

Posters from

NRCWE Anniversary Conference

“Working environment in a changing world”



**Celebrating 70 years of research
in Occupational Safety and Health**

Thursday 9 June 2016
Eigtveds Pakhus
Asiatisk Plads 2G
1448 Copenhagen

Velkommen til NFA's jubilæumskonference

Det Nationale Forskningscenter for Arbejdsmiljø, NFA, havde 70 års fødselsdag den 16. marts 2016. Jubilæet fejres den 9. juni 2016 med en international og national konference.

Instituttet blev grundlagt i 1946 som Fabrikstilsynets Laboratorium. I forbindelse med "Lov om almindelig arbejderbeskyttelse" af 1954 fik vi navnet Statens Institut for Arbejdshygiejne (SIFA) fra 1955. Ved "Arbejdsmiljøloven af 1972" ændredes navn og status. Arbejdsmiljøinstituttet, AMI, fik fra 1977 forskning som en af sine opgaver. I 1997 blev instituttet til et selvstændigt sektorforskningsinstitut. I 2007 fik instituttet navnet Det Nationale Forskningscenter for Arbejdsmiljø, NFA.

Dette er det historiske forløb, der har ført frem til det forskningscenter, der eksisterer i dag, og som vi gerne vil fejre med denne jubilæumskonference.

Vi har den glæde at kunne byde velkommen til en række spændende indlægsholdere fra både ind- og udland.

Vi byder jer hjertelig velkommen og håber, at I vil få en udbytterig dag.

Welcome to the NRCWE's 70-years' anniversary conference

On March 16, 2016, the National Research Centre for the Working Environment (NRCWE) could celebrate its 70-years' anniversary. The anniversary will be celebrated on June 9, 2016, with a national and international conference.

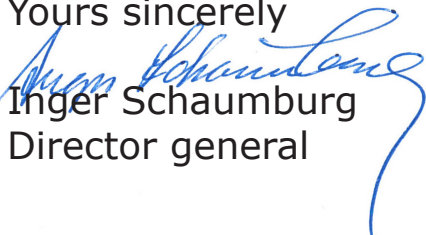
The Institute was founded in 1946 as 'The Working and Factory Inspectorate Laboratory'. In 1955, the name was changed to 'The National Institute of Occupational Hygiene' (SIFA). In 1977, research became one of the Institute's main tasks, and the name was therefore changed to The National Institute of Occupational Health (AMI). In 1997, the Institute became an independent government research institute, and finally, in 2007, the Institute changed its name to The National Research Centre for the Working Environment (NRCWE).

This history has led to the research centre as we know it today and which we would like to celebrate with an anniversary conference.

We have the great pleasure to welcome you to a number of interesting national and international lecturers.

We warmly welcome you and hope you will have a fruitful day.

Yours sincerely



Inger Schaumburg
Director general



- 09:00 – 09:20 Opening addresses – Minister of Employment **Jørn Neergaard Larsen**, Chairman of the board Kjeld Møller Pedersen
- 09:20 – 10:00 Deputy Director, **Margaret M. Kitt**, NIOSH:
More than the Sum of its Parts: the Integration of Health Protection and Promotion
- 10:00 – 10:30 Professor **Dietmar Reinert**, Chairman of the PEROSH group:
Challenge of Europe in a changing world – inclusive, innovative and reflective societies: The changing world of work and OSH
- 10:30 – 11:00 Coffee break and poster exhibition
- 11:00 – 11:30 Director general **Pål Molander**, STAMI:
The Nordic work environment and health model: Impact on research and practice
- 11:30 – 12:00 Professor **Maria Albin**, Karolinska Institutet, Stockholm:
Sustainable Work as a Resource for Health, Innovation and Growth in Horizon 2020
- 12:00 – 13:00 Lunch (afternoon program in Danish)

NRCWE 70 years of research in Occupational Safety and Health: Dialogue and Anniversary Conference

- 13:00 – 13:30 Director general **Inger Schaumburg**, NRCWE: From Factory Inspection's laboratory to the NRCWE – New ways, new goals
- 13:30 – 14:00 Director general **Peter Vesterheden**, Danish Working Environment Authority: Working environment inspection and research – an interaction
- 14:00 – 14:30 Professor **Jens Peter Bonde**, Department of Occupational Medicine, Bispebjerg Hospital: Working environment research in Denmark: challenges, possibilities and perspectives
- 14:30 – 15:00 Coffee break and poster exhibition
- 15:00 – 15:30 Vice president **Morten Skov Christiansen**, Danish Confederation of Trade Unions, and Head of department **Christina Sode Haslund**, Confederation of Danish Employers: The working environment and the Danish model in a global world
- 15:30 – 16:00 Secretary general, **Hans-Horst Konkolewsky**, International Social Security Association: Panel discussion, future implications, closing remarks
Panel: Vice president **Morten Skov Christiansen**, Head of department **Christina Sode Haslund**, Professor **Jens Peter Bonde**, Director general **Peter Vesterheden** and Director general **Inger Schaumburg**
- 16:00 – 17:00 Get-together

Who are we?

The National Research Centre for the Working Environment (NRCWE)

- carries out research, counsels the Ministry of Employment, disseminates results and offers education to contribute to the development of a safe and healthy working environment in Denmark
- has approximately 165 employed
- published 162 articles in international journals in 2015
- the core values of the NRCWE are respect, reliability and job satisfaction.



The history

- | | |
|-------------|--|
| 1946 | The Working and Factory Inspectorate Laboratory |
| 1955 | National Institute of Occupational Hygiene (SIFA) |
| 1977 | The National Institute of Occupational Health (AMI) |
| 1997 | Separated from the Danish Working Environment Authority |
| 2007 | The National Research Centre for the Working Environment (NRCWE) |

Recycling and working environment problems

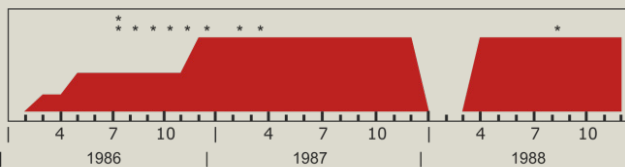
In 1986, a Danish high-technology plant for sorting household waste was established, and very soon occupational illnesses were registered. The symptoms were closely related to the production at the plant. Figure 1.

Due to this and a high number of reported health problems related to collection and treatment of household waste, a research programme was launched from 1993-1997. The programme was interdisciplinary and coordinated with the corresponding administrative programme. Figure 2.

The investigations documented many problems due to collection and treatment and recycling of waste. An example is shown in Figure 3.

The results from the programme were continuously incorporated in the administrative guidelines, and it is our experience that the problems are under control when the guidelines are followed.

The scientific programme also had considerable impact in the scientific world. Figure 4.



Start of symptoms in relation to production.
(*) Cases; (■) production.

Figure 1

The Danish combined administrative and research programme on waste collection and recycling

ADMINISTRATION

- Guidelines, rules and regulations starting with waste collection systems (2 stream and 4 stream)
- Then the waste recycling and treatment plants
- Instructions of the local authorities

RESEARCH

- New and standardized methods for measuring and evaluating the most important exposures, primarily microbiological and ergonomic
- Dose - response

VALUES OF ACCEPTANCE

Figure 2

HEALTH EFFECTS OF MOULDS AND ENDOTOXINS

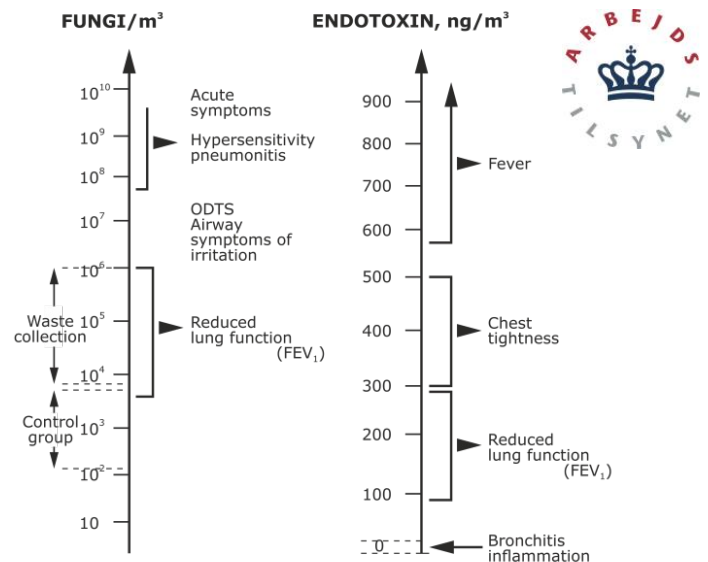


Figure 3

Output from the research programme

- 25 Danish reports with guidelines and results
- 43 scientific articles
- More than 90 related articles and abstracts for symposia
- More than 250 scientific citations in more than 56 articles

Figure 4

NRCWE research areas

Psychosocial working environment

Aim: Generate knowledge that contributes to healthy and attractive workplaces where employees avoid psychological and psychophysiological disorders and develop and maintain a high capacity for work.

3 themes:

- The psychosocial working environment and health
- Organisation and social relations
- Work retention and inclusion.

Accidents and safety culture

Aim: Generate knowledge on how to develop the ability of organizations to predict and adapt to changing risk situations through a proactive approach to safety.

3 themes:

- Background and causes of accidents
- Improving the safety climate and safety culture at Danish workplaces
- Maintaining a high and long-term safety level during flexible and dynamic conditions.

Musculoskeletal disorders and physical workload

Aim: Generate knowledge that contributes to prevention and reduction of the major challenges related to the physical working environment and promote health and enhance the potential for a long and productive work life.

3 themes:

- Reduction of risk factors in the physical working environment
- Musculoskeletal disorders - causality, consequences and preventive actions
- Work retention and inclusion.

Toxicology, nanosafety and microbiology

Aim: Unravel whether exposure to nanomaterials and products based on nanomaterials in the workplace pose a particular health risk. In addition, increase knowledge about exposure to chemicals, dust and biological risk factors in the work environment.

3 themes:

- Nanomaterials
- Chemical substances
- Biological risk factors.

Epidemiology and occupational health surveillance

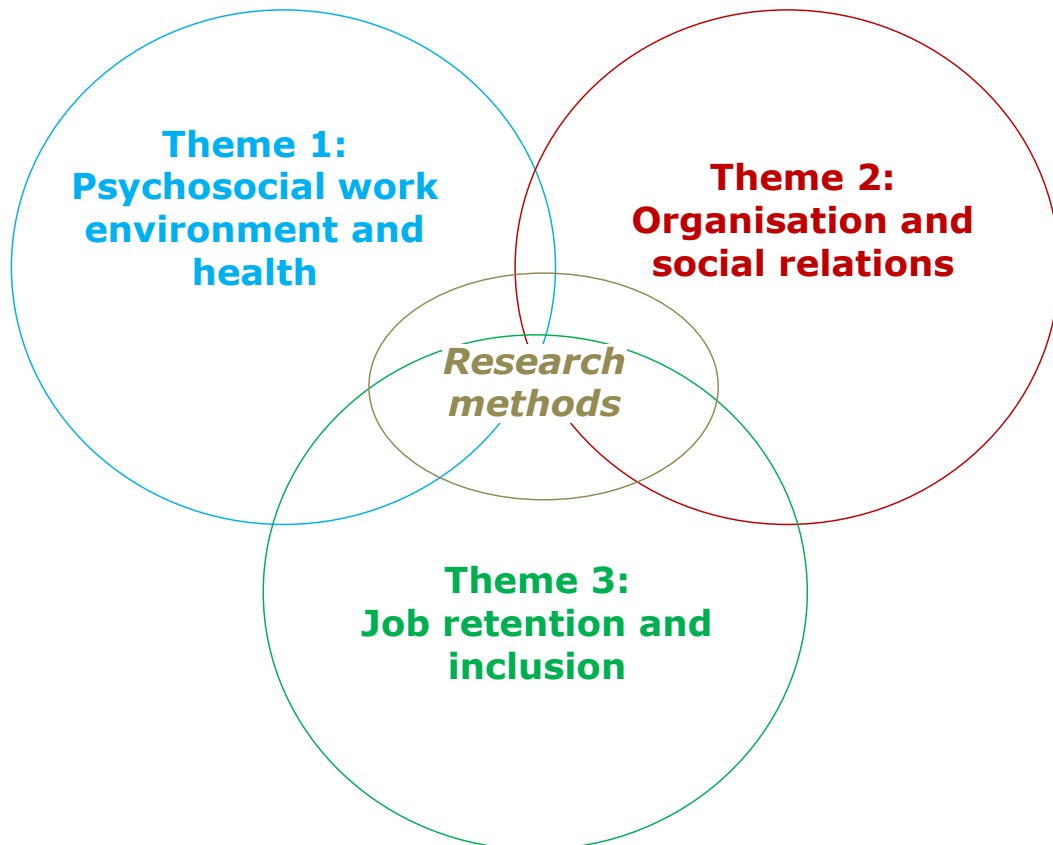
Aim: Generate knowledge on occupational medical health issues and conduct epidemiological research based on survey data and register data.

3 themes:

- Chronic diseases
- Sickness absence
- Retirement.

NRCWE's research in psychosocial work environment

Research program 2015-2019



Word cloud with key words from the research program



Psychosocial work environment

Research theme 1: Psychosocial work environment and health

Examples of questions addressed in this theme:

- **Which factors in the psychosocial work environment affect the health of employees?**
- **Through which mechanisms and under which circumstances are the employees affected?**
- **How can this knowledge be used to contribute to healthier and safer work places?**

Project example: Self-rostering

An intervention project on influence on working hours (self-rostering) among shift workers including 1.000 participants from 28 workplaces in the healthcare and financial sectors.

12 months after the intervention, managers and 70 % of the workers were positive regarding self-rostering, and there were several positive effects. For example work-family-balance improved and there was less need for recovery.



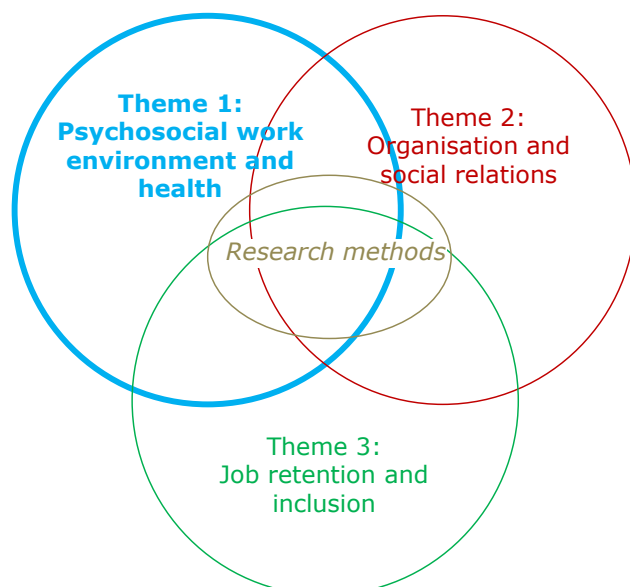
However, there are many ways to implement self-rostering and the effects depend on how it is done and why.

Project example: Work environment, mental health and labour market attachment (AhA)

The aim of the project is to study prospective associations between work environment, mental health and labour market attachments.

The project focuses on vulnerable groups and is carried out in cooperation with the IPD Work consortium that consists of more than 20 of Europe's leading psychosocial work environment researchers.

Research program 2015-2019



Psychosocial work environment

Research theme 2: Organisation and social relations

Examples of questions addressed in this theme:

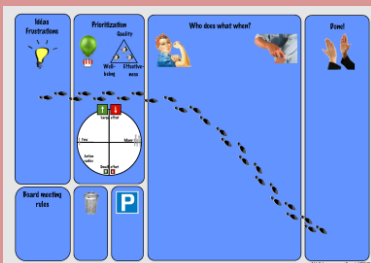
- **What influence does the organisation and the social relations have on employee wellbeing, health and productivity?**
- **How do positive factors influence work places?**
- **What is social capital and how can work places work with it?**
- **How can organisations plan and perform changes in the best possible way?**

Project example: New perspectives on Participatory Work Environment Interventions

The project studies various topics related to participatory work environment interventions.

Must certain prerequisites be met for the intervention to be completed as planned, such as a positive team climate among the participants or prior experience with employee participation?

Do certain activities in the intervention have more to say about whether the intervention is effective? For example, will the mapping of problems or the action planning have larger impact?



"Improvement board"

How do participants arrive at the problems they decide to work on and the action plans they decide to implement? And how is this process affected by employee-team leader collaboration?

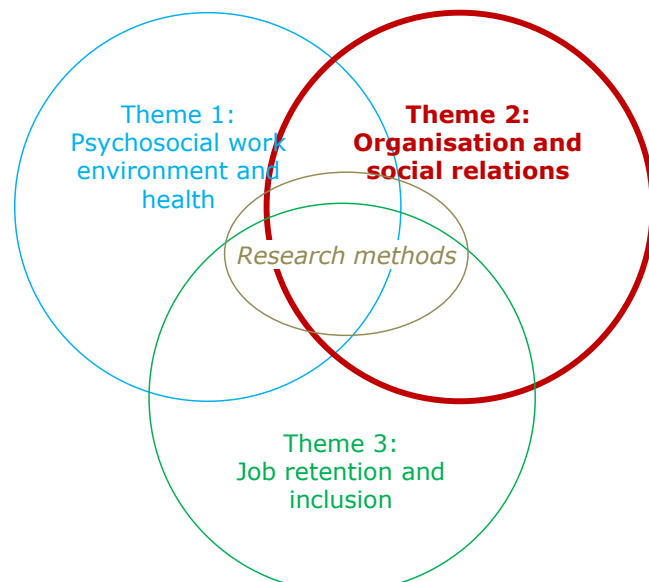
Project example: Social capital in the dairy industry

The project investigates whether social capital can be developed through planned interventions in the dairy industry.

Is it possible to find differences in the way different types of interventions affect social capital in the workplace?

Will social capital contribute to improve the efficiency of production processes while maintaining or even improving the health, well-being and engagement of employees?

Research program 2015-2019



Psychosocial work environment

Research theme 3: Job retention and inclusion

Examples of questions addressed in this theme:

- **Why and under which circumstances do ageing workers continue working?**
- **How can workers with chronic diseases be included in the labour market, and how can organisations work with job retention for this group of employees?**
- **How can stress and mental health problems be prevented and managed at the workplaces?**

Project example: Work and mental health

The purpose of this project is to evaluate the quality of international standards and guidelines and afterwards develop guidelines and tools to support Danish workplaces in their efforts to:

- prevent the occurrence of mental health problems
- detect early signs of emerging mental health problems
- manage mental health problems at work to avoid severe health and employment consequences.

The Danish guidelines and tools will be developed based on foreign standards and guidelines, research knowledge and the expertise of a broad range of professionals and stakeholders.



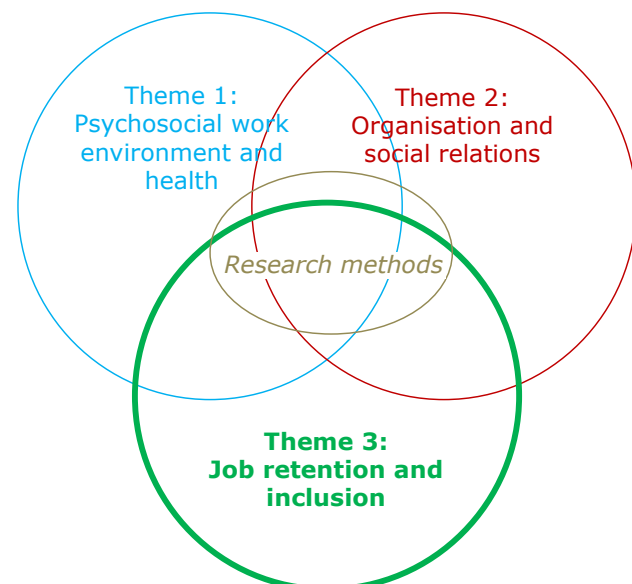
A selection of foreign standards and guidelines.

Project example: Review of reviews - Which interventions work?

In this project we conduct a review of reviews to identify the existing knowledge about the effects of interventions in the psychosocial work environment on different outcomes.

The focus is on the methodologically strongest reviews and reviews dealing with organisationlevel interventions.

Research program 2015-2019



NRCWE's research in musculoskeletal disorders

Research programme 2015-2019



Theme 1:
Exploration of factors
in the physical work
environment, that
contribute to
development and/or
worsening of
musculoskeletal
disorders

Theme 2:
Causation,
consequences, and
opportunities for
action in
workplaces

*Research
methods*

Theme 3:
Maintaining and
including employees at
work, when there is a
substantial imbalance
between individual
capacity and physical
job demands



Physical training at work reduces pain and improves social relations

Research at Danish worksites during the last 10 years show that

1. Strength training with colleagues can reduce pain in the back, neck, shoulder, and arm
2. Training for just 2 minutes a day can be beneficial
3. The effect is observed across different job groups
4. There may be positive spillover effects on the psychosocial work environment, including cooperative relations within teams
5. Training should not replace – but must complement – conventional occupational health and safety initiatives.

4 EXERCISES WITH ELASTIC BAND

The exercises train the "computer muscles" and help relieve pain in the neck, shoulder and arms.



2

Squeeze

- Shorten the elastic band and straighten your arms in front of you
- Stretch the elastic band and squeeze your shoulder blades
- Keep your elbows slightly bent at all times



1

Raise

- Raise your arms to shoulder height
- Keep your arms slightly in front of your body (like in the picture)
- Keep your elbows slightly bent when raising the arms



4

Lift

- Step on the elastic band at one end
- Make sure your wrist is free from the table edge
- Lift your wrist up and down



3

Rotate

- Secure the elastic band at one end, e.g. to a door handle
- Rotate your arm while keeping the elbow near the body at all times
- Keep your elbow flexed at all times

Training tips:

- Perform the four exercises three times a week – or daily if you prefer
- Do the exercises with colleagues as an active break away from the computer
- The "5 minutes before lunch" programme: Repeat each exercise as many times as you can, resting a minute in between each exercise
- Start out easy and increase resistance when you can do 20 repetitions in a row
- If an exercise feels uncomfortable or makes your path waver then reduce the resistance and have someone check whether you are doing it correctly. Otherwise skip the exercise
- You may feel muscle soreness during the first week of training. This is quite normal.

Professor, Lars L. Andersen



Intervention research for musculoskeletal disorders

Which specific interventions are effective for the prevention and management of musculoskeletal disorders at workplaces and can be implemented in practice?

Project example

Framing Health Literacy into the workplace

Can our work environment be improved by talking about it?

Aims

- to train employees and supervisors in pain, work environment and communication
- to ensure communication about work environment and health at the workplace, and to support action based on the acquired knowledge to improve the work environment.

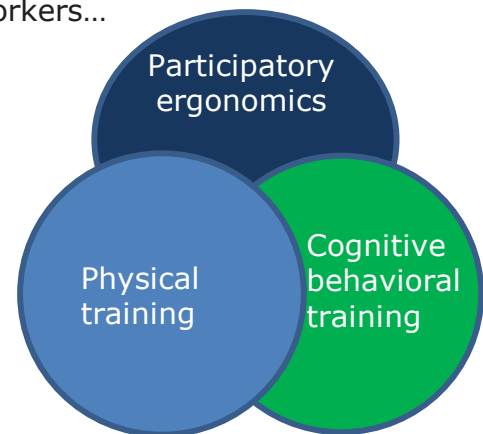


Project example

A multi-faceted intervention targeting pain and its consequences

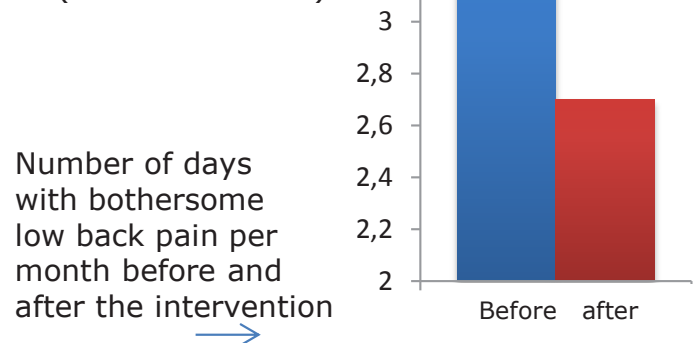
Result

A multifaceted intervention to prevent low back pain and its consequences among health care workers...



...reduced low back pain at workplace level, when measuring...

- duration (days)
- severity (intensity)
- consequences (bothersomeness)



Epidemiological research on musculoskeletal disorders

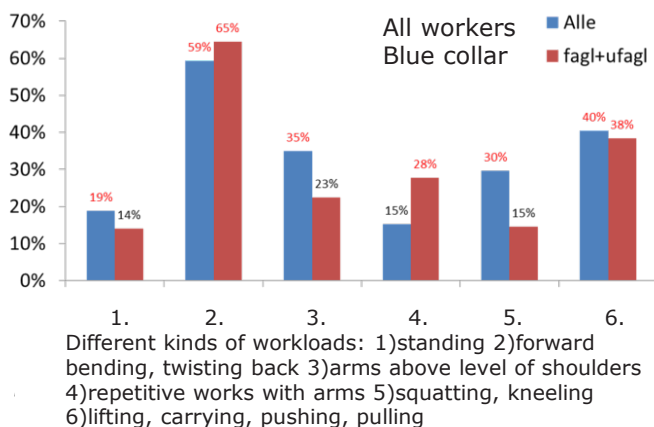
Which factors in the physical work environment contribute to development and/or worsening of musculoskeletal disorders?

Project example

Project example

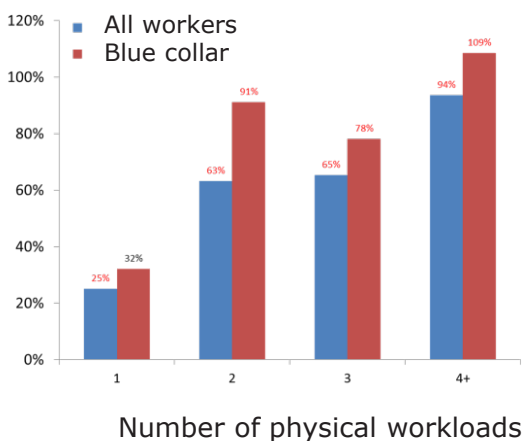
Physical workload and increased risk of long term sickness absence

Pct increased risk of long term sickness absence > 3 weeks



Andersen LL et al. 2016, Occ Env Med

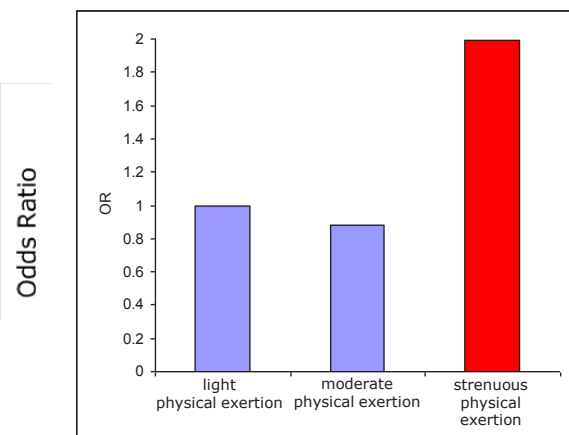
Pct increased risk of long term sickness absence > 3 weeks



Andersen LL et al. 2016, Occ Env Med

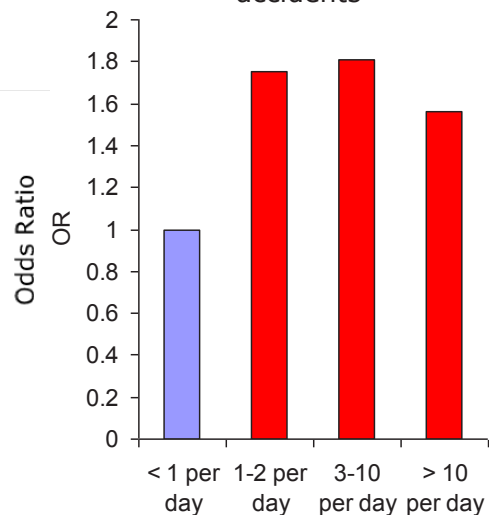
Risk of back strain accidents and back pain from physically strenuous work in the elderly care sector

Physical strain – development of back pain



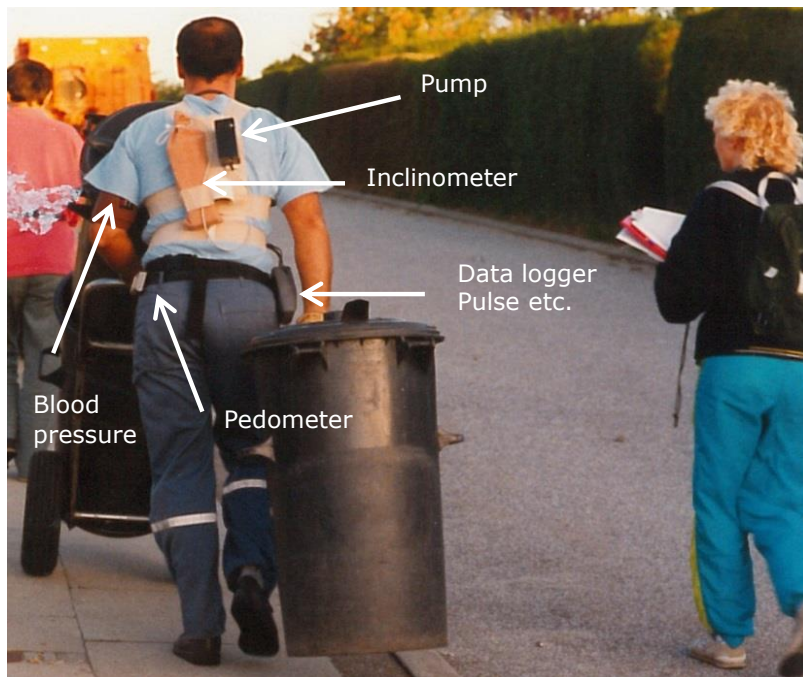
Andersen LL 2012 IAOEH

Patient handling and risk of back strain accidents



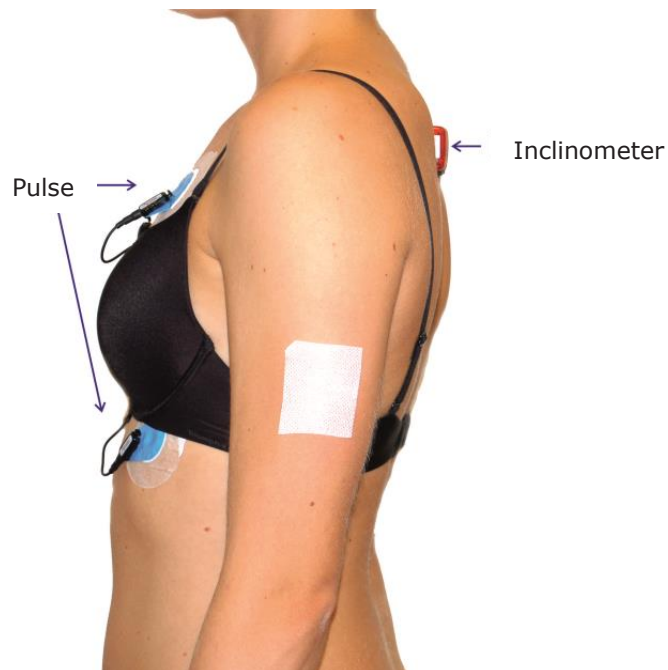
Andersen LL 2013 SJWEH

Equipment for measuring physical workload



App. 1994

This photo was taken during a research project about waste collection, including measurement of physical workloads during a workday. As the photo shows, the equipment was quite extensive and complex to use, which limited the amount of data.



App. 2012

This photo shows the "Actiheart" on the chest, which measures pulse and heart rate variability, and the "Actigraph" on the back, which measures body position, movement and physical activity. This equipment can conduct measurements for several days without the presence of a researcher, which allows for a more representative collection of data on a large number of employees.



Photos from different worksite projects using modern measuring equipment.



Research in occupational accident and safety culture

2000

Founding of a centre for research on work accidents ("CFAU")

Reactive safety research:

- Prevention of occupational accidents
- Compliance to rules and standards
- Analysis of previous accidents



Use protective footwear



Wear glasses



Wear gloves



Wear hard helmets

Nordic Occupational Safety Climate Questionnaire



Proactive approach to safety:

Create knowledge on how organizations' ability to predict and adapt to changing situations of risk can be developed by promoting their safety culture

2016

The research programme

Aetiology

Which factors influence that some groups of employees have an increased risk of experiencing an occupational accident?



Intervention

Which measures can most effectively improve businesses' safety climate and safety culture and also prevent occupational accidents?

Resilience

How can the effect of accident prevention be maintained in the long run? How is a high and long-term safety level maintained, even under flexible and dynamic circumstances?



Example of a research project about work accidents and safety culture

Research to practice (R2P)

Aim

To develop and test a method of interactive cooperation between research and practice, inspired by experiences from Canada

This study focuses on industrial work, and is based on experiences from an earlier study (SIPAW). SIPAW showed that there is substantial evidence for integrated safety measures within industrial work. Integration meaning for instance between behavioral measures such as feedback and structural measures, e.g. physical protection.



Milestones

1. Adapt and test an interactive way of cooperating between research and practice as a framework for transforming evidence-based knowledge about the prevention of accidents into "best practice"
2. Produce specific "best practice" recommendations for accident prevention initiatives in areas with a high risk of work accidents
3. Produce a set of recommendations for knowledge exchange, focusing on which skills, tools for dialogue, and learning methods that are applicable in the process of transferring research-based knowledge to practical prevention



Method

Qualitative and participatory implementation study with a multi-method design

Toolbox-training tools

Much can be gained by making health and safety a natural part of everyday work. Researchers from the NRCWE have developed a new training program – Toolbox-Training – for foremen in the construction industry in Denmark.

Training is built up around eight topics and introduces different planning and communication tools, which the foremen can immediately apply in their daily work. The 22.5-hour training program is carried out over five days, with two weeks between each day of training, where the foremen can apply their new knowledge and skills in their daily life at their worksites.

Foremen's roles

ARBEJDSGIVER/LEDER SKAL SIKRE, AT:

- de **konkrete arbejdsforhold** er sikkerheds- og sundhedsmæssigt fuldt forsvaret
- arbejdet er **planlagt og tilrettelagt** fuldt forsvaret
- det nødvendige og **egne sikkerhedsudstyr** er til stede og lever op til reglerne om indretning og brug
- de ansatte er **instrueret i**, hvordan det konkrete arbejde kan udføres forsvaret
- der er **ført effektivt tilsyn**
- der er **udarbejdet en APV + arbejdsmiljøorganisation**

Communication

KOMMUNIKATION

Åbne spørgsmål

Hvordan? Hvilke? Hvor? Hvor? Hvor?

- Åbner for forskellige svar og svarmuligheder
- Udvikler samtalen

Lukkede spørgsmål

Kan betydnings med ja og nej

- Kan præcisere en afslutning
- Kan styre samtalen
- Kan lukke ned for samtalen

Feedback med indhold

- Beskriv i stedet for at spørge
- Meddele, hvad der ses, og hvad det betyder
- Langt skærmet som ind eller som fejl
- Feedback kan anvendes til positiv feedback

Conflict management

KONFLIKTTRAPPEN

- Poterisering** - Kan ikke være sammen, nyt job
- Åbent fjendtlighed** - At skade hinanden, chikaner
- Fjendtligheder** - Finder forbandelser, gode og onde
- Samtalen opgives** - Det nytter ikke noget
- Problemer vokser** - Bestreber hinanden og trækker for tiden ind
- Personificering** - Det er din skyld
- Uoverensstemmelse** - Vi ser forskelligt på en sag

Targeted communication

KOMMUNIKATION MED DE 4 TYPER

Fortæl om tegninger, tekniske forhold og beregninger

Analytiker

Fortæl overordnet om opgaven

Instruér ikke for stramt

Lad dine folk udvikle og omforme

Oplidderen

Fokus på personer

Fortæl, hvem der skal arbejde sammen med hvem

Organisatoren

Bruges ved nær arbejdsforhold - eller andre sociale udfordringer

Interpersonel formidler

Beskriv arbejdsopgaver skridt for skridt

Planning with safety and health

DE 7 STRØMME - GRUPPEARBEJDE

Beskriv den næste aktivitet/arbejdsopgave, I skal i gang med!

Hvad ligger der af arbejdsoplysninger (AMH-S) i de 7 strømme i forhold til aktiviteten?

Injury and sickness prevention

FOREBYGGELSESTRAPPE

Fjern det farlige

- Fjernelse af risiko
- Vurder den fare, som ikke kan fjernes
- Bekæmpelse af risiko der, hvor den opstår

Tilpas arbejdet

- Tilpasning af arbejdet til mennesket: indretning, metoder, hjælpemidler, materialer og værktøj
- Udnyt mulighederne i den tekniske udvikling
- Udskift det, som er farligt, med noget, som er mindre farligt
- Kombination af flere tiltag, teknik, organisation

Personfokus

- Kollektiv beskyttelse frem for individuel beskyttelse (værnemidler)
- Hensigtsmæssig instruktion af arbejdstager

Non-verbal language

10 TIPS - BEVIDSTHED OM NON-VERBAL KOMMUNIKATION

- Start en samtale med et **smil** eller med en **godt betegnelse**, så den ikke bliver opfattet som en ordren.
- Under en samtale kan man lide med **træk** med kroppen eller med hænder i bevægelse. Det kan være udtryk for interesse og opmærksomhed.
- Stødt på et øre eller en hånd. Hvis du ikke har høret det, kan du sige: "Hvad siger du?"
- Ikke indvirkende. Når du taler, hold øje med personen, der taler. Hvis du ser på noget andet, kan det være et udtryk for manglende interesse.
- Se på personen, der taler. Hvis du ser på noget andet, kan det være et udtryk for manglende interesse.
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- Se på personen, der taler. Hvis du ser på noget andet, kan det være et udtryk for manglende interesse.
- Se på personen, der taler. Hvis du ser på noget andet, kan det være et udtryk for manglende interesse.

Communication across cultures and languages

KOMMUNIKATION PÅ TVÆRS AF KULTUR OG SPROG

4 fokusområder

- Interkulturel viden og kompetencer**
 - Tag hensyn til forskellige kulturelle værdier og holdninger
 - Tag hensyn til sproglige og kommunikative forskelle
 - Tag hensyn til kulturelle forskelle i samarbejdsrelationer, fx i samarbejdsrelationer på arbejdspladser
 - Tag hensyn til kulturelle forskelle i samarbejdsrelationer, fx i samarbejdsrelationer på arbejdspladser
- Interpersonel kommunikation**
 - Sorg for en god modtagelse
 - Sorg for en god modtagelse
 - Sorg for en god modtagelse
- Samarbejde med en, der taler et andet sprog**
 - Overvej etablerede tværkulturelle praksisser eller en medlemsordning
 - Sorg for en god modtagelse, indstruktion og vejledning
 - Tag hensyn til kulturelle forskelle i samarbejdsrelationer, fx i samarbejdsrelationer på arbejdspladser
 - Tag hensyn til kulturelle forskelle i samarbejdsrelationer, fx i samarbejdsrelationer på arbejdspladser
- Kultur og sprog**
 - Samarbejde med en, der taler et andet sprog
 - Samarbejde med en, der taler et andet sprog
 - Samarbejde med en, der taler et andet sprog



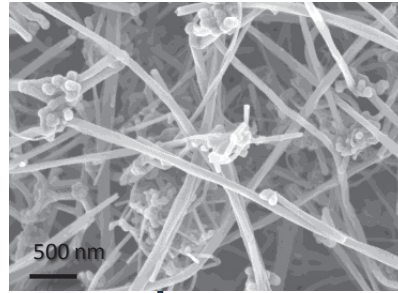
Nanomaterials – Characterization and exposure

An example by carbon nanotubes (CNT)

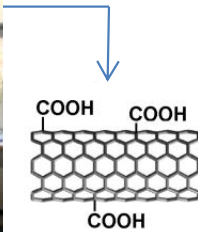
Characterization

A nanomaterial can vary in a.o. atomic structure, chemical composition, shape, and dimensions. Accurate data on their physicochemical nature is essential for correct interpretation of toxicological test results. CNTs comprise a large group of tubular nanomaterials with different aspect ratios, atomic structures, surface chemistry, content of metal catalysts and reactivity. The NRCWE focuses especially on characterization necessary for the toxicological evaluation.

Structure and dimensions are analysed using electron microscopy methods



Surface chemistry investigated by TGA-MS



Dissolution of CNT and catalysts and measurement of redox reactivity



Elemental composition of CNT measured by WD-XRF



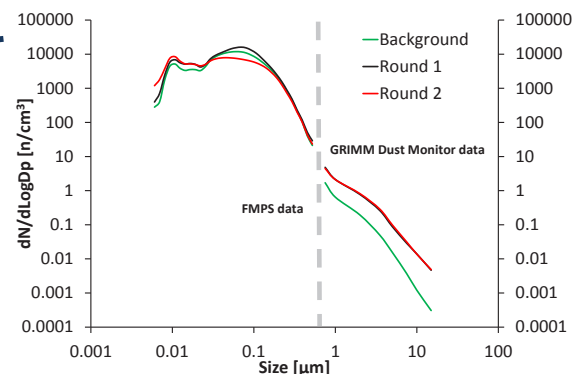
Exposure characterization

Workers may be exposed to CNT during e.g. synthesis, sonication, powder handling as well as machining and mechanical failure of CNT-composites. The release and exposure is analysed using versatile real-time particle measurement devices and offline characterization of dust particles.

Testing if conventional filter sampling applies to sampling of CNT



Airborne particle size-distribution of CNT dust measured by FMPS and Dust Monitor



Nanomaterials – Risk assessment and risk management



Risk identifikation

Inhalation of nanomaterials is more hazardous than inhalation of larger-size particles of the same chemical composition. This is especially documented for particulate materials with no or low solubility in water.

Danish workers are exposed to nanomaterial dust. Observed exposure levels were below current material-specific occupational exposure limits, but above newly proposed nano-specific occupational exposure limits.

Nanospecific risk assessment/ risk management

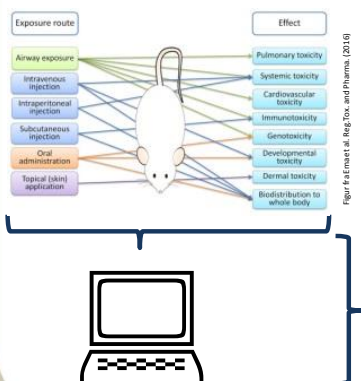
Existing risk assessment models are not valid for nanomaterials due to a lack of nano-specific occupational exposure limits and a lack of suitable default exposure and use scenarios. Therefore, we develop and test predictive models for risk assessment, which are able to take the knowledge gaps into account.

We have developed NanoSafer (www.nanosaferr.org), which can be used to perform nanomaterial- and work-specific risk assessment and obtain scenario-specific risk management recommendations for the workplace.

The risk assessment is based on physico-chemical characteristics, occupational exposure limits for analogous bulk materials, source strength data and the workplace exposure scenario.

Exposure Scenario	Tox Score	Risk Level (RL)	Recommendation
Near-field (Acute)	0.2	RL5	Very high toxicity suspected and/or moderate to very high exposure. Work should be conducted under strict dust release control, such as in a fume hood, separate enclosure etc. Air-supplied respirators or highly efficient filter masks (PP3 or higher quality) may be used as a supplement and must be readily available in case of accidents. Expert advice is recommended.
Near-field (Daily)	1.05361	RL5	Very high toxicity suspected and/or moderate to very high exposure. Work should be conducted under strict dust release control, such as in a fume hood, separate enclosure etc. Air-supplied respirators or highly efficient filter masks (PP3 or higher quality) may be used as a supplement and must be readily available in case of accidents. Expert advice is recommended.
Far-field (Acute)	0.20076	RL2	Low toxicity suspected and/or low exposure potential. Work should be performed using local exhaust ventilation, fume hoods etc. depending on the work situation. Work may be performed in combination with use of respiratory protection equipment (P3 or higher quality). Make sure to have the personal respiratory protection equipment available in case of accidents.
Far-field (Daily)	0.07271	RL1	Very low toxicity and low exposure potential. The risk level is expected to be acceptable. Work may require use of local exhaust ventilation, fume hood etc. depending on the work situation. Make sure to have personal respiratory protection equipment (PP3 or higher quality) available in case of accidents.

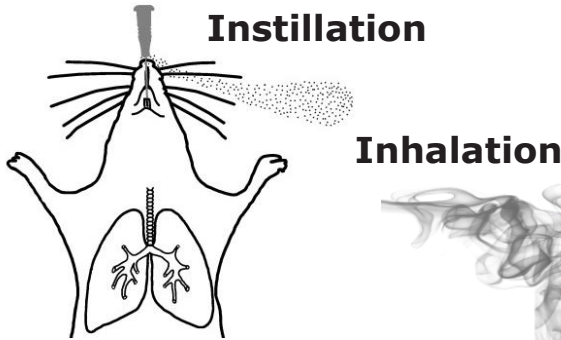
Resultater fra eksperimentelle studier



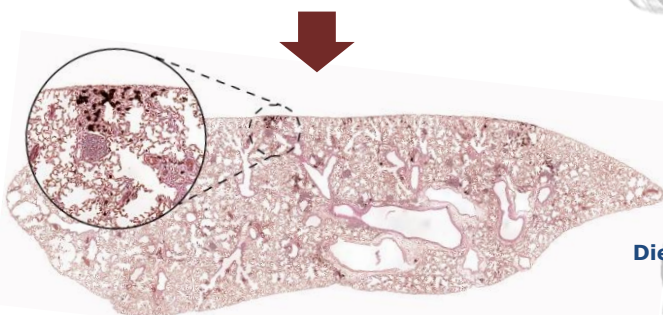
Nano-specific occupational exposure limits

The Danish Working Environment Council has made 23 recommendations for safe handling of nanomaterials in the Danish working environment. One of these recommendations is to propose specific occupational exposure limits for two high volume nanomaterials, the pigments carbon black and titanium dioxide, and one very toxic nanomaterial, carbon nanotubes. The Working Environment Authority has asked the NRCWE to provide the documentation. The work will be finalised in two years.

Nanomaterials – Hazard assessment important part of risk assessment

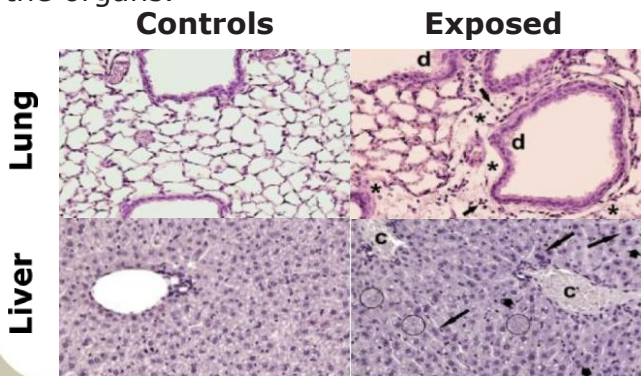


Nanomaterials (NM) are tested in cell cultures before animals. Testing in mice is essential as results resemble those of occupational human exposures. NMs are deposited in the lung either via instillation or inhalation. We focus on highly produced NMs or NMs with expected toxicity. So far we have tested 40 NMs in mouse studies.

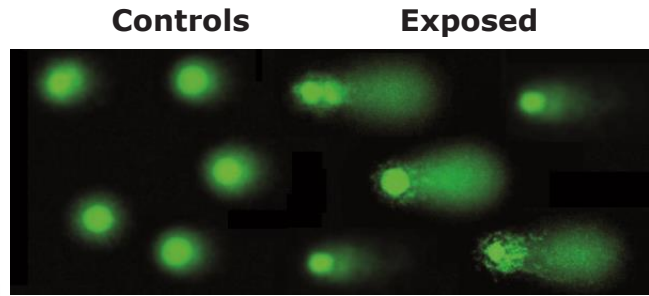


Microscopic changes in the organs

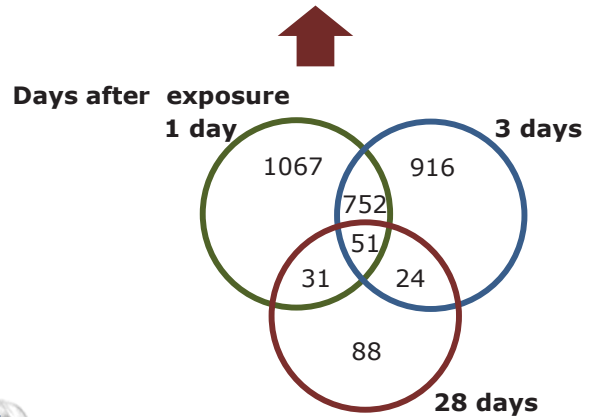
Important changes are identified and examined. Above is a cross-section of the lung with visible NM. Below: Detailed changes seen following NM exposure. *, o, d and arrows are markers that show important NM-induced changes in the organs.



- ZnO
- TiO₂
- SiO₂
- FeO₂
- Gold
- Silver
- Graphene
- Nanoclays
- Diesel Exhaust Particles
- Carbon Nanotubes
- Carbon Black
- Fullerenes

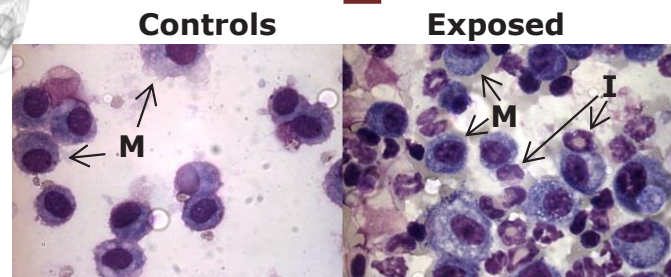


DNA damage and carcinogenicity. DNA strand breaks are noticeable as comet tails after an electric field has pulled the DNA. An intense long comet tail shows damage to the DNA indicating mutations & carcinogenicity



Mapping up/down-regulated genes

A large number of genes are followed 1, 3 and 28 days after the NM exposure. This helps to identify initiating mechanisms as well as pathways that lead to disease.



Inflammation. Macrophages (M) are the primary cells in lung fluid in control mice. Exposure may result in large influx of e.g. inflammatory cells (I). Persistent inflammation may lead to diseases.

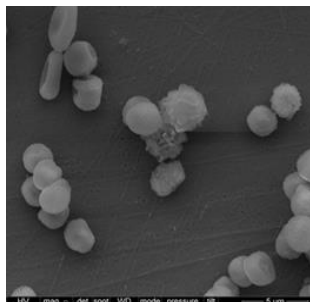
Microorganisms in the working Environment

Exposure to microorganisms in the working environment: aerosolisation, characterisation, intervention, mechanisms and health effects.

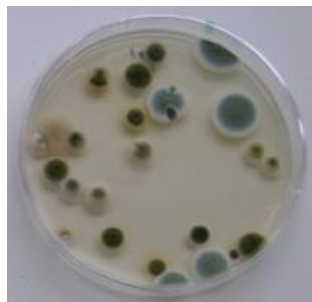
Exposure assessment



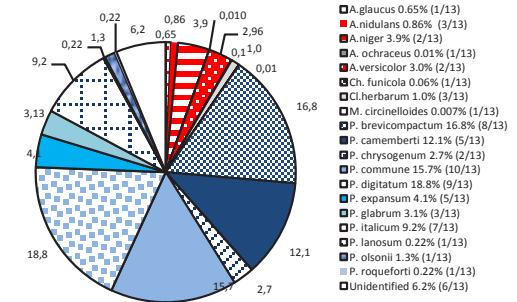
Characterisation of aerosols



Fungi from indoor air



Fungi deposited in the nose during a workday

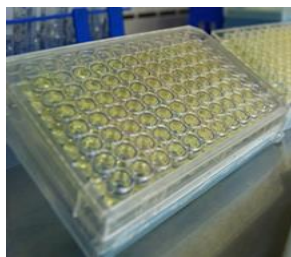


Fungal species in the inhalation zone of waste workers

Relation between exposure, work tasks and health effects



MRSA-bacteria from pig farms



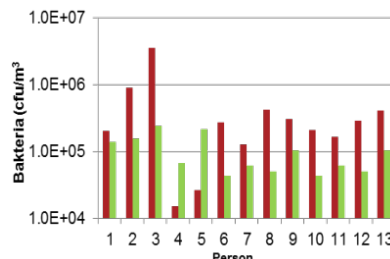
Measurement of endotoxin, glucan and inflammatory potential



Development and application of methods for sampling airborne viruses at waste water treatment plants



Fungi and bacteria in noses versus in air



Exposure **before** and **after** an intervention



Measurement of inhalation and deposition of dust and microorganisms in the airways

Working with a chronic disease

Research question

What is important for chronically ill employees and their absence from work and labour market inclusion ?

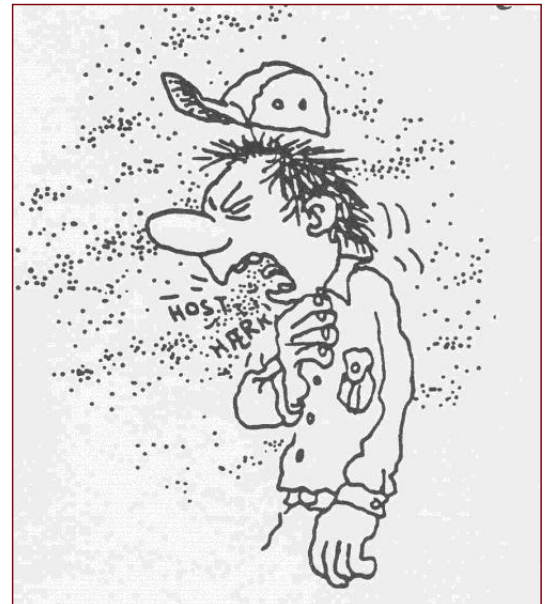
How can the working environment support labour market inclusion?

WHO

Every third Dane between 18 and 59 years suffers from a chronic disease. Many people with chronic diseases such as lung diseases and rheumatoid arthritis suffer a substantial risk of being permanently excluded from the labour market.

HOW

By combining register data, questionnaires and qualitative interviews, the NRCWE has analysed the risk of labour market exclusion of people suffering from depression, metabolic disorders and rheumatoid arthritis.



WHAT DO WE FIND

Physically demanding work and **lack of influence on work planning** increase the risk of labour market exclusion while a **high degree of freedom** at work protects against long-term sickness absence at work.



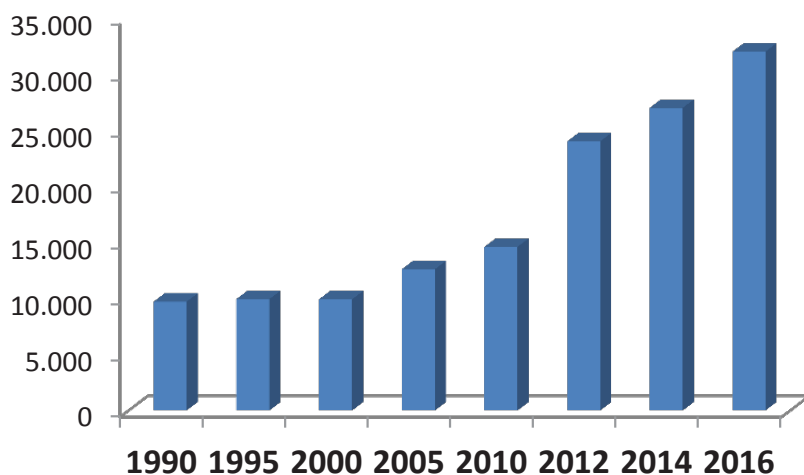
THE FUTURE

In the future, the NRCWE will continue to focus on how to support chronically ill people with a good and full working life.

OSH surveillance 1990-2016

The NRCWE has since 1990 monitored the working environment in Denmark by implementing large nationwide surveys. The surveys have grown over the years and it is now possible to analyze the work environment and health of even the smallest job and industry groups.

Survey participants since 1990



The NRCWE has surveyed virtually all factors in the Danish working environment through the years. Furthermore, the NRCWE has measured the objectives of the national OSH strategies. The surveys are also a very important part of the NRCWE's epidemiological research.

Declining response proportions since 1990

In 1990, the response proportions were more than 80 percent. Today a response rate of 50 percent is considered satisfactory. To ensure sufficient statistical power to analyze relatively small sub-groups, the sample-sizes of survey was expanded.

Mail all over the basement

In 2016, the NRCWE sent out 65,000 questionnaires by mail. The basement was filled with 40 pallets. The 2016 survey was the largest survey ever carried out by the NRCWE.



OSH surveillance

The occupational safety and health (OSH) monitoring program consists of two surveys carried out to measure virtually all factors in the Danish working environment especially in the prioritized fields of the national OSH strategy. The surveillance uncovers trends and correlations between work, health and consequences for health and labor market status. The monitoring is based on questionnaires covering issues of central importance for achieving the goals in the prioritized fields of the national OSH strategy.

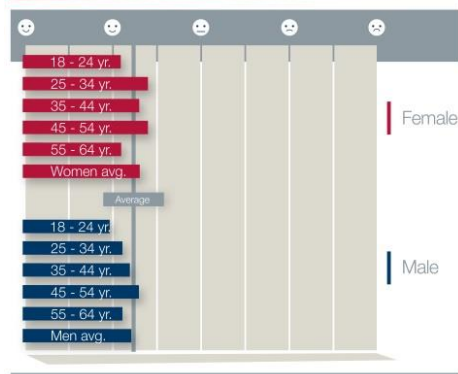
The OSH monitoring is used in many different contexts. The Danish Working Environment Authority (WEA) uses the results of the "Occupational safety and health in Denmark" survey when constructing the index that underlies the occupational exposure risk-based supervision. This enables the WEA to point out sectors with high exposure rates.

The main part of the dissemination of the OSH monitoring is carried out on the NRCWE web site. Here the NRCWE presents a very large number of tables, figures and fact sheets regarding work environment and health in Denmark – which answer a number of work-environment related questions:

Are men or women over-exposed to jobinsecurity?

Figure C

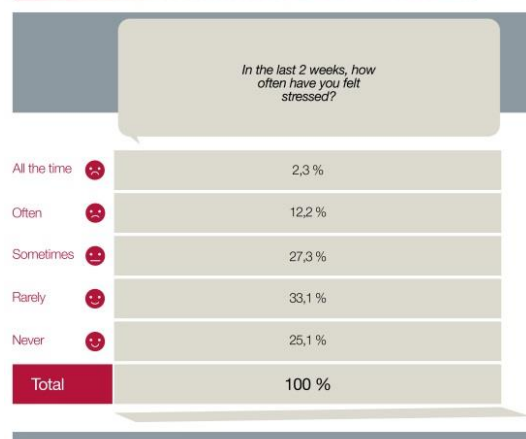
- To what extent are you worried about becoming unemployed?



The figure shows the mean calculated from 5 response categories: 1 = To a very slight degree, 2 = To a slight degree, 3 = To some degree, 4 = To a high degree, 5 = To a very high degree. The figure shows the mean.

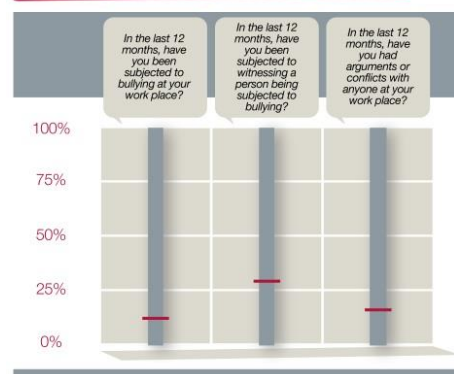
How many reports stress?

Figure A



How many are exposed to bullying?

Figure A

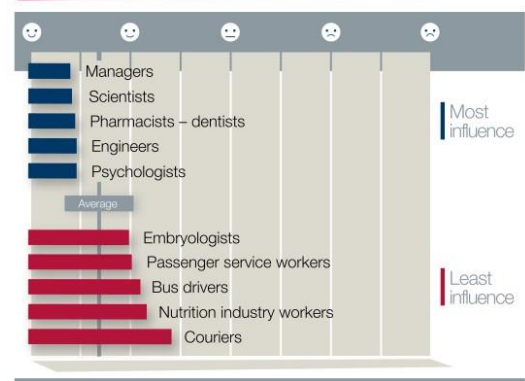


The figure shows the proportion of people who have answered "yes".

Jobs with most influence at work

Figure B

- How often do you have a say in how you complete your work tasks?



The figure shows the mean calculated from 5 response categories: 1 = Always, 2 = Often, 3 = Sometimes, 4 = Rarely, 5 = Never.

The Working Environment Information Centre



The Working Environment Information Centre communicates research knowledge, guidance tools and good practice along with news about current topics of the working environment in Denmark. Managers as well as employees can find advice and information about daily working environment efforts. The Information Centre links to other relevant organisations and their material. The Information Centre communicates through different media and initiatives:

- **The magazine 'Arbejdsmiljø'** – published 11 times a year
- **The newsletter 'Arbejdsmiljø'** – published weekly
- **Arbejdsmiljøviden.dk** – an overview of working environment knowledge
- **Social media** – shares knowledge about working environment in a broad perspective

Networking and dialogue initiatives

The Working Environment Information Centre aims to communicate actively through network and various partnerships with other organisations in the field of working environment in Denmark.

Special focus

The Working Environment Information Centre communicates knowledge about the working environment in a broad perspective with special focus on:

- Pain in muscles and joints
- The psychosocial working environment
- Accidents at work

Furthermore, a wide range of articles, videos and tools can be found on the website arbejdsmiljoviden.dk.



NATIONAL RESEARCH CENTRE
FOR THE WORKING ENVIRONMENT

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