completed a full trunk flexion/extension task carried out with two loads (5 and 15 kg). The task was performed without equipment (CON) and with two active back-support exoskeletons (EXO1 and EXO2), alternately set at two assistance levels (24 and 72Nm). The EMG activity of the erector spinae (ES) and biceps femoris (BF) muscles was analysed over two successive angular phases of the trunk extension (P1 then P2; each phase corresponding to 50% of the total amplitude of the movement).

Results The use of both exoskeletons significantly ($p < 0.01$) reduced the activity of the ES and BF muscles compared to without equipment. However, depending on the exoskeleton used (EXO1 or EXO2), the level of assistance (24 or 72 Nm), the load lifted (5 or 15 kg) and the trunk angle (P1 or P2), the EMG reductions ranged from 11 to 43%.

Conclusions The use of active back-support exoskeletons during manual handling tasks can reduce muscle activity. However, this reduction depends on the interaction between different factors such as the characteristics of the exoskeleton used (in terms of design, level of assistance) and the task performed (load, trunk angle). Thus, when deciding to integrate such systems, it is first of all essential to accurately analyse the task to be performed in order to select the most suitable exoskeleton.

Author and co-authors

Schwartz Mathilde¹, Desbrosses Kevin¹, Theurel Jean¹, Mornieux Guillaume²

¹ Working Life Department, French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (INRS)

² Faculty of Sport Sciences, DevAH, Université de Lorraine, Nancy, France



Matthias Clermont

IFA/DGUV
matthias.clermont@dguv.de



Bio sketch

Matthias Clermont studied Biomedical Engineering (M.Sc.) and works as a research associate at IFA as part of the group of accidental prevention. His working group does research in human-machine interaction regarding structural biomechanics. He has focused on using different techniques as finite-element simulation to analyse damage mechanics due to external loads.

“Estimating hazards of pulling-in zones in transportation process of flexible foils on roller in foil machines - Literature research and conception of a measurement”

Guiding rollers are often used for web transportation and processing in foil machines. Zones where a foil runs onto a roller are in some cases free of access for the worker and might constitute hazardous feed zones for the upper extremities. In contrast to opposite-moving rollers which are secured by fixed guards, there are no specific recommendations if installation of protective devices is needed in guiding rollers.

A literature research shows that national and international standardization do not give a sufficient explanation on how to assess these zones regarding a pulling-in hazard. The approach of this work is to assess what pulling strength can be applied by the human upper extremities to still escape a pull-in. In addition, the contact between foil and roller is described by physical principles, which are used to estimate resulting pulling-in forces due to traction in the hazardous area. Results will be presented and discussed at the conference.

A measuring device is developed at the Institute for Occupational Safety and Health of the German Social Accident Insurance to measure pulling-in forces. A test specimen which reproduces shape of the human hand is inserted into the critical zone. Resulting pulling forces are measured by uniaxial force measuring device. Experimental data can be compared to the results of the literature research, to evaluate entanglement hazards.

Author and co-authors

Matthias Clermont, Jan Zimmermann
Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA/DGUV)



Michael Hemingway

HSE
michael.hemingway@hse.gov.uk

Bio sketch

Michael Hemingway has worked for over 30 years in health and safety mainly in gas detection and aerosol science. He is principally concerned with the applications of real-time instrumentation for the measurement of toxic and flammable gas and dusts in incident investigations, and the Major Hazards and Occupational Hygiene fields. His work has included FTIR and IR gas detection, gas imaging techniques, mine fire detection, optimisation of gas detector location and networks, and Laboratory evaluation of vapour filter performance.

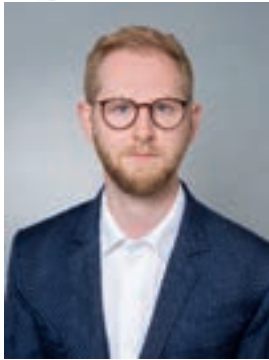


“Novel sampling and real-time measurement of workplace silica exposures”

HSE researchers' visited three manufacturing workplaces where there was a potential for respirable crystalline silica exposure. This was to determine potential worker exposures to dust and respirable crystalline silica; to evaluate a new technique for determining the number of silicon containing particles in the exhaled breath of workers; and to compare traditional and newer low-cost airborne particle measurement techniques. The first site prepared coatings by loading powders, frit and water into various sized mills, the second manufactured bricks and the third processed kitchen worktops and headstones. Airborne dust concentrations were measured using two photometers, an optical particle counter (OPC) and a respirable cyclone. The size distribution was measured in real-time using a low-cost OPC and by offline analysis of a polycarbonate membrane filter housed inside an inhalable sampler. The pre and post shift samples of exhaled breath condensate were collected from 30 workers in total, with samples analysed by single particle inductively coupled plasma mass spectrometry to measure the number and size of silicon containing particles present. The real-time air monitoring data indicated the tasks most likely to contribute to worker exposure, provided good information about the changes in concentration over time relating to worker activities, and showed good agreement between traditional measurement methods and newer low-cost instruments. The exhaled breath data showed an increase in silicon containing particles post shift, with a trend in agreement with measured airborne concentrations across the three sites.

Author and co-authors

Samantha Hall, Delphine Bard, Graeme Hunwin, Elizabeth Leese, Jackie Morton, Mike Hemingway
HSE Science and Research Division, UK



Moritz Schneider

IFA/DGUV
moritz.schneider@dguv.de



Bio sketch

Moritz Schneider, M.Sc. is Senior Specialist for Artificial Intelligence and Software Architecture and head of the competence centre for Artificial Intelligence and Big Data at the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA/DGUV). He is an university lecturer, supervises theses in the field of artificial intelligence (Deep Learning) and Software Engineering while dedicating his knowledge and skills for years to the service of science in order to advance occupational health and safety through technical solutions.

“Prevention of slip, trip and fall accidents using machine learning”

Slip, trip, and fall (STF) accidents cause high rates of work absences for many companies. In the traffic, transport, and logistics sector, STF accidents are the most common reportable occupational accidents. German employers' liability insurance associations reported 172,045 STF accidents, including seven fatalities and 2,694 pensions in the period covered by the DGUV Report 2021. To prevent STF accidents, companies should follow the internationally established STOP hierarchy of controls: substitution, technical protective measures, organizational protective measures, and personal protective measures. However, STF hazards that occur due to adverse weather conditions and road traffic are difficult to control, requiring personal protective measures. The ENTRAPon project aims to develop additional training elements for preventing STF accidents. The project's primary objective is to supplement existing training tools (e.g. warehouse simulator) by setting up and evaluating a perturbation-based training. In order to quantify the transfer of the training to STF hazards, a parkour is used that provokes standardized STF perturbations. The parkour includes STF elements, categorized as unexpected trip and slip-like perturbations and changes in surface compliance. This research project uses ambulatory inertial measurement units to collect kinematic data during training and transfer testing to assess dynamic stability control. The collected data can also be used to categorize near falls and provide a database for machine learning methods. The goal is to develop a prevention warning system suitable for broad use in occupational practice, which can accurately profile critical situations, perform precise risk assessments, predict personal fall risk, and effectively reduce STF accidents in the long term.



Mrinal Kumar Das

STAMI
mrinal.das@stami.no



Bio sketch

Mrinal Das is pursuing his second postdoctoral research at toxicology group, STAMI, the Norwegian national institute of occupational health, focusing on shiftwork and cardiovascular disease development. Previously, he did his first postdoctoral research in neurological disorder/ALS at the department of molecular medicine, faculty of medicine, University of Oslo and completed his PhD in testicular germ cell tumour biology at OsloMet – Oslo Metropolitan University.

“Working Against the Clock: A systematic review on mechanistic evidence for shiftwork-mediated cardiovascular disease”

Background Shiftwork is prevalent in modern societies, allowing for continuous operations and meeting the demands of a 24/7 workforce. Ample evidence suggests the causal relationship between shiftwork-mediated circadian disruption and various disease developments including cardiovascular diseases (CVD). The underlying mechanisms of how shift work increases the risk of CVD incidents are however poorly understood. In this systematic review, we aim to synthesize the existing mechanistic proof of evidence on the association between shiftwork and CVD, including potential mediating factors. The focus of the study was specifically to investigate the evidence of shiftwork-mediated changes on the previously described 12 key characteristics of CVD development.

Methods A systematic literature search was conducted across multiple databases, including PubMed, Embase, and Web of Science, utilizing a combination of keywords related to shiftwork or sleep deprivation and cardiovascular diseases. To select studies for full-text screening, predefined inclusion criteria were set, focusing on original epidemiological or experimental studies in healthy adult individuals. Therefore, clinical trials or reports, and case-control studies were excluded. Abstract and full-text screening was performed by using a PICO (Population, Intervention, Comparison, Outcome) approach by two independent reviewers. Quality assessment and data extraction were also performed by two independent reviewers. For the quality assessment, appropriate JBI tools were applied for epidemiological studies and a modified ToxRTool was used for in vivo and in vitro studies. Data on study design, sample size, population characteristics (e.g., age, sex, BMI), shiftwork or sleep deprivation exposure, and CVD outcomes according to the 12 key characteristics were extracted. Due to the anticipated heterogeneity among the included studies, a narrative synthesis approach will be employed, by summarizing key findings among similar groups of interventions and outcomes.

Results After removal of duplicates, 6080 articles were included for the title and abstract screening. According to the predefined inclusion and exclusion criteria, 1007 articles were included for full-text screening, resulting in 246 articles to be quality assessed. These studies included 159 epidemiological studies (mostly non-randomized observational studies), 71 in vivo studies and 17 in vitro studies. Our preliminary data indicate that most of the studies investigated the mechanistic evidence for association between shiftwork-mediated circadian disruption and vascular-specific key characteristics, i.e., vascular endothelial dysfunction, dyslipidemia, and alteration of homeostasis.



Conclusion Our preliminary data suggest that there is a little evidence on the potential involvement of cardiac-specific key characteristics in shiftwork-mediated CVD development. Furthermore, both epidemiological and experimental data imply that vascular endothelial dysfunction, dyslipidemia, and alteration of homeostasis might be potential mechanisms in the development of shiftwork- and circadian disruption-mediated CVD.

Author and co-authors

Mrinal Kumar Das¹, Evi De Ryck², Barbara Harding³, Manosij Ghosh², Merete Bugge¹, Jenny-Anne S Lie¹, Ingrid Sivesind Mehlum¹, Karl-Christian Nordby¹, Manolis Kogevinas³, Shanbeh Zienolddiny-Narui¹, Johanna Samulin Erdem¹

¹ National Institute of Occupational Health, Oslo, 0363, Norway

² Department of Public Health and Primary Care, KU Leuven, Leuven 3000, Belgium

³ Barcelona Institute for Global Health, Barcelona 08003, Spain





Narech Houessou

INRS

narech.houessou@inrs.fr



Bio sketch

Narech Houessou has been a doctoral researcher at INRS since March 2022, working on spatio-temporal mapping of pollutant exposure in working environments. She has a master's degree in information systems and computer networks, and several years' experience in software engineering. She is very interested in applying automatic methods to real-world applications. Her current research focuses on signal processing and machine learning, in particular data fusion and spatio-temporal data analysis and mapping.

“Design and characterisation of a methodology for spatio-temporal mapping of exposures at the workplace”

The INRS has started a study to define a methodology for spatio-temporal analysis of exposures, applicable to occupational environments and to design an appropriate experimental tool. The purposes are to develop an experimental prototype for the acquisition, analysis and representation of heterogeneous spatio-temporal data. The prototype includes a network of sensors measuring different airborne pollutants (gas/particles), a 3D scanner for the 2D/3D digitalization of the working environments, and an indoor positioning system. Its ability to build spatio-temporal maps of pollutant concentrations will be evaluated under controlled laboratory conditions and in companies. The potential of the experimental prototype to improve prevention actions will also be examined.

The purpose of the presentation is to provide an update on the work done in this study. The research first focused on the analysis and representation of spatio-temporal data and on mathematical models to be used, for estimating and predicting concentrations from strategically positioned measurement devices. Mathematical models based primarily on geostatic procedures such as Ordinary Kriging and others as well as machine learning techniques are tested as effective methods for spatial interpolation of environmental variables. Data fusion regarding concentration, position and 2D/3D digitalization is also studied in order to design the experimental prototype. The prototype was then deployed under controlled conditions in an experimental chamber in which pollution and purification scenarios have been tested. This allowed to achieve spatio-temporal mapping of CO₂ (used as a tracer) in the chamber and to start the investigations the main determinants of mapping including, the strategy for deploying the sensors mapped area, the repeatability and the quality of the mapping etc., as well as data fusion. The presentation will detail the main findings and discuss the experimental perspectives regarding the ongoing study and longer-term ones.

Author and co-authors

Narech Houessou^{1,2}, Karine Gérardin¹, Bruno Galland¹, Philippe Duquenne¹, Sebastian Miron²

¹ Laboratoire d'Analyses Spatiales et Temporelles des Expositions Chimiques, INRS, 54519 Vandœuvre-lès-Nancy Cedex, France

² Centre de Recherche en Automatique de Nancy, Université de Lorraine, CNRS, 54519 Vandœuvre-lès-Nancy Cedex, France



Natalia Litwicka

CIOP-PIB
nalit@ciop.lodz.pl



Bio sketch

Natalia Litwicka graduated with a master's degree from the University of Lodz, Faculty of Chemistry in 2022. Since March 2022, she has been a researcher at the Central Institute for Labor Protection - National Research Institute in the Department of Personal Protective Equipment, Laboratory of Hand and Foot Protection, as an engineer. In her scientific work, she deals with the problems of chemical research on polymer materials for protective gloves and footwear. Specialization: chemistry, environmental engineering, chemical metrology.

“Contemporary Gloves Protection”

Inspiration from nature creates opportunities for the development of hand protections as well as for imparting new features to standard products, which would be impossible to obtain with traditional technologies. There is a real need to improve the design of protection products so that manufacturing processes are miniaturized and energy efficient, and product life is extended. Protective glove materials are evaluated for compliance with normative documents falling under European Union and Parliament (EU) Regulation 2016/425.

Novel glove materials have arisen in response to technological advances and new approach in evaluating the work environment. In order to improve working conditions in wet and chemically contaminated environments, superhydrophobic polymer gloves have been developed and manufactured at the CIOP-PIB Institute, taking inspiration from nature (gecko's foot), with water and contaminants effectively draining off the glove area. The results show that the surface of the biomimetic material is characterized by a contact angle of 142° and a surface free energy of 40 mJ m^{-2} . From a physical point of view, this makes it possible for water droplets to “roll” on the surface. Such droplets may additionally collect contaminants present on the surface and also ensure good adhesion of objects to wetted surfaces, thereby protecting against slippage due to the phenomenon of reversible and controlled adhesion. A textile material coated with three-dimensional structures with added basalt (0.001–0.9 mm) has been developed and produced at the CIOP-PIB Institute in cooperation with the manufacturer, leading to a 5-fold increase in cut resistance as compared to standard gloves. Currently, work is underway on hybrid textile materials coated with a polymer layer with the addition of graphene to improve thermal and mechanical properties. Preliminary results indicate that the addition of graphene to the coating layer enhances thermal and mechanical protection properties. The material is promising in terms of further structural applications in modern hand protections for firefighters.

Author and co-authors

Natalia Litwicka, Emilia Irzmanska
Central Institute for Labour Protection – National Research Institute, Czerniakowska St. 16, 00-701
Warsaw, Poland



Omar El-Edrissi

IFA/DGUV
omar.el-edrissi@dguv.de



Bio sketch

Graduated from the German Sport University Cologne (GSU) with a master's degree in "Human Technology in Sports and Medicine" Omar is currently working as research associate in the section "Musculoskeletal Workload" of the department "Ergonomics, Physical Environmental Factors" at the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA) in Sankt Augustin.

"Impact of back supporting exoskeletons on kinematics and joint loading of the lower body during gait"

Supporting effects of active and passive exoskeletons have been reported for different workplaces and lifting conditions. Since many physically demanding jobs require at least short walking distances, an exoskeleton should not interfere with level walking. Investigating the possible influence of exoskeletons on kinematics and joint loading during gait was the main objective of this study. Therefore, a gender balanced cohort of 12 subjects performed three level walking trials with single leg contact over two adjacent force plates in the middle of the walkway. Four different conditions were investigated in randomized order: active exoskeleton (ECX), two types of passive exoskeletons (ELV, ESX) and one control condition without exoskeleton (NoX). Full body movement was captured using 12 infrared cameras (Vicon) with markers placed on anatomical landmarks. 3D joint kinematics were calculated from a Plug-in-Gait based model. Joint loading was calculated from the same model in a bottom-up inverse dynamics approach using the recorded ground reaction forces. Outcome parameters were knee and hip joint angles and corresponding moments all time-normalized to 0-100% stance phase. Since any gait asymmetries were not of interest, left and right stance phases were treated equally. Differences in angle-time histories and net joint moments were analysed using Statistical Parametric Mapping (SPM). If deviations to normal distribution existed, a non-parametric version of the repeated measures one-way ANOVA was selected. Post-hoc tests were performed using a Bonferroni corrected α -level. General curve shapes of all conditions matched for all four outcome parameters. Statistically significant differences between the exoskeleton and the NoX condition could not be observed for knee moments, but for knee angles, hip angles and hip moments. For knee angles ESX had the most and ELV the least difference to NoX. For hip angles and moments, ESX had the most, but ECX the least difference to NoX.

Author and co-authors

Omar El-Edrissi, Jasper Johns, Inga Schultes, Ulrich Glitsch, Kai Heinrich
Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA/DGUV)



Øyvind Pernell Haugen

STAMI
oyvind.haugen@stami.no



Bio sketch

Øyvind Pernell Haugen is a molecular biologist and postdoc in the Research group for Occupational Toxicology at STAMI, the National Institute of Occupational Health in Norway. As part of the EU-funded project PlasticsFatE, his research focus is to investigate potential hazard effects of micro- and nanoplastics in vitro and in vivo, as well as being involved in assessing exposure levels of airborne plastic particles in working environments.

“Occupational exposure to airborne micro- and nanoplastics”

Background Micro- and nanoplastics (MNPs) are tiny plastic particles that have become a major concern in recent years due to their widespread presence and persistence in the environment, including occupational settings. They are defined by their size, with microplastics ranging from 0.1 μm to 5 mm in diameter and nanoplastics smaller than 0.1 μm . From an occupational health perspective, exposure to MNPs can occur in various workplaces where plastic materials are present. As such, workers may encounter airborne MNPs generated during manufacturing processes, like cutting, grinding, melting, or sanding of plastic materials. These particles can be released into the air and potentially lead to adverse health effects. Although the complete extent of their impact is not yet fully understood, MNPs have been found in various human organs, and some studies show that these particles can cause inflammation, oxidative stress, and cellular death. They may also act as carriers of other toxic substances, posing additional health risks.

Aim As part of PlasticsFatE (EU, Horizon 2020), we aim to assess exposure levels of airborne MNPs in working environments.

Methods Air samples were collected from a manufacturing facility for plastic packaging products in Norway. Stationary samplers were placed near a plastic moulding machine and a residual plastic grinder. Personal samplers mounted near the person’s breathing zone were used to collect inhalable dust by the workers during an 8-hour workday. Particle mass concentration, size distribution, and morphology were analysed by gravimetric analysis, SMPS, and SEM, respectively. Plastic polymer type and mass concentrations are being analysed by pyrolysis GC/MS.

Results We found an average of 0.2 mg/m³ dust particles in personal samples versus 0.03 mg/m³ in stationary samples. The dominant particle size was 70 nm for dust collected near the plastic moulding machine and 300 nm for dust collected near the grinding machine. Moreover, the particle concentrations varied throughout the day. All measured mass concentrations were well below the current occupational exposure limit for nuisance dust (10 mg/m³). Images taken with SEM showed large aggregates in the stationary samples, which may have been formed by condensation from heated plastic.

Conclusion Our results show the presence of micro- and nanosized particles in collected air samples. The smallest particles were detected in close proximity to where heating and moulding of plastic occurred. The types and mass concentrations of plastic polymers present remain to be analysed and is ongoing work.



Pål Graff

STAMI
pal.graff@stami.no



Bio sketch

Pål Graff works as a lead senior scientist at STAMI, the Norwegian National Institute of Occupational Health, and is also a Professor at the Norwegian University of Life Sciences (NMBU). His research focuses upon characterisation of occupational exposures ranging from bioaerosols to asbestos.

“Bioaerosol exposure in waste sorting plants in Norway”

Introduction The waste management sector has a central part in the transition towards a circular economy and is subjected to technological progress and new work operations. Waste workers in both traditional waste processing as well as modern automated waste sorting plants (WSP) are potentially exposed to high levels of hazardous biological agents, which have not been studied well.

Method Personal full-shift work air samples were collected using PAS 6 for endotoxins, GSP for ddPCR and MALDI-TOF MS, as well as 37mm close faced total dust cassettes. Exposure was assessed during the workday, as well as different areas of the WSP to identify potential high exposure moments. Cultivable bacteria and fungi were analysed by MALDI-TOF MS.

Results Levels of inhalable dust were generally below the Norwegian occupational exposure limit (5 mg/m³); however, varied significantly between types of WSP, as well as between seasons. Endotoxin levels differed significantly between and within WSP, with concentrations ranging from below level of detection (LOD) to a maximum of 7479 EU/m³ with highest levels during the summer. Furthermore, microbial DNA concentrations varied considerably between and within types of WSP with generally higher levels of bacterial DNA compared to fungal DNA. Personal air samples contained substantial concentrations of cultivable microorganisms. Among these, 18 species were human pathogens, or microbial agents with pathogenic potential.

Conclusion The results of this study showed high variation in exposure levels between and within types of WSP, as well as seasonal variation for parameters such as total dust and endotoxins. Furthermore, the study identified several potential human pathogens in the work environment. This indicates that Norwegian waste workers were potentially exposed to high levels of dust and microorganisms that may cause adverse health effects in susceptible individuals.

Author and co-authors

Elke Eriksen¹, Anani Komlavi Afanou¹, Anne Mette Madsen², Anne Straumfors¹ and Pål Graff¹

¹ STAMI, the National Institute of Occupational Health Oslo Norway

² The National Research Centre for Work Environment Copenhagen Denmark



Peter Stacey

Health and Safety Executive
peter.stacey@hse.gov.uk

Bio sketch

Peter Stacey is a senior scientist at the Health and Safety Executive's science centre in Buxton researching the development and performance of methods for the measurement of exposures to respirable crystalline silica.

From 2004 to 2012, Peter was convenor of an international standards organisation working group for measurement of crystalline silica and is currently chair of the British Standards Institute committee for workplace atmospheres.



“Technical developments to support on-site workplace measurements for respirable crystalline silica using portable Fourier transform infrared instruments”

Large numbers of workers are at risk of exposure to aerosols containing respirable crystalline silica (RCS) which can cause silicosis and cancer. The collection of a sample of the aerosol, to which workers are exposed and its measurement, by X-ray diffraction or infrared in a laboratory, is an established approach to assess personal worker exposures and their potential impact on worker health. Reducing the measurement time taken to identify high RCS exposures may enable faster actions to control dust emissions.

Relatively inexpensive portable Fourier Transform Infrared (FTIR) instruments are becoming increasingly available. They potentially provide early on-site end-of-shift or end-of-task exposure measurements of RCS for samples collected using traditional respirable sampling apparatus or wearable monitors. This presentation will describe the development of a filter cassette to provide a through cassette measurement using portable FTIR. The filter cassette is placed in an aerosol sampler and holds a filter which collects the respirable particles.

The key findings were:

- The new filter cassette removes the need to handle the filter.
- A restricted area insert improved sensitivity.
- Losses of RCS to the new filter cassette walls were shown to be an average of 5% (range 0% to 7%) to when the loadings were about 100 µg. Overall the 95th percentile was 12.8%.
- The use of chemometric methods improves the accuracy of results when granite or kaolinite dusts are present.
- A principal component regression (PCR) method provided the most accurate results when the level of interference was greater than 70% compared with established FTIR and X-ray diffraction methods. This is significant because most granite dusts contain less than 30% quartz and high RCS exposures can occur when working with these materials.

Future FTIR-chemometric methods may have the potential to predict occupational exposures from the changes in mineral composition observed in the spectra pattern. This would enable exposure monitoring to be a leading rather than lagging indicator.



Philippe Duquenne

INRS
 philippe.duquenne@inrs.fr

Bio sketch

Philippe Duquenne is a laboratory manager at the INRS (France). He obtained a PhD in microbial ecology for his work on soil microorganisms, and worked at the INRS as a microbiologist. He worked on methods and strategies for measuring bioaerosols as part of the occupational exposure assessment, and piloted the "biological risks" project at the INRS. He is currently leading an INRS laboratory specialized in spatio-temporal analysis of exposures to chemical and biological airborne pollutants, including investigation of polyexposure, real-time measurement, sensor networks etc.



Patricia Battais

INRS
 patricia.battais@inrs.fr

Bio sketch

Patricia Battais is project manager for the assessment of chemical and biological polyexposures at the INRS (France). She is specialized in carrying out campaigns for measurement of deleterious atmospheric compounds in order to assess workers' exposure. She leads a project regarding the evaluation of both chemical and biological risks in cheese factories and deploys measurement strategies to collect both chemical and biological pollutants expected in the working areas of these companies.



“On the opportunities and challenges for taking into account poly-exposures to chemical and biological agents in prevention: teaching from some examples in the food processing and waste treatment industries in France”

Workers may be exposed to both chemical and biological agents in several working sectors for which the consideration of these poly-exposures in the assessment and management of risks can be useful. The objective of the presentation is to provide feedback on working situations investigated in France, to discuss how considering poly-exposures can be beneficial to prevention and highlight some of the scientific and technical challenges that this entails.

Reported studies were carried out in waste treatment plants (sorting, composting, anaerobic digestion of household waste) and food plants (cheese ripening cellars). The results show that cheese workers are exposed to allergenic fungi and to carbon dioxide at high levels. Poly-exposures are also found among workers involved in waste sorting, composting, and anaerobic digestion (microorganisms, VOCs, ammonia). It is shown that the consideration of multiple exposures to chemical and biological agents in prevention is interesting as it can provide a real benefit in the relevance of the assessment of exposures and the means of prevention to be implemented.

However, the technical prevention means to implement are not immediate for the work situations investigated. For example, cheeses brushing is done in maturing cellars and modifying the general ventilation of cellars may be deleterious to the maturing process and the final quality of products. Moving the exposing tasks to a work area, with a less polluted atmosphere by acting on the general or localized ventilation, is hindered by the risks of musculoskeletal disorders of the upper limbs caused by



load handling. Thus, concerns about poly-exposures open up a wide range of research perspectives to advance prevention. The presentation outlines some of these perspectives (measurement methods and strategies, data interpretation, health effects of a mixture of chemical and biological agents, prevention means in context of multiple nuisances etc.).

Author and co-authors

Philippe Duquenne¹, Patricia Battais¹, Lise Alonso², Pauline Loison², Simon Xavier², Sullivan Lechêne³

¹ Laboratory for Spatial and Temporal Analyses of Chemical Exposures/Proces Engineering Division

² Laboratory for aerodynamic engineering/Proces Engineering Division

³ Laboratory of Aerosol Metrology/Pollutant Metrology Division – INRS (National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases), Vandoeuvre-lès-Nancy, France.





Phong Chau

STAMI
phong.chau@stami.no



Bio sketch

Phong Chau is currently enrolled as a doctoral candidate within the Department of Psychology and Physiology at STAMI, the National Institute of Occupational Health in Norway. In this endeavour, he is actively engaged in the investigation of the intricate relationship between circadian rhythm and the physiological responses to cold and pain stimuli, specifically at the molecular level, utilising both murine and human models. This pursuit was undertaken as an integral component of the internally-funded research initiative known as the Interaction of Cold Exposure and Biological Rhythm (ICEBR).

“Night Work in Cold Environment”

The diurnal oscillations of light and temperature are arguably the most steadfast chronobiological stimuli for biological entities inhabiting our planet. It has been demonstrated that organisms employ light as a means to synchronise their internal biological clocks with the solar day, thereby establishing the basis for the coordinated circadian gene expression pattern within the mammalian body. However, the impact of temperature on this process remains inadequately investigated. Shift workers are commonly subjected to the challenging amalgamation of circadian rhythm disruption and a low-temperature environment. In the context of this research endeavour, our primary objective is to ascertain the manner in which thermal data acquired by the peripheral nervous system amalgamates with circadian oscillations.

The study employed six cohorts of C57Bl/J6 mice, each consisting of eight individuals. These mice were subjected to a four-week period of acclimation, during which they were exposed to a light-dark cycle of 12 hours each, while being maintained at a thermoneutral temperature of 27°C. Following the conclusion of the aforementioned period, the groups were subjected to a duration of 8 hours in an ambient environment characterised by a temperature of 15°C, which can be classified as a cold condition, or alternatively, a continuation of the previously maintained thermoneutral (TN) temperature. The experimental protocol involved subjecting the various groups to temperature exposures at three distinct temporal intervals throughout the day, namely ZT4, ZT12, or ZT20, which correspond to 4, 12, or 20 hours after the initiation of light (ZT0), respectively. Immediately following the exposures, the aforementioned tissues were collected in order to assess the levels of gene expression within the thermogenic brown adipose tissue (BAT), the liver as well as the peripheral somatosensory neurons located in the dorsal root ganglion (DRG). Moreover, the assessment of thermal tolerance was conducted through the utilisation of behaviour testing.

The findings of this study indicate that there was a notable increase in the expression of the core thermogenesis gene *Ucp1* in brown adipose tissue (BAT) of mice exposed to cold temperatures, in comparison to mice kept at thermoneutral conditions. An increased induction of *Ucp1* was observed at Zeitgeber Time 12 (ZT12) in comparison to the remaining time points. Furthermore, the results of the behaviour testing indicate that mice exhibited a greater degree of cold tolerance behaviours at ZT4 compared to ZT12. Ultimately, the investigations conducted on gene expression within the somatosensory dorsal root ganglion (DRG) neurons have yielded noteworthy findings pertaining to the presence of circadian oscillations within the core clock genes.



In a concise manner, the available data indicates that the temporal aspect of cold exposure may indeed exert an influence on the physiological and behavioural adaptations that occur in response to cold environments. The potential mechanisms underlying circadian patterns of gene expression in somatosensory neurons are of considerable interest. Nevertheless, further investigation is imperative in order to elucidate the intricate explanatory framework.

Author and co-authors

Phong Khac Thanh Chau¹, Somayeh Ezzatpanah^{1,2}, Knut Tomas Dalen³, Fred Haugen¹

¹ Department of Psychology and Physiology, STAMI, the National Institute of Occupational Health Oslo, Norway

² Department of Radiation Biology, Institute of Cancer Research, Oslo University Hospital-Oslo, Norway

³ Department of Nutrition, Institute of Basic Medical Science, University of Oslo – Oslo, Norway



Randi Hovden Borge

STAMI
randi.borge@stami.no

Bio sketch

Randi is a PhD research fellow at the Department of work psychology and physiology at STAMI, the National Institute of Occupational Health in Norway, where she studies differences in employee health and work ability across office concepts.



“Does job control contribute to differences in doctor-certified sickness absence across office concepts? Mediation analysis in a nationally representative sample”

Several studies have found higher sickness absence risk in shared and open workspaces compared to private offices, but few have attempted to study why these differences occur. In this paper, we propose job control as a potential mechanism underlying these differences. To test this proposition, we conducted a counterfactual mediation analysis using survey data from a nationally representative sample of Norwegian employees merged with one-year follow-up data on doctor-certified sickness absence from national registries (N=5512). Total effects indicated higher risk of sickness absence in conventional and non-territorial open-plan offices and non-territorial shared room offices compared to private offices. Natural indirect effects due to job control were significant in all contrasts. Most of the total effects, however, were attributable to pathways other than job control (i.e., natural direct effects).

Findings strengthen evidence that shared and open workspaces may be a risk factor for sickness absence and identify job control as one potential mediator of associations between office concepts and sickness absence. Future studies should continue to explore underlying mechanisms linking shared and open workspaces to sickness absence and other unfavourable outcomes in the workplace.



Rigmor Knutsen

STAMI
rigmor.knutsen@stami.no



Bio sketch

Rigmor Knutsen is a PhD Candidate at STAMI, the National Institute of Occupational Health in Norway. Her thesis project focuses on the relationship between psychosocial and biomechanical work environment factors and sick leave due to mental or musculoskeletal disorders within the Norwegian home care services.

“Impact of psychosocial and mechanical work factors on medically certified sick leave due to musculoskeletal disorders in Norwegian home care employees”

The level of medically certified sick leave in the Norwegian home care services is nearly twice as high as the national average. A substantial percentage of sick leave is due to musculoskeletal disorders and many of these cases may be attributed to risk factors at work. An improved understanding of occupation-specific risk factors for sick leave is needed to support development of preventive measures. Hence this study aimed to examine the impact of psychosocial and biomechanical work factors on subsequent sick leave episodes due to musculoskeletal disorders.

A probability sample of Norwegian home care workers (N=1.819) was surveyed on work environment factors, and subsequently followed up for 26 months using registry data on sick leave from the Norwegian Labour and Welfare Administration. This includes complete registrations of all medically certified sick leave from the first day absent, including the diagnostic codes of the International Classification of Primary Care (ICPC-2) given by the general practitioner. Incidence risk ratios (IRR) and 95% confidence intervals (CIs) were calculated using negative binomial regression with robust standard deviations.

Results suggest that decision demands (IRR = 1.24, CI95% 1.00-1.54), kneeling or squatting (IRR = 1.39, CI95% 1.02-1.88), forward bending of the upper body (IRR = 1.49, CI95% 1.09-2.05), lifting/supporting patient between bed and chair (IRR = 1.41, CI95% 1.01-1.97) and experiencing the work as physically demanding (IRR = 1.83, CI95% 1.36-2.47) were associated with excess risk of sick leave due to musculoskeletal disorders. Additionally, control of work pacing (IRR = 0.82, CI95% 0.68-0.99), empowering leadership (IRR = 0.87, CI95% 0.76-0.99) and support from immediate supervisor (IRR = 0.87, CI95% 0.77-1.00) were associated with reduced risk of sick leave.



Risto Nikunlaakso

FIOH
risto.nikunlaakso@ttl.fi

**Finnish Institute of
Occupational Health**

Bio sketch

Risto Nikunlaakso is a Senior Specialist at the Finnish Institute of Occupational Health and a Doctoral Researcher in the University of Eastern Finland. His areas of expertise include psychosocial risk factors in municipal and health care sector and the conducting and management of employee well-being surveys.

“How to promote mental health at social and health care workplaces?”

The prevalence of mental health problems is increasing in western countries. Psychosocial work stressors increase the risk of mental health problems, possibly even more when accumulating. Effective workplace interventions are needed to reduce work stress and to improve mental health. To identify and develop effective interventions, the current PhD study aimed to research previous interventions, accumulation of work stressors, and the effect of psychosocial risk reduction on mental health.

In the current PhD study the following was conducted: (1) a scoping review of interventions to promote mental health in social and health care workplaces, (2) a cross-sectional study of accumulation of work stressors (high job demands, low job rewards, and low workplace social capital), and (3) a pseudo-experiment of the effect of improving 1-3 work stressors on psychological distress. For studies 2 and 3, we analysed survey responses of Finnish health and social services workers in 2019-2021.

The scoping review showed that mental health interventions are usually targeted to help individual workers to cope with straining work and that organizational-level interventions are seldom studied. The cross-sectional analysis of accumulation of work stressors indicated considerable excess risk of psychological distress when stressors synergistically interact. The finding suggests that an organizational-level intervention tackling all three stressors would be efficient in reducing psychological distress. However, the pseudo-experiment showed that the effect of improving psychosocial stressors on the risk of psychological distress was limited, and stronger for employees younger than 50 years.

As the effectiveness of organizational-level interventions to improve mental health seems limited, future interventions should both aim to reduce accumulated work stressors and improve individual stress-coping. The results also highlight the importance of preventing accumulation of work stressors.



Romain Freund

Unisanté
romain.freund@unisante.ch

unisanté

Centre universitaire de médecine générale
et santé publique • Lausanne

Bio sketch

Romain is a Medical Doctor, specialised in Public Health with a Master of Sciences in Biostatistics and Clinical Research as well as an executive master from ESSEC Business School. He has strengthened his experience through a variety of different tenures including epidemiology, health economics, clinical research, and biostatistics (at Pitié-Salpêtrière hospital and Necker Hospital in Paris).

He currently works as a researcher in the Prof. Guseva Canu's group at the Department of Epidemiology and Occupational Health, Unisanté, University of Lausanne in Switzerland.

“Long-term occupational exposure to PM10 and respiratory health of Parisian subway workers”

Long-term exposure to particulate matter (PM) increases the risk of developing chronic obstructive pulmonary disease (COPD) and declining respiratory function. We evaluated the association between long-term PM10 exposure in underground transportation systems and COPD.

Participants were randomly selected from a 15,000-transit worker cohort within the Respiratory disease Occupational Biomonitoring Collaborative Project (ROBoCoP). Individual external exposure to PM10 was estimated using a company-specific job-exposure-matrix based on PM10 measurements conducted between 2004 and 2019 in the Parisian subway network.

This is the first study assessing the relationship between long-term exposure to subway PM10 and COPD in subway workers. The results showed that PM10 exposure levels as estimated in this study are not associated with increased risk of COPD among subway workers.

Author and co-authors

Irina Guseva Canu¹, Pascal Wild¹, Thomas Charreau¹, Romain Freund¹, Antonio Toto¹, Jacques Pralong^{2,3,4}, Kirushanthi Sakthithasan⁵, Valérie Jouannique⁵, Amélie Debatisse⁵, Guillaume Suarez¹

¹ Centre from primary care and public health (Unisanté), University of Lausanne, Switzerland

² Faculty of Medicine, University of Geneva

³ SwissMedPro Health Services

⁴ Hôpital de la Tour, Geneva

⁵ Autonomous Paris Transport Authority (RATP), Paris, France



Sarah Valentino

INRS
sarah.valentino@inrs.fr



Bio sketch

Sarah Valentino is a researcher in reprotoxicology at French Research and Safety Institute for the Prevention of Occupational Accidents and Diseases. Her research focuses on assessing the hazards of chemicals on the male and female reproductive axes, and on fetal development. More specifically, she is working on the effects of organophosphate flame retardants on fetal development following gestational exposure.

“Metabolic disruptions following gestational exposure to organophosphorus flame retardants using blood biochemistry and fatty acids profiles”

Organophosphorus flame retardants (OPFRs), including triphenyl phosphate (TPhP) and tricresyl phosphate (TCP) are incorporated into a wide variety of polymers to provide fire resistance. They are therefore present in many industrial and consumer electrical and electronic appliances, building materials, furniture and textiles. Occupational exposure has been demonstrated by the presence of OPFRs in waste electrical and electronic equipment processing plants and aircraft maintenance areas. Toxicological profiles of these chemicals have raised concerns regarding their effects on male reproductive development and lipid metabolism.

Female Sprague-Dawley rats were exposed by oral gavage to increasing doses of TPhP or TCP from gestational days 12 to 19. Organs and biological fluid samples were collected from mothers and from fetuses. Maternal physiology, via weight monitoring, blood biochemistry, and fatty acid concentrations and profiles in livers and adrenals, was analysed. Fetal testosterone production was measured. The expression of genes involved in cholesterol and fatty acid metabolism in maternal and fetal livers and adrenals, were analysed.

TPhP caused slight perturbations in the maternal body only at the highest dose, with decreased weight gain during gestation, minor disruption of metabolic gene expression in maternal organs but no effect on fetal testosterone production. TCP demonstrated stronger endocrine and metabolic disruption capabilities, inducing at the highest dose maternal toxicity and fetal toxicity, with decreased testosterone production and increased lipid storage in fetal liver; and a dose-dependent disturbance of the expression of metabolic genes.

These results shed new light on the toxicological properties of OPFRs with different mechanisms of action through endocrine and metabolic disruption. Moreover, employees are exposed to mixtures, so it could be relevant to determine, through a field study, whether metabolic changes are also observable in employees exposed to these chemical agents and the consequences on health.

Author and co-authors

Valentino S.A., Sabaté J-P., Perceau M., Denis F., Viton S., Ndiaye D., Gaté L.

French Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (INRS), Toxicology and Biomonitoring Division, Vandoeuvre les Nancy, France



Silvia Torres

INSST

silvia.torres@insst.mites.gob.es



Bio sketch

Silvia Torres is working at the Spanish National Institute for Safety and Health at Work (INSST). Currently she is the coordinator of the physical and mechanical risks area and she is mainly involved in testing and certification of eye protection and hearing protection too. The institute has huge experience in testing ocular filters against solar radiation so that it is setting up a test method to measure UV protection factors in textiles. She is a member of the CEN TC248 WG14 "UV protective properties" and gives assessment to the PPE expert group about certification category of products for protection against natural UV radiation.

"Fabric's solar UV radiation protective properties"

Scope Study of the UV protection of textiles for general use and textiles with UPF (ultraviolet protection factor) declared by the manufacturer. In addition, laboratory experiment to investigate whether an optimal relationship between UV protection and water vapour transmission can be established.

Justification Activity framed within the Objective 2 of the Spanish Strategy for Health and Safety at Work focuses, among others, on the preventive management of the effects of climate change. Speaking about occupational sector, climate change mainly affects those sectors or jobs including outdoor activities, where traditional exposure to high temperatures and/or solar UV radiation is worsening considerably.

In case of exposure to solar radiation, protection against UV radiation means taking shelter in the shadows, wearing appropriate protective clothing and using sunscreen creams and lotions.

Any textile offers certain protection against UV radiation, but in this study we want to compare the protection offered by different textiles whether or not they have a UV protection factor declared by the manufacturer. On the other hand, the current state of the art indicates that when the fabric is wet, the protection it offers against UV radiation is enhanced. For this reason, for the selected fabrics we want to determine the properties related to breathability and thermal comfort offered according to the requirements set out in the standards for protective clothing, in order to find a possible correlation between these properties and the UPF of a fabric. The results will allow us to provide guidelines for a correct selection of protective clothing depending on the level of exposure to solar UV radiation.

State of the art about certification categories of clothing for protection against natural UV radiation regarding based on decisions of the PPE Expert group.



Solveig Krapf

STAMI
solveig.krapf@stami.no

Bio sketch

Postdoctoral researcher in toxicology at STAMI, the National Institute of Occupational Health in Norway. Previously BSc in molecular biology from University of Oslo and an MSc in infectious diseases from University of Western Australia before conducting a PhD in pharmacology at the university of Oslo.

“Mycotoxins, where do we find them? and why are they important?”

Closing data gaps on natural toxins effect on human health: Immunotoxic effects of Alternaria toxins using reporter cell lines and a co-culture lung exposure model”

Species of the fungi *Alternaria* are widely distributed in nature and known to infect a large variety of plants such as fruits, vegetables, and grains. *Alternaria* species produce secondary metabolites, mycotoxins, which can be found in food and feed products as well as in organic dust derived from infected sources. Animal and in vitro studies have shown a broad spectrum of toxic effects after exposure to *Alternaria* toxins including acute-, geno- and cyto-toxicity as well as developmental and foetus toxicity. Inhalational or dermal contact are the most likely occupational exposure routes and most at risk includes persons engaged in farming, grain handling, waste handling, food production, bakeries, or occupations where indoor environment allow for fungal growth including office buildings, schools, hospitals, and residents (home offices). In 2011 the European food safety authority reviewed the safety of *Alternaria* toxins in feed and food. However, this led to no regulations due to shortage of toxicological occurrence and exposure data, and even less is known regarding the occupational and inhalational risks. This project is part of the Partnership for the Assessment of the Risk of Chemicals (PARC), which is an European research and innovation programme that aims to apply Next Generation Risk Assessment (NGRA) for hazard and exposure assessments. Closing data gaps related to the effect of natural toxins on human health is necessary to improve the current hazard characterization.

The study specifically aims to clarify effects of *Alternaria* toxins on immunoreceptor activation, inflammasome response and the respiratory transcriptome. This will be investigated by using different immunoreceptor reporter cell lines and in vitro exposure in a co-culture lung model followed by transcriptomics analysis. The gained knowledge may be important for future setting of health-based occupational exposure limits for *Alternaria* toxins.

Author and co-author

Solveig Krapf, Anne Straumfors, Steen Mollerup
STAMI



Stavros Kyriakidis

NFA
stk@nfa.dk



Bio sketch

Stavros Kyriakidis is currently a PhD student at the National Research Centre for the Work Environment and at the Department of Sports Science and Clinical Biomechanics at Southern Denmark University. His PhD project explores how daily occupational physical behaviours are associated with low back pain, healthcare utilization and medication usage among Danish blue-collar workers. His research interest include epidemiology of 24-h physical behaviours in blue-collar workers with a special focus on work domain, analysis of accelerometer data and statistical methods for physical activity data.

“Low back pain among eldercare workers: What is the occupational physical activity Sweet-Spot?”

High occupational physical activity is considered a main contributor for poor musculoskeletal health in eldercare workers. However, high occupational physical activity might not be a problem for musculoskeletal health if combined with sufficient sitting time (resting periods). Despite this, we do not have knowledge about the optimal balance (Sweet-Spot) between physical activity, standing and sitting time during the course of a workday in eldercare workers. As a result, it remains unclear what is the optimal balance between physical activity, standing and sitting time during work, which can subsequently promote musculoskeletal health. To address this gap, this research tries to identify the optimal balance between physical activity, standing and sitting time during work in an effort to improve musculoskeletal health in eldercare workers. Defining the optimal balance between physical activity, standing and sitting time during work will assist in the development of guidelines for organizing eldercare work to enhance musculoskeletal health.

Background Eldercare work is characterized by high occupational physical activities (OPAs) and prevalence of low back pain (LBP). The aim of this study was to investigate the longitudinal association between OPA [sedentary time, standing, light-physical activity (LPA) and moderate-to-vigorous physical activity (MVPA)] and LBP intensity and to define the “Sweet-Spot” of daily OPA time-use for LBP in eldercare workers.

Methods The study population consisted of 411 eldercare workers in 20 Danish nursing homes. Average daily OPA composition (sedentary time, standing, LPA and MVPA) was assessed through 4-day, 24-hour accelerometry. LBP intensity was monthly assessed on scale from 0-10 for 1-year follow-up. Zero-inflated linear mixed models were used to investigate the prospective associations between averaged daily OPAs (expressed as isometric log-ratios) and LBP intensity adjusted for leisure-time physical activities, sex, BMI, smoking, baseline values of LBP intensity, occupational position and seniority. The model was used to predict the “Sweet-spot” of daily OPAs compositions associated with lowest 5% of LBP intensity.

Results Daily OPAs compositions were not associated with LBP intensity in neither the conditional (χ^2 test = 4.93, $p = 0.18$) or the zero-inflated part of the model (χ^2 test = 3.55, $p = 0.31$). Daily OPAs compositions with more sedentary and LPA time as well as less standing and MVPA time were associated with reduced LBP intensity. The compositional mean (proportion) of daily OPAs associated with the

lowest 5% (“Sweet-Spot”) of LBP intensity were: sedentary: 303 min/d (71.5%), stand: 35 min/d (8.3%), LPA: 35 min/d (8.3%), MVPA: 51 min/d (12%).

Conclusions Compared to the population mean, the “Sweet-Spot” of daily OPAs for reduced LBP intensity involves more sedentary and LPA as well as less standing and MVPA time. These findings offer valuable insights for organizing eldercare work to match a physical activity composition that decreases the risk of LBP.

Author and co-authors

Stavros Kyriakidis¹, Charlotte Lund Rasmussen², Karen Sjøgaard³, Andreas Holtermann^{1,3}, Charlotte Diana Nørregaard Rasmussen¹, Nidhi Gupta¹

¹ National Research Centre for the Working Environment, Lersø Parkallé 105, 2100 Copenhagen, Denmark

² Curtin School of Allied Health & enAble Institute Faculty of Health Sciences Curtin University, Kent Street, Bentley, Western Australia, 6102, Australia

³ Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, Campusvej 55, 5230 Odense M, Denmark



Stefan Voss

BAuA
voss.stefan@buaa.bund.de

Bio sketch

Stefan Voss is head of the unit "Workplaces, Safety of Machinery, Operational Safety" at the Federal Institute for Occupational Safety and Health in Germany (BAuA). The main research topics of the unit are safety technology, especially innovative networked and intelligent systems, methods for risk assessment, protective measures for the use of work equipment and working environment factors with a focus on the indoor climate.

“Risk assessment of safety-critical AI-applications in work equipment”

The increasing performance of AI-based applications qualifies them as potential candidates for safety-critical applications in machinery and work equipment. Such solutions are advantageous in situations where traditional safety technology is unable to adequately solve the task at hand. This is particularly the case, when flexible, dynamic solutions are required, for example in robotic applications or in the monitoring of safety zones. Here, an AI-based solution may contribute to a safer and healthier working environment. However, the use of AI in safety-critical applications in machinery and work equipment poses new challenges in terms of risk assessment.

We want to contribute to a safe and healthy integration of AI by developing quantitative and qualitative metrics and measures along the AI-lifecycle in order to determine the level of trustworthiness of a given application. This is a prerequisite for a comprehensive risk assessment, which requires the consideration of AI properties such as robustness, accuracy, explainability, uncertainty or runtime behaviour. Robustness is a fundamental pillar of AI dependability and describes how a given AI model reacts to small variations in the input data, e.g. whether it will make misclassifications when image data is corrupted by some environmental noise. We develop methods to test and quantify robustness based on statistical corruption of test data sets. The model-agnostic nature of the approach will allow for an assessment of AI-models without requiring insight into the applied algorithms, qualifying the methods as manufacturer-independent testing tools.

Author and co-authors

Stefan Voss, Silvia Vock
German Federal Institute for Occupational Safety and Health (BAuA)



Susann Wolf

STAMI
susann.wolf@stami.no



Bio sketch

Susann Wolf is a Postdoctoral researcher at STAMI, the National Institute of Occupational Health in Norway, with a PhD in Molecular Medicine. Her main research interests are Nanotoxicology and Nano-safety in an occupational setting. The development and use of advanced *in vitro* cell culture models to study occupational exposure to nanoparticles has been the focus of her work.

“Understanding the mechanisms of inflammatory responses of titanium dioxide nanoparticle exposure using an ALI inhalation model”

Background Occupational exposure to manufactured nanoparticles that are used in engineered nanomaterials (ENMs) is of great concern as it may lead to acute or chronic health effects in workers. One of the most widely produced nanomaterials worldwide is titanium dioxide nanoparticles (TiO₂ NPs), which are quite important in the Norwegian industry, e.g. Kronos Titan. Recent studies indicated evidence of adverse effects in the respiratory systems of workers exposed to these nanoparticles. However, the cellular mechanisms of these effects are not fully understood and there is a lack of advanced *in vitro* cell culture models to study inhalation exposure to NPs. The aim of this study was therefore to increase the understanding of the cellular events involved in occupational-related development of chronic lung disorders due to NP exposure using an advanced *in vitro* model system.

Methods TiO₂ NPs were characterized as to their physicochemical properties. Prior to cellular exposure, the TiO₂ NPs were dispersed in artificial lung surfactant to better mimic *in vivo* pulmonary exposure scenarios. The ALI inhalation model was exposed to relevant occupational doses of TiO₂ NPs and cellular uptake and biodegradation of TiO₂ NPs were assessed using (high-resolution) transmission electron microscopy. Cellular viability and gene expression of genes relevant to oxidative stress responses, DNA damage and inflammation were assessed up to 14 days post-exposure.

Results Exposure of the ALI inhalation model to TiO₂ NPs showed that, despite particle biodegradation in the cells, none of the particles significantly affected cell viability. The TiO₂ NPs up-regulated the gene expression of inflammatory mediators at all time points and induced a dose-dependent up-regulation of DNA damage markers at 14 days post-exposure.

Conclusion The *in vitro* ALI inhalation model represents a valuable tool to assess the cellular effects of nanoparticles. Cell viability was not affected by TiO₂ NP exposure in this model. However, the altered gene expression by the TiO₂ NPs needs to be further studied to reveal the exact mechanisms involved.

Author and co-author

Susann Wolf, Torunn Kringlen Ervik, Shan Narui, Johanna Samulin-Erdem
STAMI



Susanne Niehaus

BAuA
niehaus.susanne@baua.bund.de

b a u a :
Bundesanstalt für Arbeitsschutz
und Arbeitsmedizin

Bio sketch

Susanne Niehaus is a highly skilled researcher who specializes in the scientific processing of research proposals on physical and cognitive stress at work at the German Federal Institute for Occupational Safety and Health (BAuA). With extensive experience in data analysis and interpretation, she prepares findings for scientific publications. Additionally, she has successfully supported two third-party funded projects from the EU and is adept at implementing experiments to advance our understanding of stress in the workplace.

“Diffusion of responsibility in adaptive human-robot interaction and system transparency”

The development of artificial intelligence and advanced robotics has sparked a debate on responsibility within human-robot interaction (HRI). Although machines cannot assume responsibility, humans often attribute it to them, particularly when machines exhibit a higher degree of autonomy. This humanization can lead to greater acceptance and interaction in HRI, but it also carries the risk of responsibility diffusion, where humans overly rely on machines, posing a significant danger if technical malfunctions occur. Studies on transparency in HRI show inconsistent findings: some suggest that transparency reduces false error attribution to robots, while others claim that transparency about system boundaries may decrease trust. The impact of transparency on responsibility and the attribution of intentionality and perceived ability to act remain unresolved. To address these issues, our goal is to design a model for system transparency in cooperative industrial robot settings to achieve appropriate responsibility attribution and ensure effective human-machine collaboration.



Torunn K. Ervik

STAMI
torunn.ervik@stami.no

Bio sketch

Torunn K. Ervik is a research scientist with a background in material science. She works at STAMI, the National Institute of Occupational Health in Norway, in the chemical work environment group since 2015. Her research activities focuses on occupational exposure to airborne particulate matter and the characterization of particles.

“Measurements of airborne asbestos fibres during abatement of asbestos containing materials”

Asbestos containing materials (ACMs) are still frequently found in buildings and houses, even though it is more than 30 years since the use of these materials was prohibited in Norway. This study aimed to measure airborne asbestos fibre concentrations during the abatement of asbestos-containing building materials to investigate the exposure levels that may occur during renovation work. The release of fibres during short-term work tasks, such as drilling and sawing, was also investigated. Additionally, a comparison between results from scanning electron microscope (SEM), transmission electron microscope (TEM) and phase-contrast microscope (PCM) were performed for these measurements.

Parallel air samples were collected during asbestos abatement of different ACMs and analysed with SEM, TEM and PCM. Thin fibres (0.2 μm) were included in the count and listed separately when analysed by SEM. A real-time fibre monitor was used to measure asbestos during short-term work.

The results showed that the direct TEM method was not suitable for samples collected during this type of work operations. The highest fibre concentrations were measured during removal of asbestos insulating boards (1.5-4.5 fibres/cm³ (f/cm³)) and measured concentrations were relatively similar for SEM and PCM. A large difference in asbestos concentrations was found between SEM and PCM when analysing floor materials, and all SEM counts were below LOD. The difference was probably caused by a high number of gypsum fibres that the PCM operator counted. Asbestos fibre concentrations varied from 0.01 – 0.6 f/cm³ for abatements involving asbestos cement materials and SEM and PCM counts were in the same range for this type of material. Short-term work led to peak concentrations above 30 f/cm³.

Author and co-authors

Ervik, T., Hammer, S.E., Skaugset, N.P., Graff, P.
National Institute of Occupational Health, Gydas vei 8, N-0363 Oslo, Norway



Vincent Grosjean

INRS
vincent.grosjean@inrs.fr



Bio sketch

Vincent is a researcher in occupational psychology at the French Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (INRS). Amongst his recent topics of interest are non-conventional psychosocial risks prevention technics, for instance drama-based interventions. He is also working on working conditions in companies seeking to participate in the ecological and civic transition and on the health and safety consequences of the use of new technologies at work.

“In response to climate and environmental emergencies, do mission-based companies improve workers' well-being or enhance conflicts amongst workers?”

The French Ministry of Finance and its counterpart of Ecology are behind the creation in 2019 of a new business model known as the “Société à mission”. In addition to the usual objectives of making a profit, common to most companies in our western liberal economy, companies that voluntarily subscribe to this model must include in their statutes environmental and/or social objectives articulated to a mission purpose («raison d’être»). Amongst internationally visible companies that have adopted this model, we can mention the French post office, the postal bank and Danone. Currently, more than 1.000 French companies are “Sociétés à mission”, most of them small structures.

From the point of view of occupational psychosocial risks, we hypothesized a positive effect: the model could promote *meaning at work* and is likely to reduce ethical dissonance among employees aware of ecological concerns. On the other hand, the model could increase work related interpersonal tensions, for instance if it increases antagonisms between those (employees- managers) who pursue objectives focused on economic efficiency and those who want to put the emphasis on environmental related objectives. Finally, in terms of internal operating procedures, if, as the supporters of the model envisage, socially valued objectives are seen as the company's «consensual and common strategic compass», they can be used as a reference for decisions structuring the activity, whether they are taken at governance level or in teams. Conversely, a number of analysts warned against '*purpose washing*', which could offend employees who are seduced by a discourse that the reality of practices disconfirm. In a preliminary phase of a study on the consequences of this model for working conditions and H&S, we analysed the purpose statements of a sample of 50 companies and interviewed four experts concerned by this change in companies' governance. The paper will present the results of this analysis of the intentions expressed by companies and the points of vigilance, hopes and fears put forward by this short panel of experts.



Yiqun Chen

HSE
yiqun.chen@hse.gov.uk



Bio sketch

Dr Yiqun Chen is a Principal Epidemiologist at the Health and Safety Executive (HSE). She has 27 years of experience in epidemiology, with jobs at the University of Manchester and government agencies in Canada, Australia and the UK, where she managed large national or provincial disease surveillance systems. Between October 2020 and March 2023, she led the Outbreak Investigations Theme within the wider PROTECT COVID-19 National Core Study on transmission and environment, where she worked across traditional boundaries and brought together multidisciplinary teams of researchers from UK Health Security Agency (UKHSA) and universities to deliver a large programme of work.

“COVID-19 outbreak in a large meat processing plant in England: transmission risk factors and controls”

The meat processing industry had frequent COVID-19 outbreaks reported worldwide. In May 2021, a large meat processing plant in England had an outbreak affecting 4.1% (63/1,541) of workers. A rapid investigation was conducted to assess virus transmission risk factors and controls. This included observational assessments of work activities, control measures, real-time environmental measurements and surface microbial sampling. The production night-shift attack rate (11.6%, 44/380) was five times higher than the production day-shift (2.4%, 9/380). Production areas were noisy (≥ 80 dB(A)) and physical distancing was difficult to maintain. Face visors were mandatory, additional face coverings were required for some activities but not always worn. The refrigeration system continuously recirculated chilled air. In some areas the mean temperature was as low as 4.5°C and mean relative humidity (RH) was as high as 96%. The adequacy of ventilation in the production areas could not be assessed reliably using CO₂, due to the use of CO₂ in the packaging process. An alternative ventilation assessment approach should be considered to mitigate respiratory pathogen transmission in this environment where air has to be kept cooled and constantly recirculated. While there were challenges in the production areas, the observed COVID-19 control measures were implemented well in the non-production areas. Sixty surface samples from all areas were tested for SARS-CoV-2 RNA and 11.7% were positive. Shared work transport was provided to 220 staff per day-shift and 120 per night-shift. Multi-layered measures, informed by the workplace specific risk assessment, are required to prevent and control workplace outbreaks of COVID-19 or other similar respiratory infectious diseases. Meat processing plants are part of the national essential infrastructure and could develop and rehearse a response plan for controlling future outbreaks of infectious diseases and to maintain business continuity.

Thank you for your participation

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A certificate of attendance is available and will be handed over at the end of the conference. For those who did attend, but could not collect their certificate, please contact us through the conference email address: info@perosh.eu.

The Book of Abstracts and all presentations of the speakers who gave consent, will be available soon through the PEROSH repository. We also invite all delegates to subscribe to the PEROSH Newsletter on our website to stay up to date on news and events from PEROSH. Videos of all sessions will be published on our YouTube feed.

[Jan Michiel Meeuwsen](#)

PEROSH Manager International Affairs



