Colloquium of the ISSA International Section for Research on Prevention

Research on the effectiveness of prevention measures at the workplace

15 and 16 October 2009
Institute Work and Health (BGAG), Dresden, Germany
Colloquium of the ISSA International Section for Research on Prevention

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This conference focuses on the research to optimize the process for the transfer of classical risk oriented research into service oriented prevention provided to support the companies.

According to current knowledge OSH research must be supplemented by the aspect of process analysis and process optimization of all prevention services. First results of this extended research approach will be presented.
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PROGRAMME

14th October 2009 – Day of arrival

Conference check-in

Poster presentations, continuing during all coffee breaks

Get-together of the participants and dinner in the BGAG restaurant

15th October 2009

Welcome by the President of the Research Section, Jean-Luc Marié

The relevance of research for prevention worldwide
Address by Hans-Horst Konkolewsky, Secretary General of ISSA

1st plenary lecture
Risk-oriented research and its preventing effects – A critical review
Jean-Luc Marié, INRS, France

OSH research is only effective, if its results improve the quality of workplaces and working procedures. The transfer of these results into prevention services is therefore one of the essential criteria of OSH research. Indicators show today that the effectiveness and efficiency of this transfer could be improved.

This lecture will include case studies from industry, demonstrating the successful transfer of research results.
2\textsuperscript{nd} plenary lecture

Indicators on the effectiveness of prevention services

Nilton Freitas, Sindicato dos Quimicos do ABC, Brazil

If the transfer of OSH research into prevention services is to be systematically improved, ways have to be found to assess or even measure the effectiveness and efficiency of these prevention services. As a consequence we also need research to improve these services. Indicators serve as a substitute yardstick of information and phenomena that cannot be directly measured. The lecture describes suitable indicators for the most important OSH prevention services and for the improvement of the OSH transfer.

Coffee break

Parallel sessions on the different prevention services

- Up to 8 lectures per session (10 minutes each)

Session 1

Interaction between different OSH services

Chair: Hanna Zieschang, DGUV, Germany
Rapporteur: Rolf Marter, DGUV, Germany

The interaction between different OSH services will be reported on. These can include inspection, consultations, information, communication, investigations e.g. in the event of occupational accidents or diseases, testing and certification of work equipment, training (qualification) and OSH research. This session will also include reports on the effectiveness of combined services.

Cameron Mustard, IWH, Canada
Development of a performance measurement report for the prevention system in a Canadian province

Stefan Droodofsky/Jens Jühling, BGETE, Germany
New challenges in the field of prevention in small enterprises

Pawel Rozowski, GIP, Poland
Preventative activities – Strategic planning and evaluation

Catherine Montagnon, INRS, France
Research, assistance, training and consultancy in practice: A virtuous circle
Hanna Zieschang, DGUV, Germany
Networking of competencies: Reciprocal action between prevention services

Session 2

OSH consultation and inspection
Chair: Ho Siong Hin, Ministry of Manpower, Singapore
Rapporteur: Ruth Krausse, DGUV, Germany

These prevention services include consulting for employer and the employees/insured for the prevention of occupational accidents, occupational diseases and work-related health hazards. Consulting can be carried out upon request, in the course of targeted prevention strategies, in connection with plant tours and as collective consultations, e.g. in the context of national and international standardisation procedures. The consultations are backed up by monitoring the measures taken within the companies to prevent occupational accidents, occupational diseases and work-related health hazards plus the provision of first aid. Monitoring covers:

- inspections,
- instructions to eliminate deficiencies,
- monitoring of deficiency elimination.

With reference to individual examples, this session will show how prevention within the companies can be improved by research on more efficient monitoring and consulting procedures in industry.

Lynda S. Robson, IWH, Canada
OHS management audits: The importance of their measurement properties

Martin Goder, VDSI, Germany
Key figures for occupational health and safety – Making occupational health and safety measurable and presentable

Edwin SW Yap, ESIS Asia Pacific Pte Ltd, Australia
Yang Miang Goh, Curtin University, Australia
OSH monitoring: A review of current research

Eleni Douvi, ERGOSE S.A., Greece
Research on the safety climate in ERGOSE’s worksites

Christoph Preusse, BGM, Germany
Process observation at machine tools – Preventive approach and reality
OSH research aims to identify causal relations between working conditions and their effects on safety and health and to ensure participation in the development, testing and validation of effective prevention strategies and measures. OSH research is one of the strongest initiators for the improvement of other prevention services and therefore has to undergo continuous improvement itself. How this can be successfully performed is discussed in this session.

Eva Flaspöler, DGUV, Germany
OSH research – Improvement of research and development

Ehsan Habibi, University of Esfahan, Iran
Application of a hazard and operability study to hazard evaluation of a chemical unit of the power station

Harald Sefrin, BGM, Germany
Protection systems against fire and explosion hazards at machine tools when using flammable metal working fluids

Marika Lehtola, FIOH, Finland
Interventions for preventing exposure to chemical substances known to cause health hazards in workers: A Cochrane systematic review protocol

Alvian Tan, Ministry of Manpower, Singapore
Development of the Construction Safety Audit Scoring System (ConSASS) in Singapore

Francis Pierre, INRS, France
Biological or airborne Al monitoring in the aluminium industry?

Joachim Herrmann, DGUV, Germany
Requirements for funding procedures to support knowledge transfer to OSH practice
Session 4

Investigations, testing and certification
Chair: Daniel Podgórski, CIOP, Poland
Rapporteur: Volker Didier, DGUV, Germany

Investigations are carried out as a means of ascertaining the causes of and circumstances accompanying occupational accidents, occupational diseases and work-related health hazards. By learning from past mistakes, prevention approaches for the future can be systematically improved. Whereas investigations are performed in the companies themselves, testing and certification on the manufacturers’ site are considered to be an effective means to exert an influence on the development of safe products. This session shows how investigation, testing and certification can lead to safe workplaces with safe working equipment and processes and how these services aid to transfer OSH research into safe products.

Roger Stamm/Markus Kohn, DGUV, Germany
The investigation prevention service

Rüdiger Reitz, DGUV, Germany
Product testing and certification: An efficient means to exert influence on the safety of products

Dariusz Pleban, CIOP, Poland
Development of test methods for PPE as a stimulation for innovative preventive solutions

Albrecht H. Glöckle/Ralf Renninghoff, BGDP, Germany
The prevention network “inspection”, “testing/certification” and “standardisation”

Matthias Umbreit, BGM, Germany
Hans-Jürgen Ottersbach, DGUV, Germany
Research on biomechanic stress factors of workplaces with collaborating robots

Lunch

Plenary session
Reports on sessions 1 to 4
3rd plenary lecture
Quality in Prevention: Outcomes of a research project by the German Social Accident Insurance (DGUV)
Bodo Pfeiffer, DGUV, Germany

For the implementation of their statutory prevention assignments, the statutory accident insurance institutions in Germany provide a variety of prevention services.

These services are substantially driven by the results of applied research in the field of OSH. The most important services are:

- monitoring and consultation,
- provision of information and information material, communication,
- investigations, testing and certification,
- training and further training in OSH,
- research and development.

The goal of all these services is to preserve, protect, improve and, if necessary, restore the health, quality of life, mobility and performance of employees by exercising influence on the companies. All parties responsible, and thus the statutory accident insurance institutions, are called upon to carry out prevention work on the basis of the best available scientific and technical knowledge and at a high level of quality. This demands regular analysis, assessment and, if necessary, improvement of the effectiveness and efficiency of prevention services. Against this background, the statutory accident insurance institutions of the industrial sector have carried out a research project on the evaluation of prevention services. This plenary lecture reports on the available findings of the project.

Coffee break
Research into the following subject: How can we facilitate and promote the implementation of OSH activities in the companies?

4th plenary lecture
How can companies improve OS&H performance through adoption of leading practices?
Sietse van der Woude, South African Chamber of Mines, South Africa

Companies are often not aware of the results of OSH research. In some cases they do not use prevention services to improve safety and health. What new strategies do we have to encourage companies to invest in OSH?

Appropriate tools will be presented and discussed in the following parallel sessions. The plenary lecture will provide an introduction on how the acceptance of OSH measures can be enhanced.

Social event: Elbe riverboat cruise to Pillnitz Castle, dinner on the boat
Photo show of the first day

Summary of the first day and introduction to the parallel sessions
Walter Eichendorf, DGUV, Germany

4 parallel sessions
► Up to 8 lectures per session (10 minutes each)

Session 5
OSH training
Chair: Didier Baptiste, INRS, France
Rapporteur: Güler Kici, DGUV, Germany

Not only prevention service providers themselves, but all persons in charge at the particular workplaces have to systematically improve and extend their knowledge and skills on how to identify safety and health risks. Thus they should be able to assess these risks and convince the companies to implement effective measures against them. This session covers research to improve the effectiveness and efficiency of training and further training in prevention.

Catherine Montagnon, INRS, France
General strategy for training

Hans-Jochem Fuhrmann, BG BAU, Germany
Quality cooperation qualification

Maria Wolff/Kati Masuhr/Annekatrin Wetzstein, DGUV, Germany
How to ensure transfer in qualification measures in the field of occupational health and safety (OHS)

Ulrike Bollmann, DGUV, Germany
Anna Koch, Dresden University of Technology, Germany
Standard of competence for instructors and trainers in health and safety in Europe: A research-based requirements profile

Max Masse, INTEFP, France
Work, risk evaluation, professional training – Between prescriptions, activities performed and activities prevented

Ulrich Winterfeld, DGUV, Germany
Rüdiger Trimpop, University of Jena, Germany
Long-term study of the effectiveness of the work of safety specialists
Session 6  
OSH information and communication
Chair: Marc de Greef, PREVENT, Belgium
Rapporteur: Marlen Kaufmann, DGUV, Germany

This prevention service comprises committee work, the media and public relations on prevention subjects and the implementation of prevention campaigns. This session is intended to present the latest findings on how to measure and improve the quality of information and communication.

Hiltraut Paridon, DGUV, Germany  
Information and communication: Do our messages get through?

Christian Davillerd, INRS, France  
The enterprise, ultimate link and essential actor in the long chain of preventive communication

Katariina Röbbelen-Voigt/Ellen Schmitz-Felten, Kooperationsstelle Hamburg, Germany  
Improvement of the quality of OSH information and communication

Esin Taskan-Karamürsel/Annekatrin Wetzstein, DGUV, Germany  
Measuring the effectiveness of prevention campaigns

Tim Tregenza/Zinta Podniece, EU-OSHA, Spain  
Using case studies to raise awareness and disseminate solutions

Bernard Salengro, CFE-CGC, France  
Health and stress at work: Different actions of communication used by a manager’s trade union

Megan Gilliver, NAL, Australia  
Hear no evil: Encouraging construction workers to reduce their noise exposure
In addition to rules and regulations incentive systems are to motivate the companies for particular prevention efforts. In this course of lectures important incentive systems such as bonuses for prevention measures or safety and best practice competitions will be presented by means of concrete examples.

Dietmar Elsler, EU-OSHA, Spain
Exchange of economic incentives good practice at European level

Deborah Walker, Loughborough University, United Kingdom
Use of health and safety awards for internal and external marketing

Norbert Schulz, FBG, Germany
Cost benefit analysis of an economic incentive model

Maria Ottati, HSE, United Kingdom
Research into the feasibility of using economic instruments to internalise the costs of health and safety

Sandra Dohm, BGW, Germany
The BGW health prize – An award for the image

Anna Richardson-Owen, HSE, United Kingdom
Behavioural economics in the context of workplace health and safety

Stephan Schwarzwälder, BAuA, Germany
INQA – Making good prevention visible to customers

Holger Imhoff, StBG, Germany
The award “Work – Safety – Health”: An open marketplace for new ideas

Preventing disruption of all internal and external processes is one economic benefit of OSH activities. “Return on prevention” (in accordance with ROI) is a good and convincing argument for investment
Research on the effectiveness of prevention measures at the workplace

in OSH. Based on new research findings the economic benefit of OSH activities will be presented.

Dietmar Bräunig/Katrin Mehnert, University of Giessen, Germany
Thomas Kohstall, DGUV, Germany
Accounting for costs and benefits of prevention work: Is it worth for companies to invest in occupational safety and health?

Norman Tan, ORC Worldwide, Singapore
Using financial metrics such as ROHSEI to make HSE decisions

Ina Sockoll/Wolfgang Bödeker/Ina Kramer, BKK-BV, Germany
The costs of work-related diseases for economies and companies – A rational for investment

Emile Tompa, IWH, Canada
An economic evaluation methods initiative for occupational health and safety

Birgit Köper, BAuA, Germany
Strategic steering of occupational safety and health (OSH) – Examples on different organisational levels

Frank Thalau, BAuA, Germany
Cost effectiveness of cardiovascular disease prevention comparing worksite and community-based programmes – A systematic review

Christian Trontin, INRS, France
Preventing the manual handling risk for healthcare workers: A cost-benefit analysis

Claudia Oldenburg, BAuA, Germany
Reducing sickness presenteeism: The neglected source of productivity increase?

Coffee break

Plenary session
Reports on sessions 5 to 8
This lecture outlines approaches for the evaluation of private or public OSH service providers on the basis of appropriate case studies.

Lunch

6th plenary lecture
Strategic agility – An oxymoron or a necessity for OSH organizations?
Harri Vainio, FIOH, Finland

Maintaining and developing sustainable cultures of work in future will require two things: Firstly, the productivity of their workplaces must be raised to levels in which the organizations are able to operate profitably even if the global competitive pressures will increase significantly in comparison to the present situation. Secondly, the promotion of sustainable economic growth and the creation of more sustainable forms of work must be done simultaneously. These two preconditions require strategic agility also from OSH organizations. But if they are met, the citizens may have good reasons to believe that work can have a future and that this future is something that is worth striving for.
7th plenary lecture
Research for prevention in the US
John L. Henshaw, Former Assistant Secretary of Labour of the US government, USA

The lecture focuses on general research issues and development around the prevention of workplace accidents and disease originating in the United States. In this regard, the balance between research and regulation in the US and efforts of the new NIOSH initiative “Research to Practice (r2p)” will be discussed.

Summary, outlook, closure
Olaf Petermann, Chairman of ISSA’s special commission on prevention, Germany

Coffee break
Responsible for the colloquium

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Cameron Mustard, IWH Toronto, Canada
Bodo Pfeiffer, DGUV, Germany (local organizer)
Dietmar Reinert, DGUV, Germany

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INTRODUCTION
Prevention in the field of Occupational Safety and Health complemented by measures of health promotion in the working environment (OSH) is organized by different national bodies. Most of these organizations supply their services via different service products, i.e. a range of prevention services. In Germany the Social Accident Insurance Institutions have defined a set of ten prevention services they offer (fig. 1). Similar definitions (with slight variations depending on the legal framework) exist in many countries.

Except “Research and Development” all prevention services can be directly offered to the enterprise – be it a multinational company or a SME – as illustrated in fig. 2. Results of R&D are in most cases transmitted to the enterprise via all other prevention services.

Each enterprise has internal processes influencing Occupational Safety and Health. Quality control processes are especially interesting in the context of prevention. External prevention services are supposed to encourage prevention activities within the enterprise. Conventional OSH research related to risks (Research I in fig. 3) feeds external and internal prevention processes with new input only if the research results are comprehensible and transferable to the company.

| 1. | Incentive schemes |
| 2. | Consulting (on request) |
| 3. | Company medical support and guidance on safety technology |
| 4. | Investigation |
| 5. | Research and development, model projects |
| 6. | Information and communication; information material |
| 7. | Testing and certification |
| 8. | Prevention regulations |
| 9. | Training and qualification |
| 10. | Inspection including consultation |

Fig. 1: Different products (Prevention services) are offered by OHS services worldwide; the sets of products will slightly differ depending on the national legal frameworks. In Germany 10 different services are distinguished.
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OSH research needs information input from prevention and enterprise processes. Therefore OSH research can only be successfully performed with feedback loops from the internal processes in the enterprise and additionally from the prevention service supplier.

In fact external prevention services are supplied as a combination of different services adapted to the needs of the service customer. In this respect prevention services are combined services which transfer knowledge and research in different ways resulting in strong synergies.

An additional new aspect of prevention research (Research II in fig. 4) helps to measure and increase the efficiency of prevention research (transfer orientation) and of the combined prevention services 1..n. This kind of prevention research can be summarized as process optimization.

Fig. 2: OSH R&D results are hardly ever directly applicable to a particular company. Structure quality and process quality will determine the degree of Occupational Safety and Health in a specific workplace.

Fig. 3: Results from OSH research transferred via other prevention services 1, 2, 3, …
The Research III aspect looks at the acceleration or support of prevention processes by optimization of the business environment and incentives. This kind of prevention research will for example investigate legislation or regulations with respect to their applicability and efficiency or the potential for the optimization of incentive systems. Any external framework conditions that support the OSH efforts in the enterprise may be subject of Research III in fig. 5.

This Colloquium “Research on the effectiveness of prevention measures at the workplace” of the ISSA International Section for Research on Prevention is the first international conference that concentrates mainly on Research II and Research III. Insofar this congress is dedicated to quality research as regards all different prevention services. To measure the effectiveness and efficiency of prevention services or their “quality” we need “indicators”. So we have to:

- clarify the terms “quality” and “indicators” in the context of OSH institutions’ prevention work.
- develop a methodological framework to enable a systematic presentation of comparable quality characteristics in prevention.
- identify indicators showing the effectiveness and efficiency of prevention.
- evaluate indicators and establish a quality score.
- identify measuring tools for the indicators of all the prevention services provided.

As learned from different projects to be presented at this international conference we have to state that OSH research can no

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1 The model developed by Donabedian (1966) has become the established model for describing the structure of the term “quality”. He breaks quality down into three dimensions: structure quality, process quality and outcome quality. Structure quality describes the supply side whereas process quality describes the quality of the performance of a prevention service compared with the provider. Outcome quality, on the other hand, is compared with the service customer or at the workplace rather than with the service provider.

2 An indicator serves as a substitute measure for gathering information on or measurement of phenomena that cannot be measured directly.
longer be restricted to providing methods for risk assessment or risk reduction or to effective management systems. OSH research must also be targeted towards optimization of all prevention services applied nationally, but in a first step towards those that are offered worldwide: presumably inspection, consultation and qualification.

The following example is to illustrate the necessary new research approaches:

1. In a research project noise-reduced saw blades are to be developed. This is classical risk-oriented Research I.

2. To achieve a fast availability of the new saw blades (or generally the improved products) in the market, the following aspects have to be examined additionally: With which cooperation partners should this research (step 1) be accomplished? In which technical periodicals should the results be published in order to arouse interest in the market? In which technical language are the results to be presented in order to achieve their introduction on the market? Research II requires the ability to provide answers to such questions in generally valid terms.

3. When the product is finally available, the results must be verified by practical tests; testing and certification procedures are to be developed if required (Research I).

4. To make the positive result of practice testing available for all woodworking enterprises and to use them for new products, appropriate information brochures and documentation must be designed. Consulting concepts should be optimized particularly in terms of economic aspects; training measures must be developed and tested. Research II will then examine which result representations in Research I can facilitate and accelerate all the necessary developments. Research II will also help determine their most successful presentation and the best argumentation.

5. Research II is also performed when investigating the best order and/or combination of the different prevention services to facilitate a comprehensive introduction of the new saw blades in the industry concerned (in order to achieve the goal with the lowest possible expenditures).

6. Research III finally examines which incentives the industrial safety organizations should provide in order to promote a fast introduction of safe products. Research III also examines the legislation and rule setting for how they can support the penetration of the improved products.
We wish this International Colloquium all the best of success. May our guests be able to take a lot back home from the lively discussions we hope for. The colloquium wishes to provide strong and lasting stimulus to the OSH research community so that the transfer of research outcomes into operational practice may become faster and more effective in the future. We would like to thank all participants, especially the speakers, for their contributions which are to be understood as the first steps to explore terra incognita.

Dresden 2009-10-15

Walter Eichendorf             Bodo Pfeiffer
KEYNOTES
Indicators on the Effectiveness of Prevention Services

Nilton Freitas
Sindicato dos Químicos do ABC, Brazil

Abstract
At the context of conceptual and methodological evolution of occupational safety and health management (OSH) worldwide, it's important to stand out the development and application of indicators which assist the continuous improvement of measures and prevention services due to the policies, programmes and systems of OSH management in public scope and internally at the organizations. The choice of indicator and the range of its coverage are part of its process of selection, followed by quality and specificity of surveillance in occupational health criteria, such as: reliability, validity, sensibility, practicability and comparability. In the occupational health and safety field, some categories of indicators of health surveillance, working conditions, process safety, legislation application, services infrastructure quality and others, have been developed and applied at specific scopes in some countries and/or public and private organizations. At this field, it is noteworthy the effort of the World Health Organization (WHO), the International Labour Organization (ILO), the National Institute on Occupational Safety and Health (NIOSH) from the United States of America, the Finnish Institute of Occupational Health (FIOH), the European Commission, Worksafe Australia, the German Institute Work and Health (BGAG) and others. Concerning the latter, this presentation describes the development of indicators for measuring the effectiveness and efficiency of all the Social accident insurance institutions’ prevention in Germany, a relevant contribution for the improvement of the effectiveness in prevention services.

Introduction
The development of indicators makes up a fundamental element for the most effective management of occupational health and safety systems, whether at the policy scope or for the implementation of programs in public scope or internally at private organizations. Historically, there is an effort concentrated on public and private organizations which act in the prevention field, in order to develop and adopt indicators which assist the assessment of the impact and effectiveness of their actions. Traditionally, the most used indicators are those which measure the impact of preventive actions and which show, most of the time, rates of accident, death, diseases and health injury, caused exactly by the ‘failure’ in prevention services. Based on this information, it is supposed that safety or health protection measures would be taken to strengthen the effectiveness of policies and preventive actions. However, a more recent approach, has tried to ‘anticipate’ the development and practical application of indicators capable of measuring, in advance, the occurrence...
of failure, the efficiency and effectiveness of services and protection measures. This presentation aims to show the most recent studies and development of prevention indicators attempts, from the recognition of its historical evolution and from the practical difficulties found by those who have strived on this subject. Therefore, several extracts from studies and related publications have been used as a reference.

**Background**
Some international instruments – notably the Conventions, the Recommendation and the OIT Protocol following described – define and establish the minimum parameters undertaken by the State-members by ratifying and/or implementing them in their national legal system. Among the parameters of interest in this presentation, are the prevention services and the production of statistic data of accidents and occupational diseases which shall take part in the structure of a policy, a system and a national program on occupational health and safety.

**ILO 161 Occupational Health Services Convention**
The International Labour Organization – ILO Convention 161, concerning Occupational Health Services was adopted in 1985 and came into force in 1988. For the purpose of this Convention, the term occupational health services means services entrusted with essentially preventive functions and responsible for advising the employer, the workers and their representatives on the requirements for establishing and maintaining a safe and healthy working environment which will facilitate optimal physical and mental health in relation to work; and, the adaptation of work to the capabilities of workers in the light of their state of physical and mental health.

Without prejudice to the responsibility of each employer for the health and safety of the workers in his employment, and with due regard to the necessity for the workers to participate in matters of occupational health and safety, occupational health services shall have such of the following functions as are adequate and appropriate to the occupational risks of the company:

(a) identification and assessment of the risks from health hazards in the workplace;

(b) surveillance of the factors in the working environment and working practices which may affect workers’ health;

(c) advice on planning and organization of work, including the design of workplaces, on the choice, maintenance and condition of machinery and other equipment and on substances used in work;

(d) participation in the development of programmes for the improvement of working practices as well as testing and evaluation of health aspects of new equipment;

(e) advice on occupational health, safety and hygiene and on ergonomics and individual and collective protective equipment;

(f) surveillance of workers’ health in relation to work;

(g) promoting the adaptation of work to the worker;

(h) contribution to measures of vocational rehabilitation;

(i) collaboration in providing information, training and education in the fields of occupational health and hygiene and ergonomics;

(j) organization of first aid and emergency treatment;

(k) participation in analysis of occupa-
tional accidents and occupational diseases.

As expected conditions of operation, in accordance with national law and practice, occupational health services should be multidisciplinary. This is due to the fact that OSH is a complex subject involving a large number of specific disciplines and requiring consideration of a wide range of workplace and environmental hazards. The composition of the personnel shall be determined by the nature of the duties to be performed.

Occupational health services shall carry out their functions in co-operation with the other services in the company. It means, maintaining close contact with the other departments and bodies in the company concerned with questions of the workers' health, safety or welfare, and particularly the welfare department, the safety department, the personnel department, the trade union organs in the undertaking, safety and health committees and any other committee or any person in the undertaking dealing with health or welfare questions.

The personnel providing occupational health services shall enjoy full professional independence from employers, workers, and their representatives, in relation to the functions mentioned before.

The competent authority shall determine the qualifications required for the personnel providing occupational health services, according to the nature of the duties to be performed and in accordance with national law and practice.

All workers shall be informed of health hazards involved in their work, what requires effective communication expertise.

**ILO 112 Occupational Health Services Recommendation**

The R112 Occupational Health Services Recommendation, 1959, both include among its recommendations the function of compilation and periodic review of statistics concerning health conditions in the undertaking; and, the research in occupational health or participation in such research in association with specialized services or institutions.

Occupational health services should also maintain relations with external services and bodies dealing with questions of the health, safety, retraining, rehabilitation, reassignment and welfare of the workers.

**ILO 155 Occupational Safety and Health Convention**

This advice is reinforced by the ILO 155 Occupational Safety and Health Convention, 1981, concerning Occupational Safety and Health and the Working Environment, which came into force in 1983, two years before the adoption of the Convention 161.

Each Member shall, in the light of national conditions and practice, and in consultation with the most representative organizations of employers and workers, formulate, implement and periodically review a coherent national policy on occupational safety, occupational health and the working environment.

The aim of the policy shall be to prevent accidents and injury to health arising out of, linked with or occurring in the course of work, by minimizing, so far as is reasonably practicable, the causes of hazards inherent in the working environment.

The formulation of this policy shall indicate the respective functions and responsibilities in respect of occupational safety and health and the working environment of public authorities, employers, workers and others, taking account both of the complementary character of such respon-
Research on the effectiveness of prevention measures at the workplace

The situation regarding occupational safety and health and the working environment shall be reviewed at appropriate intervals, either over-all or in respect of particular areas, with a view to identifying major problems, evolving effective methods for dealing with them and priorities of action, and evaluating results.

The enforcement of laws and regulations concerning occupational safety and health and the working environment shall be secured by an adequate and appropriate system of inspection.

To give effect to the policy referred before, the competent authority or authorities shall ensure that the following functions are progressively carried out:

(a) the establishment and application of procedures for the notification of occupational accidents and diseases, by employers and, when appropriate, insurance institutions and others directly concerned, and the production of annual statistics on occupational accidents and diseases;
(b) the holding of inquiries, where cases of occupational accidents, occupational diseases or any other injuries to health which arise in the course of or in connection with work appear to reflect situations which are serious;
(c) the publication, annually, of information on measures taken in pursuance of the policy referred in this Convention and on occupational accidents, occupational diseases and other injuries to health which arise in the course of or in connection with work.

Convention 155 does not provide any further details regarding the provision of occupational health services, OSH training and education systems or a nationwide network of OSH services, which are regulated separately in the Occupational Health Services Convention, 1985 (No. 161).

Protocol to the Occupational Safety and Health Convention

As a result, many countries still do not have effective systems for the recording and notification of work-related accidents and diseases. The recent adoption of a Protocol to the Occupational Safety and Health Convention, 1981 (No. 155), on the recording and notification of occupational accidents and diseases, and of a revised ILO list of occupational diseases, underlines the serious need for more reliable and comprehensive statistics in this area.

Each Member which ratifies this Protocol shall, based on the notifications and other available information, publish annual statistics that are compiled in such a way as to be representative of the country as a whole, concerning occupational accidents, occupational diseases and, as appropriate, dangerous occurrences and commuting accidents, as well as their analysis.

These statistics are usually used to identify trends within industrial sectors and regions, devise coherent enforcement strategies and develop effective preventive campaigns at national level or directed at sectors and specific enterprises. The accumulation of statistics enables the authority to gauge the success of its preventive programmes.

However, there are serious disparities between countries in the capacity to collect and analyze vital statistics pertaining to OSH, more particularly occupational accident and disease statistics. While a number of countries have provisions for the notification of occupational accidents...
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and diseases to national authorities, few countries provide for recording at the level of the enterprise.

 Estimates of occupational accidents and diseases are by necessity extrapolated from statistics that are often heterogeneous in terms of definitions, data collection methodologies and quality. As such, they provide more of an approximation of the burden of work-related accidents and diseases than an accurate assessment.

 Many countries still lack the expertise and the resources to collect statistics that would allow a sufficiently reliable evaluation of the magnitude of work-related accidents and diseases. There is a strong need in these countries to improve recording and notification, as well as data analysis systems, and to harmonize lists of occupational diseases. Improvements in these areas would provide countries with more reliable indicators of the effectiveness of national OSH systems and help them in prioritizing OSH issues and focusing scarce resources to resolve them.

 It means, focus on the prevention measures, and focus on the effectiveness of the prevention services. And just to finish this topic concerning ILO instruments related to OSH preventive measures and preventive services, some points should be underlined, such as:

 1. Low level of ratification (updated to September 2009):
     ▶ 54 ratifications – Occupational Safety and Health Convention, 1981 (No. 155);
     ▶ 28 ratifications – Occupational Health Services, 1985 (No. 161);

 2. No mention and consequently no indicators about the quality of the prevention services.

 Convention on Promotional Framework for OSH, 187

 According to some points of view, it was supposed that the factors aforementioned were the reason for the Convention concerning the Promotional Framework for Occupational Safety and Health, 2006 (No. 187) to include some innovative and auspicious concepts and compromises such as:

   ▪ the assessment of progress for the achievement of objectives and priorities;
   ▪ the principle of prevention as the highest priority;
   ▪ the principle of the continuous improvement of occupational safety and health;
   ▪ the development of a national preventative safety and health culture that includes information, consultation and training.

 Based on this Conventions, it is also clear the need for a National System for occupational safety and health which shall include, among others, a mechanism for the collection and analysis of data on occupational injuries and diseases.

 And finally, for a National Programme which shall include objectives, targets and indicators of progress. This kind of approach seems to be beginning to change from the time of collecting rates of failures to the era of taking previous actions in terms of priority, planning, budget, expertise, assessment, reviewing and improving all the time. It seems to be the real practice of something we have heard from OSH management system.
Searching for the improvement of their prevention services, in recent years, governments, enterprises and international organizations have all been giving greater attention to the need to adopt systematic models for managing OSH. The so-called OSH management systems approach provides a promising strategy for augmenting traditional command-and-control approaches with performance improvement tools, more effective health and safety auditing concepts, and schemes for management systems. Current management science theories suggest that performance is better in all areas of business, including OSH, if it is measured and continuous improvement sought in an organized fashion.

Because they reflect the effects of socio-economic and technological changes on working conditions and environment, national and enterprises OSH systems are dynamic and need to be built through an ongoing cycle of review, performance and evaluation of its contents, which may consider among others, the OSH information and advisory services; occupational health services; and research on OSH.

Effectiveness of the prevention services
Connected with this trend, several countries, insurance systems, and private organizations have been attempting to set up a range of predictive indicators to replace the usual availability of some kind of “failure” indicators, as we can nominate the traditional indicators of accidents and diseases rates.
To look into this issue, the bibliography made available by the German Social Accident Insurance (DGUV) was used as a reference.
What is prevention? The term “prevention” means “coming before”. Prevention involves taking precautions and protecting against events that could pose a danger or existential threat to an individual or community.
What is indicator? An indicator is a device which indicates some quality, change etc., of a situation or system, and draws attention or gives warning. Something which serves to give an indication, suggestion or something else which can be used in a scientific experiment to indicate some quality, change, etc. (see Oxford 1993).

If the aim of the programme is to train a number of workers annually, the number of workers trained each year is a direct – or output – indicator. If the aim is to improve child health, several indicators could be used, such as nutritional status, psychosocial development, the immunization rate, or the morbidity and mortality rates. While efforts are normally made to quantify indicators, this is not always possible. Moreover, evaluations cannot always be made by aggregating numeral values alone. Qualitative indicators are therefore often used, for example, to assess people’s involvement and their perception of their health status.

Indicators constitute an organized set of information presented in a way that enables information steering and utilization of otherwise unorganized information.
The relation between the indicator system and policy programming and implementation is presented in fig. 1.
Indicators may be used for several purposes, for example:
- to describe the current state of the organization, environment or activities
- to provide signals for the need for special actions
- to follow-up and monitor progress towards the pre-set objectives
- to provide evidence on achievement of the subjective
- to compare the state of comparable systems, country, region, enterprise, etc.

Indicators are useful devices to assess OSH services at all different levels:
- At global level
- At national level
- At regional and provincial level
- At local level
- And at the enterprise level

For each different level of possible preventive actions we have particular and specific preventive services such as:
- Consulting
- Inspection
- Investigation
- Accident prevention regulations
- Incentive schemes
- Information and communication
- Training
- Certification
- Research and development

Some of them are conducted by public bodies and others by private entities at the enterprise level or broader as well. The World Health Organization – WHO has produced a document for indicators on Good Practices in Health, Environment and Safety Management in Enterprises (HESME) intended to satisfy the information needs at the company and the workplace levels, while the Work and Health Indicator Profile (WHIP) approach covers national and regional/provincial levels.
These two documents are intended to be complementary, helping to cover all the levels of societal structures with appropriate indication systems.

**How to select indicators?**

Indicators have to be selected carefully to make sure that they are responsive to current trends of development and that they are usable for the analysis of ongoing activities. The comparability of data requires the harmonization of concepts, definitions and methods for data compilation. This is a difficult task due to many differences, for example, in the legal systems of different countries. Therefore, the construction of profiles requires not only the mechanical compilation of registered data, but full knowledge and understanding of the principles on which the data are collected and how they should be interpreted.

When selecting indicators, full account has to be taken of the extent to which they are valid, objective, sensitive and specific:

**Validity** implies that the indicator actually measures what is supposed to measure.

**Objectivity** implies that even if the indicator is used by different people at different times and under different circumstances, the results will be the same.

**Sensitivity** means that the indicator should be sensitive to changes in the situation or phenomenon concerned. However, indicators should be sensitive to more than one situation or phenomenon.

**Specificity** means that the indicator reflects changes only in the situation or phenomenon concerned.

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Another important attribute of an indicator is its availability, namely, that it should be possible to obtain the data required without undue difficulty. As we have been seeing the indicator systems may address different geographical levels spanning from global to enterprise levels. However, we have to take care while comparing indicator systems from different countries or regions. Even indicators at the enterprise level have to be considered carefully when in comparison, as it is often reasonable to compare the situation in an enterprise only with that of enterprises in the same sector.

**Quality criteria of indicators**

Since indicators are used for making well-informed decisions the quality criteria for indicators are critical. Whatever the use of indicators may be they should meet a number of universal quality criteria:

a. reliability – to provide valid information in different conditions and in hands of different users;

b. validity – to indicate what they are expected to indicate;

c. sensibility – to detect weak enough signals to enable appropriate conclusions and actions;

d. feasibility – possible to be produced in standard procedures and to work well in everyday practices;

e. comparability – to allow comparisons with other subjects or reference values or standards.

The need for wide applicability might lead us to take feasibility (i.e. availability of data) as the starting point for choosing indicators in order to measure and/or to compare some issues. However, such an approach might result in a set of indicators which are not the most relevant and scientifically most valid.

An alternative to data-driven indicators is to adopt a concept-driven approach. Concept-driven indicators are developed on the basis of a conceptual framework irrespective of the availability of data. Concept-driven indicators are primarily science-based and valid, whereas data-driven are primarily feasible.

**WHO relevant indicators criteria**

Choosing an indicator involves also discussing the policy/normative aims and priorities of OSH. Indicators should address relevant phenomena in OSH. World Health Organization – WHO has published a list of criteria for checking the relevance of environmental health indicators:

- directly related to a specific question of concern;
- related to conditions which are amenable to action;
- easily understood and applicable by potential users;
- available soon after the event or period to which it relates;
- based on data that are available at an acceptable cost-benefit ratio;
- selective, so that they help to prioritize key issues in need of action;
- acceptable to the stakeholders.

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Occupational Health Indicators

The Indicators are not a data system but a series of surveillance measures that describe adverse work-related outcomes. An occupational health indicator is a specific measure of a work-related disease or injury, or a factor associated with occupational health, such as workplace exposures, hazards, or interventions, in a specified population. These indicators can be generated by states to track trends in the occupational health status of the working population.

Occupational health indicators can provide information about a population’s health status with respect to workplace injuries and illnesses or to factors that can influence health. The indicators represent a core set of data that, if collected at the state level, would assist in the development of programs to prevent workplace injuries and illnesses.

The indicators are a subset of the larger number of conditions that were recommended for surveillance. The indicators are intended to be used in conjunction with other guidelines for the state-based surveillance of occupational injuries and illnesses.

World Health Organization has proposed four categories of indicators:
1. Health policy indicators
2. Social and economic indicators
3. Indicators of health care delivery, and
4. Indicators of health status, including quality of life.

Conceptual model for OSH Indicators

In this Figure there is a very simplified model which describes the domains of the indicators adopted by the Finnish Institute of Occupational Health – FIOH. The Finnish Institute includes in the OSH

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Fig. 3: Conceptual model for OH&S indicators

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indicators both indicators for known hazardous working conditions and indicators for their known health effects. The third group of indicators consists of measures of the state of OSH legislation and occupational safety and health management systems. They call indicators that describe working conditions, exposure indicators. Indicators that describe health outcomes are called as effect indicators. 

The Finnish Institute calls indicators that describe OSH policy and infrastructure prerequisite indicators as they describe the state of the most important factors required for successful performance of national OSH systems.

They concern, i.e. the quality of legislation, coverage of OSH, characteristics of the occupational health services and labour inspection system etc. The state of OSH policy and infrastructure also has an effect on the availability and quality of exposure indicators and effect indicators.

**Surveillance process on OSH**

Indicators are an essential tool in occupational health surveillance which includes worker’s health surveillance and work environment surveillance. It is the ongoing systematic collection, analysis, interpretation, and dissemination of data for the purpose of prevention, improving the health, work ability and well being of the labour force.

The surveillance system includes the capacity for data collection, analysis and dissemination linked to occupational health programs. The surveillance process starts with data collection from various sources:

- Registers
- Administrative sources
- Questionnaire-based surveys
- Expert assessment systems etc

The data are usually computerized, analyzed statistically and displayed in tabular or graphical forms providing distributions, trends, means or other statistics. The data analysis is often followed by interpretation and evaluation. The process should continue by decision making on direct prevention, dissemination of information, training, research or other relevant activities. The approaches and methods applied should therefore be regularly assessed and modified before the next data collection. (See Tüchsen, 1998).

**Targets and indicators**

The targets and indicators must be tailor-made for each country, organization and purpose. The indicators could be achievement indicators if specific objectives are set and may include:

- Indicators of capacity and capability – such as number of inspectors health professionals dealing with occupational safety and health;
- Indicators of activities – such as trainee day, numbers of inspections;
- Indicators of outcome – such as number of diseases and accidents and mortality rates.

In 1999 the former Director of ILO SafeWork Programme Jükka Takala stressed a number of Targets and Indicators on OSH which could be measured by fairly simple indicators:

1. Improved policies and legislation to cover OSH – that result in better

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coverage of enforcement (inspection) and compensation in case of accidents and diseases. 
Indicators: percentage of labour force covered by inspection and compensation.

2- Occupational Health Services Available 
Indicators: percentage of labour force covered.

3- Improved Infrastructure and Manpower 
Indicators: number of inspectors, specialists, safety officers, safety representatives, information centres, research specialists in relation to the labour force.

4- Better recording and Notification Systems 
Indicators: fatal injuries/100,000; fatal occupational diseases/100,000; disabling injuries and disease rates by sector and occupation; costs of accidents and diseases in relation to the gross domestic product of the country.

5- Advisory bodies and Voluntary Mechanisms established 
Indicators: number of tripartite advisory bodies, number of safety committees, safety representatives, number of management systems, number and quality of codes of conduct, in relation to the labour force.

The IPO’s SafeWork Programme indicators included several of these indicators and, in particular:
- The number of ratifications of ILO conventions on OSH;
- The number of governments and/or enterprises that have adopted new policies and programmes consistent with ILO principles and policies;
- Coverage of legislation, enforcement and compensation systems, and recording and notification systems, and occupational services;
- Rates of accidents and diseases collected through reporting systems and specific surveys.

Other sources of information and other experiences of positive performance indicators could be described indefinitely, but, an experience recently developed by the German BG-Institute Work and Health (BGAG), entitled “Quality in Prevention”, was designed to evaluate the prevention services.

The German Social Accident Insurance (DGUV) has carried out the research project in order to investigate all the prevention services provided to businesses and organizations by its members (e.g. consulting, training, or information and communication). A number of indicators and measuring tools were developed to meet the project’s goals. This means that in the future will be possible to ensure sustained monitoring of the effectiveness and efficiency of the prevention services, with a view to further improving quality through a continuous improvement process.

Quality in Prevention

In the German Accident Insurance System the task of prevention is based upon the following considerations: the accident insurance system, which bears the costs of work-related accidents and occupational diseases within the framework of rehabilitation and compensation, should first of all have the ability to prevent the occurrence of injuries insofar as possible. Employers should be aware that they remain responsible for health and safety in the workplace, even though their direct liability to the employees has been replaced by the accident insurance system.

The connection between accident insurance and accident prevention should
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make clear to the parties involved – particularly the employers – that capital investment in workplace safety pays off, primarily in the humanitarian sense, by preventing human suffering, but also in an economic sense, through the reduction of accident insurance premiums and company costs resulting from injuries.

In the interests of the employers as well as the employees, all the accident prevention work of the carriers aims to organize workplace safety and health measures as efficiently and economically as possible. Implementation strategies must also be practical. The effectiveness of preventive work is also monitored.

Structuring the industrial accident insurance system by branches and involving the concerned parties within the framework of self-administration results in a high degree of practical preventive experience, as well as acceptance and motivation by those affected. This close connection between accident insurance and prevention distinguishes the German system from the systems of most other nations, which generally provide for the inspection of workplace safety by government officials.

In order to comply with the duty of prevention, the social accident insurance institutions provide a range of prevention services. The services are given the following names by these institutions:
1. Consulting
2. Inspection
3. Investigation
4. Company medical support and guidance on safety technology
5. Training
6. Information and Communication and Information Material
7. Accident Prevention Regulations
8. Certification
9. Research and Development
10. Incentive Schemes

The goal and intended benefits of these services are to maintain, protect, promote and, where necessary, restore the health, quality of life, mobility and productivity of employees. The aim is to guarantee safety and health at work, and to achieve further reduction in the level of expenditure.

With the purpose of measuring the effectiveness and efficiency of all the previous listed prevention services, some appropriate “indicators” were identified, step-by-step as following:
- Clarification of the terms “quality” and “indicator” in the context of the social accident insurance institutions’ prevention work;
- Development of a methodological...
framework to enable systematic presentation of comparable quality characteristics in prevention;
- Identification of indicators for showing the effectiveness and efficiency of prevention (literature review);
- Evaluation of indicators and establishment of a quality score;
- Identification of measuring tools for the indicators of all the prevention services provided by the social accident insurance institutions.

The term “quality” was broken down into three dimensions:

a) structure quality – describes the supply side;
b) process quality – quality describes the quality of the performance of a prevention service, measured at the accident insurance provider point; and
c) outcome quality – is measured in the workplace rather than at the accident insurance provider.

Each prevention services were assessed in terms of three quality dimensions, meaning that indicators for these quality dimensions were also need.

Literature review and expert interviews were then conducted with a view to assessing the indicators identified in the earlier evaluation studies which engaged the entire subproject conducted by all the social accident insurance institutions.

An indicator checklist tool was employed to ensure that indicators met theoretical, methodological, practical and political requirements. Of the 234 indicators initially identified, 90 (ten per prevention service) were selected for assessment. The indicator checklist allowed the potential quality of each indicator to be assessed, and provided a clear idea of the extent to which each indicator met the four criteria.

The overview of all the indicators that met the required quality standard allowed those indicators to be identified that are used across all services to measure prevention service quality. These indicators are as follow:

- Target group orientation;
- Prevention service evaluation;
- Customer satisfaction;
- Acceptance of requested measures;
- Publications;
- Knowledge gain;
- Change in behaviour.

An evaluation system and measuring toolkit with goals and indicators was developed for each prevention service. Furthermore, the prevention evaluation systems need to be adapted by each individual user to their specific situation. The Project’s Report declares that it was not possible to develop a standard system for all accident insurance providers that use the same indicators and target values. Rather, the prevention evaluation systems should be understood as a resource from which the different accident insurance providers can select the indicators that are relevant to them, as a basis for developing their own target values and measuring tools in accordance with their particular circumstances.

Conclusions
Based all the research I have done to address to this Colloquium and taking into account my professional experience the main points to be considered concerning the development of OSH Indicator are: all the concepts and criteria presented should be followed in order to get effectiveness in prevention services; there is no standard system of OSH indicators to
be followed; each country or organization should select and develop its own measuring tools, assuring quality.

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Quality in Prevention: Outcomes of a Research Project by the German Social Accident Insurance (DGUV)

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1 Introduction
All companies have a duty to take comprehensive measures to ensure their employees’ safety at work. To meet this requirement, they have to use the services of various experts. The experts can either be people who work for the company or external service providers. Examples of their activities are:

- building maintenance
- maintenance of the vehicle fleet
- security
- advice provided by health insurance funds
- inspections of lifts
- fire protection
- advice on work processes and investment planning
- insurance against occupational accidents and diseases
- measurement services
- company medical support and guidance on safety technology
- advice on occupational safety and health (OSH)
- health management
- OSH audits
- inspections

In most countries, the field of occupational safety and health is monitored by the state, whilst OSH prevention services are organised in a number of different ways. In Germany, we have a dual OSH system, involving the state and statutory accident insurance institutions, which is supplemented by services offered by private providers.

As mentioned in the introduction to these proceedings, it is the companies that ensure health and safety and health promotion at the workplace. Inspection bodies and advisors can only support the OSH processes at the workplace and set standards.

The aim of the DGUV’s “Quality in Prevention” project was to define individual prevention services as products, describe the actual services, define quality indicators for them and thus to enable OSH researchers to assess the service processes and, ultimately, to optimise them.

Although the project has officially ended, its findings are being followed up on and processes are being optimised. This paper endeavours to give the ISSA colloquium an overview of this extensive project.

The project was structured in 14 subprojects according to the results of subproject 1 “List of Prevention Services”, additionally the interactions of prevention services were investigated and examples of economically successful prevention collected.
Table 1: Project structure of “Quality in Prevention”, overall project leader was Thomas Kohstall, BGAG Dresden.

<table>
<thead>
<tr>
<th>No.</th>
<th>Subject</th>
<th>Research Institutions</th>
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<tbody>
<tr>
<td>1</td>
<td>List of Prevention Services</td>
<td>DGUV – BGAG</td>
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<td>2</td>
<td>Interactions of Prevention Services</td>
<td>DGUV – BGAG</td>
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<td>3</td>
<td>Indicators</td>
<td>DGUV – BGAG</td>
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<td>4</td>
<td>Examples of Successful Prevention</td>
<td>DGUV – BGAG</td>
</tr>
<tr>
<td>5</td>
<td>Prevention Costs and Benefits</td>
<td>University of Giessen, chair of management of personal utility companies</td>
</tr>
<tr>
<td>6</td>
<td>Accident prevention regulations</td>
<td>DGUV – SiGe</td>
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<td>7</td>
<td>Consulting/Inspection</td>
<td>DGUV – SiGe</td>
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<td>8</td>
<td>Investigation</td>
<td>DGUV – BGIA</td>
</tr>
<tr>
<td>9</td>
<td>Company medical support and guidance on safety technology</td>
<td>DGUV – BGAG, Technical University of Dresden, Institut und Poliklinik für Arbeits- und Sozialmedizin (Institute and Outpatient Clinic for Occupational Health and Social Medicine)</td>
</tr>
<tr>
<td>10</td>
<td>Training</td>
<td>DGUV – BGAG, University of Regensburg, Institut für Pädagogik (Institute of Pedagogy)</td>
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<td>11</td>
<td>Certification</td>
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<td>14</td>
<td>Incentive Schemes</td>
<td>DGUV – BGAG, Dresden International University (DIU), University of Giessen, Professur für Risikomanagement und Versicherungswirtschaft (chair in risk management and insurance industry)</td>
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</table>
2 The ten prevention services of the German Social Accident Insurance institutions

As a result of the DGUV-project “Quality in Prevention” the “List of Prevention Services” offered by the German Social Accident Insurance institutions has been modified and 10 different services have been defined. These ten services are the basis for the cost and results accounting of these institutions.

Only services are listed, that are directly offered to the member-enterprises of Berufsgenossenschaften or Unfallkassen. Not all the insurance bodies do offer all the ten services, different portfolios are to be found regarding prevention service 1 “Incentive Systems” and prevention service 3 “Company medical support and guidance on safety technology”.

This service catalogue is to create an uniform basis for controlling costs and efficiency of the processes. On the basis of the project “Quality in Prevention” also the appropriate indicators are going to be harmonized at present.

Table 2: List of prevention services, offered by the Statutory Accident Insurance institutes – a result of the project “Quality in Prevention”

| Prevention service 1: Incentive schemes | • Award financial and non-monetary rewards in recognition of implementation of specific prevention measures and/or achievement of specific safety standards.  
• Actively motivate and inform companies re opportunities to participate in reward schemes. |
| --- | --- |
| Prevention service 2: Consulting (on request) | • On-request consultancy service for employers and insured parties regarding prevention of work-related accidents, occupational diseases, and work-related health hazards, and to ensure provision of efficient first aid.  
• Written, telephone and face-to-face information and motivation to help with implementation and integration of health and safety measures at member companies, on demand and on an individual basis.  
• Investigation services in association with consulting services. |
| Prevention service 3: Company medical support and guidance on safety technology | • Implementation in the workplace of German Occupational Safety Act (ASiG).  
• Provision of resources to aid implementation of professional support and guidance. |
| Prevention service 4: Investigation | - Investigation of possible causes and attendant circumstances of suspected or actual cases of work-related accidents, occupational diseases or work-related health hazards.  
- Carry out investigations based on interviews, site inspections, examination of documents and performance of measurements.  
- Report on investigation findings.  
- Process investigation findings to provide new data for prevention purposes.  
- Investigation of work-related health hazards in the workplace.  
- Written and face-to-face analysis/evaluation of accidents and technical arrangements for reported occupational diseases. |
| Prevention service 5: Research, development and pilot schemes | - (Industry-specific) research and development in the field of health and safety.  
- Testing of prevention measures. |
| Prevention service 6: Information and communication | - Presentation of prevention programmes at events (e.g. symposia, conferences, trade fairs).  
- Systematic needs-based production, updating and dissemination of thematic, job-related, industry-specific or company-specific health and safety information material designed to serve as a practical guide. |
| Prevention service 7: Testing/certification | - Verify that equipment, materials and systems comply with health and safety requirements.  
- Carry out product testing and certification for member companies and other customers.  
- Audit and certify management systems.  
- Certification of individuals. |
| Prevention service 8: Regulations | - Establishment of independent legal standards for the prevention of work-related accidents, occupational diseases and work-related health hazards.  
- Development, checking, introduction/withdrawal, updating and dissemination of the independent rules and regulations.  
- Development of rules for approving technical regulations. |
## Prevention service 9: Training

- Provision of continuing professional development for people within companies who deal with health and safety activities or do jobs that are relevant to safety.
- Systematic teaching of knowledge and skills to help people recognise and assess health and safety risks, and to motivate them to implement measures in a targeted fashion.

## Prevention service 10: Inspection including consulting in response to specific problems

- Inspection of on-site measures to prevent work-related accidents, occupational diseases and work-related health hazards and to ensure provision of first aid.
- Production of inspection reports.
- Provision of instructions for shortcomings to be resolved.
- Follow-up measures taken to resolve shortcomings, and introduce relevant management procedures where necessary.
- Provision of systematic written or on-site reviews and active consultancy to companies in order to ensure legal compliance with technical, organisational and personal requirements for health and safety in the workplace and working environment. The focus of the reviews should always be on advising the customer on how to implement health and safety measures.
- Investigation services in association with inspection services.

### 3 Scope versus depth of impact in prevention services

In order to gain a better understanding of the interrelationships between scope and depth of impact in prevention services and, where relevant, to obtain ideas for improving the statutory accident insurance institutions’ prevention activities, the BGAG commissioned the Marketing Management Department of the Leipzig Graduate School of Management (Händelshochschule Leipzig - HHL) to undertake a literature review led by Professor Manfred Kirchgeorg (assisted by Dr. Christiane Springer). The following is a summary of the findings of the literature review “Managing the effectiveness of the statutory accident insurance institutions’ prevention services – an analysis of depth of impact in relation to scope of impact in individual services” (Leipzig 2007). In summary, the findings of the study are as follows:

**Complementary effects of individual communication measures:**

Different communication measures have different marketing goals which, depending on the terms of reference, may be mutually complementary or exclusive. Thus, in order to impart practical skills, use should primarily be made of didactic methods that actually offer the learner the opportunity to practise the activity
they are learning.

**Relevance of learning types:**
As far as information intake is concerned, it is important to take into account individual sensory preferences for knowledge acquisition. Every individual favours particular teaching and learning methods associated with positive experiences that they have had. Conversely, negative experiences can lead to certain methods being rejected. Consequently, improved recall performance is achieved mainly by seeing and reading for visual learners, hearing and speaking for auditory learners, and touching and experimenting for tactile learners.

**Congruence of information media combinations:**
TV, radio and cinema tend to be associated with entertainment, while print and online media are more usually associated with information. The marketing medium therefore has a clear influence on the perception, processing and evaluation of the campaign message.

**Need to take into account target group characteristics:**
In order to meet the high expectations of well-educated people, it is necessary to offer them a comprehensive range of information and a two-way dialogue. Likewise, the extent to which the recipient of a piece of information is involved in health and safety matters will have a significant influence on which information is processed and which media are preferred.

**Summary and implications for the “Quality in Prevention” project**
The impact measurement studies illustrate that different media can have very specific impacts on the recipients and their social systems. “Media do not simply convey messages, they also have their own impact that can shape and alter ways of thinking, perceiving, experiencing, behaving and communicating” (Engel, F. (2004), p. 504.). How to choose the correct medium is a complex matter, particularly when considering effectiveness and efficiency. It may therefore be helpful, as a first step, to undertake a comparison of the characteristics of different media types, in order to identify the strengths and weaknesses of different communication channels.

The traditional media types of print, radio and TV, that pursue their goals through the transmission and dissemination of information in the public communication sphere by occupying time and space in advertising media with the relevant advertising material, are mainly characterised by the high level of coverage that they achieve. In this context, coverage is defined as the proportion of the target audience that is reached by a particular advertising medium or combination of advertising media. In recent years, however, coverage figures have flattened out for radio and TV, and have actually undergone a constant decline in the print media. While it is true that coverage figures for the traditional media types remain significantly higher than for online media, current media trends will ensure that online media experience the highest growth rates over the next few years. The internet is a platform that is not constrained by time and space, and is therefore able to focus on providing a communication process guided by the individual needs of the target group using a computer-assisted, interactive and multimodal approach. The multiple options available via the internet make it an unprecedentedly malleable medium that is consequently hard to define.
Notwithstanding the above, face-to-face communication, where there is direct personal contact and the target group actively experiences the accident insurance provider and their prevention services, remains one of the highest-impact information sources, since it can make a major contribution to the creation of unique and lasting memories. It is clear from this that a blended learning approach offers several advantages, and this approach is in fact becoming increasingly popular with accident insurance providers.


<table>
<thead>
<tr>
<th>Criteria</th>
<th>Print/(Radio/TV)</th>
<th>Face-to-Face</th>
<th>Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coverage</td>
<td>+++</td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td>Geographical limitations</td>
<td>O</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Time limitations</td>
<td>O</td>
<td>+++</td>
<td>O</td>
</tr>
<tr>
<td>Intensity of contact</td>
<td>+</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Personal contact</td>
<td>O</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Networking of recipients</td>
<td>O</td>
<td>++</td>
<td>++</td>
</tr>
<tr>
<td>Control over recipient’s environment</td>
<td>O</td>
<td>++</td>
<td>O</td>
</tr>
<tr>
<td>Contact costs</td>
<td>++</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Interaction</td>
<td>O</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Tangibility of experience</td>
<td>+</td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td>Emotionality</td>
<td>++</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Multisensoriality</td>
<td>O</td>
<td>+++</td>
<td>+</td>
</tr>
</tbody>
</table>

However, the decision to choose a particular prevention service is not solely dependent on how good its coverage is (scope of impact). It also depends on the target groups the service is aimed at and the goal of the service. Recall (depth of impact) among the relevant target groups is once again influenced by predisposing variables such as how the content of the message is arranged (following a thorough problem analysis), the media usage behaviour of the message’s recipient, and the recipient’s socio-demographic and other personal characteristics (e.g. the degree to which each individual is motivated to search for, assimilate, process and store information). Good coverage is therefore a necessary condition for prevention services to be effective, but it is not enough on its own. It is especially important to check whether the target groups identified at the planning stage actually receive and actively use the relevant prevention service. Activation of the target groups is most successfully achieved by addressing them in an emotional and motivating fashion. In order for the service’s goal to be achieved, it is therefore important to remember that the attitudes that prevention services
seek to influence have both a cognitive and an emotional dimension. The cognitive processes that lead to the creation of knowledge structures and thus result in changes in behaviour cannot occur without activation of emotions, motivation and attitudes. Side, while process quality describes the quality of the performance of a prevention service, measured at the accident insurance provider point. Outcome quality, on the other hand, is measured in the workplace rather than at the accident insurance provider. The interactions of

A hypothesis has been withdrawn from this investigation of HHL “The useful effect of a prevention service is function of the scope of impact and depth of impact variables”. To prove this hypothesis and to identify an optimum of scope and depth of impact further research is needed.

4 Quality-measurements
The model developed by Donabedian (1966) has become the established model for describing the structure of the term “quality”. He breaks quality down into three dimensions: structure quality, process quality and outcome quality. Structure quality describes the supply structure, process and outcome quality between accident insurance providers and companies have been illustrated in the introduction of these proceedings. In the “Indicators” sub-project, the individual prevention service was treated as the unit where quality measurement was to be facilitated. Each prevention service was assessed in terms of the three quality dimensions, meaning that indicators for these quality dimensions were also needed. An indicator serves as a substitute measure for gathering information on or measurement of phenomena that cannot be measured directly themselves.
4.1 Example: prevention service “Training”

According to section 14.1 of German Social Security Code Book (SGB) VII, the statutory accident insurance institutions are required to use all appropriate means to prevent work-related accidents, occupational diseases and work-related health risks. This general duty of prevention also includes the provision of training measures alongside other preventive measures such as information material, law and rule-making, and company medical support and guidance on safety technology. Continuing professional development on health and safety in the workplace is one of the main focuses of the statutory accident insurance institutions’ prevention work. It is becoming increasingly important to ensure that the people responsible for health and safety within companies are well trained, in order to prevent accidents and diseases, but also to ensure that companies are legally compliant. The goal of the “Training” sub-project is to check whether the initial and further training provided to in-house health and safety experts, multipliers and insured parties meets the goals established by statute in a targeted and effective manner.

Evaluation system

In order for continuous professional development to be successful, it is essential that the statutory accident insurance institutions’ education measures should be of high quality. According to the terms of the “Quality in Prevention” project, it is not enough for the stakeholders to be satisfied. The insurance premiums paid by companies are invested in preventive education measures in order to achieve concrete impacts. Consequently, it is crucial to evaluate the effectiveness of preventive training measures, and more specifically whether the training has achieved the intended effects and thus fulfilled the requirements originally placed upon it. Participation in training can therefore only be considered to have been successful if the people receiving the training have increased their knowledge, have a greater awareness of the problems, and are able to improve health and safety in the workplace or maintain it at a high level.

The value of training measures only becomes apparent if they bring practical benefits. Conditions outside the working environment have a major influence on the extent to which training measures can contribute to changing working conditions, or whether indeed they can change them at all. Furthermore, the field of education controlling tells us that an education service can typically have several customers. At the very least, the “Training” prevention service’s customers include the participants in training measures, i.e. the people who are actually being trained, and the organisations that they belong to, where the knowledge and skills they acquire are expected to have an impact. The evaluation system should also demonstrate whether the intended interactions of preventive training measures with other prevention measures have actually come about. It is therefore necessary to investigate the synergies arising from the strategy of having a single prevention service provider.

The evaluation findings of the “Training” sub-project are intended to serve as the basis for optimising preventive training measures. As a rule, prevention actions do not have a direct effect on outcomes, as they form part of a chain of complex cause and effect relationships. It is important for the different intended effects of preventive training measures to be systematically related to the analysis levels where a benefit
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for the different customer levels can occur. The following phase model is based on measures to achieve the statutory prevention goal of “preventing work-related health risks”.

Table 4: Phases of training and appropriate evaluation strategies
(see for details paper Wolff, M. at al., session 5)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Concerning</th>
<th>Quality measurable as</th>
<th>Quality measurable in</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Trainings offered (product range), Training</td>
<td>Structure quality</td>
<td>Supplier</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Process quality</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Training, Implementation, Impact</td>
<td>Transfer motivation, Satisfaction and learning success, Process quality</td>
<td>Participant</td>
</tr>
<tr>
<td>3</td>
<td>Impact: improvement of OSH measures</td>
<td>Achievement of prevention target</td>
<td>Enterprise, Company</td>
</tr>
</tbody>
</table>

Table 4 shows the different stages of the presumed impact of the “Training” prevention service. During the training, both the process and implementation quality can be assessed. Once the training has been completed, data can be gathered on learning success, allowing a first glimpse of the outcome quality for the participants. Thereafter, if the training has been successful, the learning outcomes will begin to be transferred into practice in the workplace, and the quality of this learning transfer can also be assessed (phase 2). Finally, the extent to which the prevention target was achieved can be evaluated (phase 3). Specific (measurable) quality indicators can be identified for the individual links in the chain.

Project methodology

The “Training” sub-project focused on the phase model described above and analysed it systematically from the bottom up, identifying the phases shown in table 4. However, this report can only go as far as the end of phase 2, and a follow-up project would thus be required in order to study phase 3.

The first phase looked at the range of training measures available, analysing the extent, goals and topics of the measures being provided. The question of who the training measures are aimed at was answered by building up a comprehensive list of the training activities undertaken by the statutory accident insurance institutions.

The second phase of the project took an in-depth look at the effectiveness of as representative as possible a sample of the types of training listed in the first phase, by way of examples. The “transfer success” study carried out in conjunction with the University of Regensburg measures the extent to which the desired competences and attitudes have been ac-
required both before and after the training seminars, as well as in the participants’ workplace three months after they attended the training.

It is proposed that a potential, although as yet unattempted, follow-up project could continue with the third phase of the transfer study by carrying out a further evaluation two years after participants attended the training. This study could also investigate the interaction in the workplace between the “Training” prevention service and other measures and services, and its qualitative contribution to achieving the prevention targets.

**Goals and target groups of preventive health and safety training measures**

Section 23 of German Social Security Code Book VII stipulates that the accident insurance providers should take active steps to ensure that the stakeholders within companies receive training, and details the costs that the statutory accident insurance institutions shall cover in this regard. The training seminars provide technical information, background on legal matters, and information on industry-specific health and safety procedures. Awareness-raising, motivation and training of participants with regard to health and safety issues is carried out with the focus on a practical and industry-specific approach. Participants include employers, management, company doctors, health and safety experts, safety officers, staff council and works council members, and other specific target groups within companies.

In addition to those people who are traditionally responsible for dealing with health and safety in the workplace and are explicitly mentioned in the relevant health and safety legislation and regulations, the statutory accident insurance institutions also target their training activities at other groups, in accordance with section 23 of German Social Security Code Book VII.

The goal and intended benefit of training measures is to maintain, protect and promote the health, quality of life and productivity of employees. This in turn should lead to a partial reduction in the current level of spending, particularly on occupational diseases, work-related accidents and the associated rehabilitation and pension benefit costs.

The strategy is to influence working methods within companies so as to promote safe and ergonomic tools and machinery, a safe workflow, a safe and healthy working environment, well-informed employers and a well-trained workforce. Ultimately, training measures that focus on these issues will serve to promote prevention measures affecting conditions in the workplace.

**Supply of and demand for the statutory accident insurance institutions’ training measures**

Every year, the statutory accident insurance institutions hold more than 18,000 continuous professional development seminars on health and safety. This makes them the main training providers in the field of health and safety. In 2005, 339,253 people from the BGs took part in training provided by the statutory accident insurance institutions. The range of products on offer includes one-day information and motivation events in companies on very specific topics, seminars lasting several days, and continuous professional development of company health and safety experts.

In order to show who is using the statutory accident insurance institutions’ training products and to what extent, the (industry-specific) “training volume” for 2005 of 3,926,000 teaching units was
analysed. Fig. 3 shows a breakdown of the training volume by target group. (The training volume of a given training course is the actual number of participants multiplied by the number of teaching lessons).

**Fig. 3: Statutory accident insurance institutions’ (BGs) training volume 2005**

In-depth training and company-specific seminars are often provided to a range of target groups at the same time. This means that the relevant stakeholders within the company not only learn a common language, but also have the opportunity to analyse and discuss the training content from their different practical perspectives. Consequently, this type of seminar was assigned to multiple target groups. The statutory accident insurance institutions discuss the nature and scope of the training to be provided with employer and employee representatives on an annual basis. This regular review process results in training products that go a long way towards meeting the specific needs of different industries while remaining financially viable.

**Are the topics appropriate?**

When designing their training products, the statutory accident insurance institutions take account of accident rates, company requirements, key prevention issues, changes in the world of work, and legal developments. The topics dealt with in the training can be divided into the following four categories:

- reduction of risks and stressors,
- health and safety organisation,
- health promotion and
- methodological and social competence.

The majority of seminars deal with at least two if not three or all four of these topics. The amount of attention paid to the different topic categories will vary depending on the goals of the seminar.

**Effectiveness of the seminars in the study**

In order to study the impact of the training seminars right across the impact chain on participants’ knowledge, attitudes and behaviour with regard to health and safety, a study entitled “transfer suc-
Research on the effectiveness of prevention measures at the workplace

cess” was carried out in conjunction with the University of Regensburg (Hans Gru-ber, Dagmar Festner). The findings point to the conclusion that the main purpose of the training is to teach knowledge and know-how. A comparison of mean values shows that significant attitude change was achieved both during the training and up to three months after its conclusion. This indicates that the training was able to contribute to a sustainable increase in desired attitudes to health and safety. Based on the transfer model developed by Baldwin and Ford (1988), the “transfer success” study assumed that transfer success is influenced by factors on three different levels:

1. participant level
2. training level
3. company level

The aspects identified in this regard are shown in fig. 4. A partial correlation to the two aspects of transfer success was calculated for each aspect. At the same time, participants’ prior knowledge, the level of health and safety measures in the company, and people’s respective attitudes were all evaluated before the seminar.

These correlations suggest that:
- the work environment has the strongest influence on health and safety actions (by support available, transfer and OSH climate).
- if “reported transfer” is used as an indicator for “transfer quality”, then an initial indication of transfer quality can be obtained at the end of the training by measuring satisfaction and transfer motivation at this point.
- an improvement in attitudes to health and safety during the training can make a significant contribution to achieving an increase in health and safety actions.
- the higher the transfer orientation of the training the higher the reported transfer.

Fig. 4: Identified influences on transfer success (difference in thickness of arrows reflects observed correlation)
It was also apparent that the use of other prevention services was perceived to support the implementation of training content. Half of the respondents said that consulting regulations and reading additional information material from the statutory accident insurance providers helped them to implement content. 29% felt supported by company medical support and guidance on safety technology. The transfer success study asked participants and their superiors to rate the practical usefulness of training for health and safety in the workplace. 71.4% of participants in the training and as many as 82.9% of their superiors rated its usefulness as high or very high, although five of the superiors gave no response because they felt unable to rate the training's usefulness. The value of participating in the transfer study seminars therefore received a high rating.

3.2 Example: prevention service “Consulting/Inspection”

The legal basis for the consulting and inspection activities of the statutory accident insurance institutions is contained in section 17.1 of German Social Security Code Book (SGB) VII, according to which: “The accident insurance providers shall monitor the implementation of measures to prevent work-related accidents, occupational diseases and work-related health risks, and to ensure effective first aid in the workplace, and shall advise companies and insured parties on these matters. In individual cases, they may instruct companies or insured parties to take certain measures
1. in order to comply with their duties arising from the accident prevention regulations in accordance with section 15,
2. in order to avert specific accident and health risks.”

Fig. 5: Practical usefulness of training in the workplace: participants sub-sample: N = 126; valid cases: N = 126, superiors sub-sample: N = 47; valid cases: N = 41, time of data collection three months after the training
In addition, in the case of imminent danger, section 19.2 of SGB VII entitles inspectors to issue orders that must be complied with immediately, in order to avert work-related risks that pose a threat to the life and health of the insured parties. Consulting and inspection are two separate services that usually involve personal contact between the inspector and the company.

Table 5: Description of prevention service “Consulting (on request)”, here the OSH-initiative is with the company.

<table>
<thead>
<tr>
<th>Prevention service:</th>
<th>Consulting (on request)</th>
</tr>
</thead>
</table>
| Description of prevention service: | - On-request consultancy service for employers and insured parties regarding prevention of work-related accidents, occupational diseases, and work-related health hazards, and to ensure provision of efficient first aid.  
- Written, telephone and face-to-face information and motivation to help with implementation and integration of health and safety measures at member companies, on demand and on an individual basis.  
- Investigation services in association with consulting services. |
| Product groups: | - on site  
- by telephone  
- written |
| Goals: | - Prevention of work-related accidents and occupational diseases.  
- Prevention of work-related health hazards.  
- Recognition as competent consultant on health and safety issues.  
- Targeted motivation and information to encourage people to act on their own initiative in the field of health and safety. |
| Legal basis: | - Section 17.1 German Social Security Code Book (SGB) VII |
| Typical example: | - Consultancy on organisation of health and safety.  
- Consultancy for companies acquiring new machinery or introducing new working materials or procedures.  
- Consultancy on return-to-work strategies for employees who have been on sick leave for more than six weeks. |
| Delimitation: | - Consultancy services in association with investigation and inspection services. |
Table 6: Description of prevention service “Inspection including consulting in response to specific problems”, here the OSH-initiative is generally with the inspectors

<table>
<thead>
<tr>
<th>Description of prevention service:</th>
<th>Inspection including consulting in response to specific problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Inspection of on-site measures to prevent work-related accidents, occupational diseases and work-related health hazards and to ensure provision of first aid.</td>
<td></td>
</tr>
<tr>
<td>• Production of inspection reports.</td>
<td></td>
</tr>
<tr>
<td>• Provision of instructions for shortcomings to be resolved.</td>
<td></td>
</tr>
<tr>
<td>• Follow-up measures taken to resolve shortcomings, and introduce relevant management procedures where necessary.</td>
<td></td>
</tr>
<tr>
<td>• Provision of systematic written or on-site reviews and active consultancy to companies in order to ensure legal compliance with technical, organisational and personal requirements for health and safety in the workplace and working environment. The focus of the reviews should always be on advising the customer on how to implement health and safety measures.</td>
<td></td>
</tr>
<tr>
<td>• Investigation services in association with inspection services.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Goals:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Prevention of work-related accidents and occupational diseases.</td>
<td></td>
</tr>
<tr>
<td>• Prevention of work-related health hazards.</td>
<td></td>
</tr>
<tr>
<td>• Ensuring that employers meet their responsibilities in the field of health and safety.</td>
<td></td>
</tr>
<tr>
<td>• Checking and ensuring that employers and insured parties are fulfilling their duties in the field of health and safety.</td>
<td></td>
</tr>
<tr>
<td>• Achieving target for minimum health and safety standards across all companies.</td>
<td></td>
</tr>
<tr>
<td>• Ensuring all serious hazards are dealt with.</td>
<td></td>
</tr>
<tr>
<td>• Targeted motivation to encourage people to act on their own initiative and ensure that they meet their responsibilities in the field of health and safety.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Legal basis:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Section 17 German Social Security Code Book (SGB) VII</td>
<td></td>
</tr>
<tr>
<td>• Section 19 German Social Security Code Book (SGB) VII</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Typical example:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Monitoring compliance with health and safety regulations in workplaces where there is a risk of workers suffering falls.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Delimitation:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Top-down inspection and consulting in response to specific problems at head offices of companies with branch offices.</td>
<td></td>
</tr>
</tbody>
</table>
Some structure quality parameters for inspection and consulting are listed in table 7. The numbers demonstrate that “orders” are very seldom and consulting is the major part of this prevention service.

The competence and quality of the advice provided by the inspectors is largely attributable to support from the statutory accident insurance institutions’ own technical committees and research institutes, as well as those of the German Social Accident Insurance (DGUV). However, consultancy services provided to companies, manufacturers or standards organisations by the technical committees or research institutes of the statutory accident insurance institutions or the DGUV fall outside the scope of the “Consulting/Inspection” sub-project.

Some of the most common consultancy enquiries made to the statutory accident insurance institutions are with regard to:

- plans to acquire personal protective equipment or technical manufacturing equipment
- planned construction work
- risk assessment
- how to deal with psycho-social stress
- support with maintenance and monitoring of technical manufacturing equipment

Technical measurements of e.g. noise, hazardous substances, dust, vibrations...

In inspectors’ day-to-day work, the consulting and inspection services naturally complement each other during site inspections. Inspectors decide on-site on the extent and relative importance of consulting versus inspection activities, depending on the specific characteristics of the industry and the specific circumstances at the site in question. The balance between the two services can vary depending on the industry and on-site conditions. While consulting is often the main activity at permanent sites, inspection generally plays a greater role at non-permanent sites such as building sites, owing to the rapidly changing working conditions.

**Infrastructure – institutions supporting consultancy**

The particularly high quality of the non-personal and personal prevention services provided by the statutory accident insurance institutions can be attributed especially to their in-depth knowledge of different industries and the infrastructure that was developed in the past to sup-

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Table 7: Structure and outcome data for prevention services consulting and inspection

<table>
<thead>
<tr>
<th>Data, facts</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>BG-employees in prevention departments</td>
<td>4,395</td>
<td>4,394</td>
<td>4,297</td>
</tr>
<tr>
<td>Inspectors</td>
<td>2,319</td>
<td>2,301</td>
<td>2,240</td>
</tr>
<tr>
<td>Number of site inspections</td>
<td>671,055</td>
<td>660,156</td>
<td>645,951</td>
</tr>
<tr>
<td>Number of consultations</td>
<td>181,864</td>
<td>189,560</td>
<td>178,138</td>
</tr>
<tr>
<td>Orders acc. section 17 SGB VII (problems that must be solved)</td>
<td>32,111</td>
<td>28,885</td>
<td>24,897</td>
</tr>
<tr>
<td>Orders acc. section 19.2 of SGB VII (imminent danger)</td>
<td>5,514</td>
<td>4,452</td>
<td>3,344</td>
</tr>
</tbody>
</table>
port the prevention services. The main components of this infrastructure are the technical committees, the testing and certification system, the co-operation activities in the field of standardisation, and last but not least the activities of the DGUV institutes. At the core of the infrastructure lies a highly qualified network of experts on all manner of issues relating to health and safety in the workplace. The statutory accident insurance institutions’ network of experts is actively used by all the personal and non-personal prevention services, and is unrivalled in Europe in terms of its qualitative and quantitative competence and facilities.

The network of experts can be used in different ways, for example:

1. it can be brought in directly to help with on-site consulting and inspection, setting up new workplaces or in introducing new equipment, inspection and approval of machines and equipment, or introduction of new substances;
2. it can be involved in the development of regulations, testing equipment, or writing information publications and procedure manuals;
3. it can be used indirectly by the technical committees or DGUV institutes for topics where the relevant statutory accident insurance institution believes that it does not have all the necessary competences, or by the DGUV institutes for specific topics where the statutory accident insurance institutions have requested detailed technical expertise;
4. it can participate by sharing experiences in initial and further training activities or through active involvement in the work of the technical committees, the statutory accident insurance institutions’ testing and certification system (BG-PRÜFZERT), standardisation work, or the institutes’ technical discussions.

The full extent of the network of experts can be seen particularly in the number and expertise of the experts involved. 582 employees of the statutory accident insurance institutions (equivalent to approximately 187 person-years) work in the technical committees, with 300 also being involved in standardisation work, meaning that they are able to bring additional knowledge and experience to the prevention services. 400 employees work in the fields of research, consultancy and training at the three DGUV institutes. In addition, there are the numerous employees of the individual statutory accident insurance institutions’ own research institutes, such as the BGN Central Laboratory (BGN-Zentrallabor – ZL) that is a department of the prevention section of the statutory accident insurance institution for the foodstuffs industry and catering trade (Berufsgenossenschaft Nahrungsmittel und Gaststätten – BGN), or the statutory accident insurance institution for the mining industry’s central mine rescue station in Hohenpeißenberg.

The prevention infrastructure also has extensive information systems at its disposal that can be used by inspectors particularly for consulting and inspection work. The information systems, databases and software are constantly kept up to date by IT experts at considerable expense.

**Quality criteria for consulting**

It was agreed with representatives of almost all the statutory accident insurance institutions that the “Consulting/Inspection” sub-project would describe quality criteria for the following three products:

- consultancy on demand,
- targeted consultancy, and
- inspection including active consultancy.
Indicators approved by all the statutory accident insurance institutions for measuring the quality of these services have not yet been developed or used. The report for this sub-project details possible approaches to defining the relevant quality indicators, so as to enable assessment of the quality of prevention measures and calculation of the staffing requirements. These are based on studies and experiences provided by the former Central Federation of Public Sector Accident Insurers (BUK) and the Berufsgenossenschaft for the meat processing industry. An appropriate follow-up project is needed to test the usability of the indicators in practice, in order to confirm that they are transferable to the other statutory accident insurance institutions.

Impact of consulting and inspection
Prevention experts consider the consulting and inspection prevention services to be relatively effective. However, owing to the interactions with other prevention services, it is difficult to calculate the overall contribution made by consulting and inspection to the effectiveness of all the statutory accident insurance institutions’ prevention measures. Nevertheless, the effectiveness of consulting and inspection is demonstrated by some of the specific prevention activities undertaken by the statutory accident insurance institutions. The same can also be said of the statutory accident insurance institutions’ joint campaigns.
Table 8: Proposed indicators for consulting and inspection prevention services

<table>
<thead>
<tr>
<th>Target</th>
<th>Indicator</th>
<th>Method of obtaining indicator values</th>
<th>Value</th>
<th>Target value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Human resources:</strong></td>
<td>1. Initial/further training (amount per year, further specialist training. CPD on soft skills etc.)</td>
<td>Consult HR department data</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Technical Inspection Service / Prevention department capacity rating</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Average age of employees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Material resources:</strong></td>
<td>Criteria for good equipment</td>
<td>Departmental checklist</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Availability/access:</strong></td>
<td>1. Guarantee all requested consultations</td>
<td>Departmental statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Inspect as many companies as possible in accordance with inspection plan</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. High frequency as stipulated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Structure quality:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Punctuality:</strong></td>
<td>Consultation within x weeks</td>
<td>Departmental statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percentage of consultations carried out within stipulated deadline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Communication (style):</strong></td>
<td>Competence to provide advice in response to enquiries</td>
<td>Questionnaire</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Clarity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Target group orientation:</strong></td>
<td>1. Timely inspection in special circumstances (serious accidents, cases covered by section 3 of Occupational Disease Regulation (BKV), ...) and perform specific actions where necessary</td>
<td>1. Departmental statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Take into account content of previous consultations</td>
<td>2. Consult reports from previous consultations</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Process quality:</strong></td>
<td>Solution-focused approach</td>
<td>Questionnaire</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Transparency/standardisation:</strong></td>
<td>Ensure visibility of solution-focused approach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Documentation/evaluation:</strong></td>
<td>Available reports and evaluations</td>
<td>Departmental statistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Regular documentation with subsequent evaluation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Target</td>
<td>Indicator</td>
<td>Method of obtaining indicator values</td>
<td>Value</td>
<td>Target value</td>
</tr>
<tr>
<td>--------</td>
<td>-----------</td>
<td>-------------------------------------</td>
<td>-------</td>
<td>--------------</td>
</tr>
</tbody>
</table>
| **Customer satisfaction/acceptance:**  
Customer satisfaction | Satisfaction with consultation | Questionnaire |       |              |
| **Attitude change:**  
Discussion and monitoring of whether the employer and insured parties are meeting their health and safety responsibilities | Identification of regulations and measures implemented in the workplace | Inspection and assessment carried out by inspectors |       |              |
| **Problem-solving capacity and performance:**  
1. Companies should comply with quality criteria in the test catalogue  
2. Targeted motivation to use own initiative and ensure they are meeting their health and safety responsibilities | 1. Monitored companies that comply with quality criteria in test catalogue within one year (divide companies into groups based on extent of compliance, bring in test with quality criteria)  
2. Was problem-solving capacity improved or not? | 1. Currently not yet feasible, research ongoing at St. Augustin  
2. Questionnaire |       |              |
| **Complaint management:**  
1. Opportunity to make complaints  
2. Receive few complaints | 1. Complaint management e.g. by speaking to customer service worker/manager on the phone or writing to them  
2. Number of complaints | 1. Checklist with complaint management requirements  
2. Departmental statistics |       |              |

Research on the effectiveness of prevention measures at the workplace
5 Interaction of different prevention services

This sub-project is reported on by Hanna Zieschang, session 1. In conclusion the findings can be summarised as follows:

1. The interactions between the statutory accident insurance institutions’ services are particularly significant when one person is responsible for providing several services. These combined functions occur particularly within two sub-networks: the prevention service, and the members of the technical committees or testing and certification agencies.

2. The key drivers for the overall prevention service network are mostly found in the technical committee and testing and certification agency sub-network. The “recipients” are the services in the prevention service sub-network.

3. The most important driver for the overall statutory accident insurance institution prevention work system is the research and development outcomes service.

4. All services need to be tested, optimised or modified for the next prevention service in the service chain that will use them.

All prevention services should be seen as distinct but interconnected sub-processes. Only if we know our customers (including our internal customers) and their requirements, will these processes contribute to increased customer satisfaction among the different services’ recipients. This sub-project is also a plea for future research:

- Which combination of services has the highest impact?

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**Fig. 7:** Prevention activities in enterprises are stimulated by combined elements of quality controlled prevention services (example: R&D serves consultation, the aim is an enterprise without disturbances having satisfied customers)
Which combination of services should be carried out by the same personnel to achieve high synergies?

In which sequence should we apply our different services?

In what way have branches and enterprise sizes an impact on these questions?

6 Purpose of the “Quality in Prevention” project

With the high rate of new innovations, resources for improving working conditions and preventing work-related health risks are scarce in all economies and companies. As a result, the available resources have to be used in as effective and cost-efficient a manner as possible. Given this need, the four-year “Quality in Prevention” project was conducted with the aim of determining the situation in Germany and laying the foundations for process optimisation. Benchmarking, process control and continuous improvement processes can only be implemented if the necessary tools are available: product definitions, indicators and measuring instruments. This ISSA colloquium is the first step towards being able to compare the processes with those of other countries and thus to learn from optimisation carried out in other OSH systems.

7 References

For references, see “Quality in Prevention” final report in English

For more detailed information and all references see the reports on the 14 subprojects in German:
http://www.dguv.de/bgag/de/forschung/forschungsprojekte_archiv/qdp/qdp_abschluss/index.jsp
How Can Companies Improve OS&H Performance Through Adoption of Leading Practices?

Sietse van der Woude
South African Chamber of Mines, South Africa
Summary

• Leadership…
  – Commit to measurable goals
  – Value people, involvement, …
  – Recognize human error is mainly a symptom of trouble in the system

• Systematic, research-informed and science-based approach to adoption of leading practice

Leaders commit…

2005 Employer Summit         CEO Roundtable 2008
Leaders value...

- **People**: Care for people...
- **Empathy**: ... alignment with people’s values and effective communication
- **Excellence**: ... consistent with the highest standards worldwide ...
- **Involvement**: Employees at all levels will be involved in leading practices that may affect them...
Leading practice adoption: the opportunity

![Graph showing a decline in fatalities per million hours worked from 2003 to 2013 with a 50% improvement indicated.](image)

Year

Leading practice adoption: the challenges

- From mental models research, we concluded leaders at various levels believed:
  - Their communication is key
  - Other people’s beliefs and behaviour are barriers
Research on the effectiveness of prevention measures at the workplace

**Leading practice adoption: the challenges**

- Technology is about hardware and software. Adoption is about people, their beliefs and behaviour.

- Enabling systematic adoption - not selling, directing or sharing - is the challenge

- Adoption system, complete with new knowledge and tools, should be as uncomplicated as possible

---

**Leading Adoption System: Process Steps and Outcomes**

<table>
<thead>
<tr>
<th>Identity &amp; Plan</th>
<th>Investigate &amp; Document</th>
<th>Demonstrate</th>
<th>Promote Adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OUTPUTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prioritized List of Leading Practices</td>
<td>Leading Practice from Source Mine</td>
<td>Leading Practice Guide</td>
<td>Community of Practice for Adoption</td>
</tr>
<tr>
<td>Plan for Next Steps</td>
<td>Behavioural Communication Plan</td>
<td>Adopted Practices</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>OUTCOMES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Improved health and safety</td>
</tr>
</tbody>
</table>
What makes this initiative different?

Differentiator 1: Behavioural communication – the concept

A science-based leading practice in itself tapping current understanding in:
- Risk perception
- Risk communication
- Decision-science
- Behavioural decision research

Notable work done at Engineering and Public Policy Department, Carnegie Mellon University, Pittsburgh, etc.
Behavioural Communication – the practical features

- Communication for behavioural outcomes, not information sharing
- Focuses strategy and messages on people’s mental models, i.e. where people are at today in their thinking
- Interviews to reveal and characterize in-depth people’s knowledge, beliefs, priorities and criteria for judging leaders’ trustworthiness and competence
- Based on insight into people’s thinking, not assumptions or guesses
- Plans include innovative tactics e.g. visits of crews to source mines
Behavioural Communication – the outcomes

- **Respect**: ‘People feel involved and are happy that they get the opportunity to raise their views’

- **Broader impact**: ‘We use the leading practice as part of culture change at our mine’

- **Break past negative behaviours**: ‘Contrary to the past, we have experienced no vandalism of the leading practice technology’

- **Encourage new positive behaviours**: ‘If the fogger stops, workers stop because they are concerned about dust levels’
Differentiator 2: Leadership Behaviour Plan

- ABC approach is applied behavioural analysis, NOT Behaviour-Based Safety.
- ABC Approach e.g.:
  - Antecedents: Training and coaching on legal requirements for shift bosses
  - Behaviours: Shift bosses comply with legal requirements
  - Consequence: Management gives positive recognition to shift bosses for consistent compliance
- Defines behaviours at 4 levels i.e. team members, 1st line supervisors, middle management, senior management

Differentiator 3: Adoption Guide with Example Plans

- Structured guidance enabling the “how” of adoption
- Lessons learnt from demonstration mine
- Supporting information and coaching from those experienced in successful adoption
- People and technology
Differentiator 4: Community of Practice for Adoption

Peer group learning:

- Helping each other with adoption, including:
- Avoiding surprises, solving problems as they arise
- Generating necessary insights - “Mental model” interviews
- Behavioural communication/leadership behaviour implementation

Differentiator 5: Learning Hub
Role of Learning Hub Programme Management Unit

- Communicate extensively with stakeholders
  - Ensure all leaders understand their responsibilities and how initiative can help them

- Scan external environment for leading practices

- Support teams with documentation, expert assistance and monitoring

- Arrange meetings, workshops, etc.

- Provide continuity and institutional memory

- Ensure quality control

OSH Results from pilot project

- Noise: 5 x quieter machine

- Dust: Up to 90% reduction in harmful dust, depending on application

- Falls of ground: Quality of examination and making safe improved leading to 50%+ reduction in accidents
Challenges and spin-offs

- **Challenges**
  - Production pressures
  - High turn-over in management ranks
  - No short cuts particularly on people issues
  - Practice is part of system

- **Spin-offs**
  - People’s involvement in e.g. development of training materials
  - Better stakeholder relations
  - Suppliers coming to the party
  - Stimulate innovation: measurement methods

Conclusions

- It’s all about people

- Leaders have a key role to play in improved safety by e.g.:
  - Understanding how their decisions, actions, inactions and systems impact on OSH

- Learning from pockets of excellence is a huge opportunity to improve OSH and practical tools exist to do this better
Evaluation of OSH Research Institutes and OSH Service Providers – Aims, Strategies, Indicators

Park Doo Yong
Hansung University, South Korea

Background
As far as I know, there is no universal evaluation protocol and method for evaluation of OSH research institutes and service providers. However, recently it has been found increased need for evaluation of OSH research institutes and service providers as well as research projects and service performance in both public and private sectors in Korea. There were several reasons of increased demand for these evaluations.

The first reason was the increased demand of fund for OSH research and services. On the contrary, pressure of cutting off the budget has also been increased. This conflict resulted in necessity of critical evaluation of performance of OSH research and services.

The second reason was due to the changes of characteristics of OSH problems. In the past, the OSH problems were relatively simple and clear in both causes and consequences. Therefore, control measures were based on problems and symptoms. However, most of current OSH problems show multiple, complex and vague in causal relationship. In these situations, proactive, comprehensive, management system approaches are preferred as control measures (fig. 1).

<table>
<thead>
<tr>
<th>Past</th>
<th>21C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Due to specific</td>
<td></td>
</tr>
<tr>
<td>▶ localized</td>
<td></td>
</tr>
<tr>
<td>▶ over-exposure</td>
<td></td>
</tr>
<tr>
<td>▶ specific agents</td>
<td></td>
</tr>
<tr>
<td>▶ for a certain group</td>
<td></td>
</tr>
<tr>
<td>Problem-/Symptom-based</td>
<td></td>
</tr>
<tr>
<td>▶ post-control (reactive)</td>
<td></td>
</tr>
<tr>
<td>▶ direct to problem</td>
<td></td>
</tr>
<tr>
<td>▶ individual control</td>
<td></td>
</tr>
<tr>
<td>Due to non-specific</td>
<td></td>
</tr>
<tr>
<td>▶ wide area</td>
<td></td>
</tr>
<tr>
<td>▶ very low concentration</td>
<td></td>
</tr>
<tr>
<td>▶ multi-components</td>
<td></td>
</tr>
<tr>
<td>▶ for non specific group</td>
<td></td>
</tr>
<tr>
<td>System-based</td>
<td></td>
</tr>
<tr>
<td>▶ pre-control (proactive)</td>
<td></td>
</tr>
<tr>
<td>▶ orient to management</td>
<td></td>
</tr>
<tr>
<td>▶ comprehensive control</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1: Changes of characteristics of OSH problems and management approaches
Emerging OSH issues in 21C have shown different characteristics from those of past as shown in fig. 2. Typical risk factors of physical agents such as noise and vibration and chemical agents such as gases and vapours have been considered to be able to identify, measure and control scientifically, technically and objectively. However emerging risk factors such as ergonomic and psychogenic problems are hardly defined with scientific, technical and objective measures since they are quite relative, relational and subjective problems.

In the past, it might be unnecessary to evaluate the OSH research and services because their objects and targets were simple and clear. For example, research subjects are very clearly defined to test a specific hypothesis, to monitor workplace for a certain hazards, and to develop a certain methodology e.g., sampling and analytical method. A target of training program on employees by a service provider set as a number of employees to be trained. In this circumstance, most research and OSH services were almost always believed to achieve a sort of high performance regardless research area/subjects and type of service. It might be true that any kind of research and OSH services was directly effective to reduce occupational injury and illness in the past. No significant attention was paid to evaluation of appropriateness and performance for OSH research and services both in effectiveness and efficient in this era.

Economic growth, technologic advances and industrial diversity in recent years have changed the characteristics of OSH problems. Sharp decrease of occupational injury and illness rate has been changed to be staggering. It did not take a long time to perceive that traditional approaches played a limited role. OSH research and services have been partly responsible for this limitation. It was criticized that OSH research and services were ineffective and inefficient with the fact of no reduction of injury and illness rates. Slow or no reduction of injury and illness rate could not be an evidence of ineffectiveness and inefficiency of them,
it was enough to press government and society to evaluate OSH institutes and service providers.

However, it is inappropriate to simply evaluate OSH research and services based on the injury and illness rate since final outcome in terms of injury and illness rate cannot be understood in isolation. No protocol and method was available to apply in this evaluation. Therefore, a number of evaluation protocols for OSH research and services have been developed under the pressure in last decade in Korea. Although these efforts affect to the OSH institutions and service providers, the result was unsatisfactory and ineffective since the evaluation protocols and methods were mainly focused on procedure check-up rather than the performance.

Due to controversies of fairness and appropriateness of evaluation, most evaluation protocols and tools relied on quantitative measures. Although quality evaluations have been introduced especially for OSH research area, it could not resolve its limitation since quality evaluation was limited to appropriateness of research methodology, interpretation of data and conclusion derived from the research.

To overcome this limitation, I have developed and proposed new ways for evaluation of OSH services and research respectively. One is the Pre-Expectation of Performance Index System (PEPIS) for evaluation of OSH service provider and the other one is Value Evaluation System (VES) for OSH research.

An Existing Evaluation Protocol for Service Provider: SHARP

There are a number of programs to directly and indirectly assist industries to improve workplace safety and health from the Korean government. Some of them are direct financial supports to industries, but most of assistant program are designed to provide technical services and education which are run by OSH service providers.

Small-business health assistance program is one of the typical assistant program developed by Korean government late in 1990s. Comprehensive occupational health consultation services are provided to the small-sized industries by the occupational health service organizations. To participate this program, the occupational health service organization has to apply for the program with business plan and certification of qualification for manpower and facilities and equipment required. Based on their business plan, resources, location and accessibility, total number of industries to be serviced are allocated to each organization if they are passed to minimum required qualification. They have to visit industries more than 4 times a year and have to provide essential consultations such as hazard and risk identification, appropriate control measures and training.

Small-business Health Assistance Rating Program (SHARP) was developed and applied to evaluate these health service providers early in 2000s. SHARP Index has been developed to evaluate the participant service providers as shown in Table 1. It has been modified almost every year to accommodate appeals from the participants by the committee. However, it is still in debate.
But the real problem is that it is very limited to evaluate real performance of services. This limitation is not only for the SHARP but also almost every evaluation schemes for OSH service providers. In addition, these pre-defined evaluation tools does not help service providers to develop and implement better services. Even it often interferes to provide better services which are inherently flexible and diverse to fit and consider customers’ need and demands.

In this system, it is possible to evaluate the appropriateness of service plans at the stage of budget allocation and to screen the service plans based on pre-defined performance index. Performance evaluation after the service implemented can also be easily conducted following the tools that were proposed by service provider when they proposed the service. It is possible to apply PDPES for individual service as well as service provider.

### Table 1: Evaluation category of SHARP and scoring tablet

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation/management for organization</td>
<td></td>
</tr>
<tr>
<td>Operational system</td>
<td>50</td>
</tr>
<tr>
<td>Training and Education system for staffs</td>
<td>50</td>
</tr>
<tr>
<td>Operation/management system for Technical services</td>
<td></td>
</tr>
<tr>
<td>Appropriateness of technical reports</td>
<td>225</td>
</tr>
<tr>
<td>Development and supply of additional services</td>
<td>50</td>
</tr>
<tr>
<td>Appropriateness of implementation of services</td>
<td>125</td>
</tr>
<tr>
<td>Performance of services</td>
<td></td>
</tr>
<tr>
<td>Ratio of completeness of services among planned industry</td>
<td>175</td>
</tr>
<tr>
<td>Ratio of Implementation of control measures</td>
<td>125</td>
</tr>
<tr>
<td>Satisfaction index of industry</td>
<td>200</td>
</tr>
<tr>
<td>Total</td>
<td>1,000</td>
</tr>
</tbody>
</table>

**Pre-Defined Performance Evaluation System (PDPES)**

To resolve these shortcomings, a Pre-Defined Performance Evaluation System (PDPES) for OSH service providers was proposed. In the PDPES, service providers have to define the performance evaluation index and tools when they submit a proposal. Therefore, it must be precisely defined the objects of services and target performance during planning the services.

**Traditional Evaluation System for Research**

Evaluation of research projects is one of the most difficult subjects. Relative comparison cannot be applicable for different disciplines. Outcomes or performances are hardly measured directly when researches are completed. Generally, injury and illness data do not considered as a performance index for research. Thus, it may be only evaluated individual basis for research projects.
Traditionally, there have been three steps for research project evaluation; at the proposal stage, in the middle of conducting the research project and after submitting the final report. Generally, these evaluation made by experts for the research subject.

It has been found that it was very difficult to set priority of research projects, and to appropriately allocate the research funds in this system because evaluations among the various disciplines have been made successfully. Experts on the specific subject are good enough to evaluate the specific research plan, progress and outcome. However, they are not good at set priorities among various research subjects. Usually, they tend to keep the research funds to their discipline and reluctant to yield the resources to other subject even though it is more significant and required in the view point of OSH injury and illness in the workplaces. Often they are interested in the specific subject that they preferred rather than those that are required by society.

Evaluation of Value System for Research

Evaluation of Value System (EVS) for research projects and institutions was proposed to supplement these problems. In the EVS, a survey is made for the research projects to a large number of personnel including OSH professionals, policy decision-makers, OSH inspectors, OSH practitioners, employers and employees to evaluate ‘their perceived value’ of the research projects. Surveys for evaluation of value are made at stage of the proposal as well as final report submission.

Conclusion

As PDPES and EVS have been introduced, a lot of controversies were faced. Most of stake-holders were reluctant to adopt these systems. It is still under discussion although the results of pilot scale trials have shown very positive signs. Although they are not completely applied yet, it was successful to change ‘a mindset’ of service providers and researches from the supplier-oriented to the customer-oriented.
Strategic Agility – An Oxymoron or a Necessity for OSH Organizations?

Harri Vainio
Finnish Institute of Occupational Health (FIOH), Finland

Few challenges are more complex than understanding and managing the hazards and health risks in workplaces. Investigators and managers need to learn from past human experience, from experiments in laboratories and other fields, and to apply this knowledge to the current day work situation. This also concerns uncertainties; OSH experts must make predictive causal inferences and recommend protective measures based on a less than ideal knowledge base.

The occupational safety and health (OSH) community has traditionally focused on collecting information relevant for improving working conditions and human health, and on transforming this information into meaningful knowledge and useful practical tools which can be applied to improve health and safety at work.

As absolute certainty is rarely an option, action programmes would not be effective if such proof were required. Government officials and advisors in OSH organizations have to use the best available evidence to determine safety and to set limits and guidelines for harmful agents and practices at work.

Today’s OSH institutions need to build flexibility around their OSH core competencies. Expenses are an important issue, and therefore organizations should be lean, quick to react, agile.

The roots of strategic agility lie in competitive business organizations. The concept of strategic agility was created when US car manufacturers realized in the 1980s that they had fallen behind their Asian counterparts in some fields of production. It meant anticipating change, a new way of reacting and leading.

Strategic agility revolves around understanding one’s core-business and markets, and being in a position to take advantage of change as it happens. This is important in today’s global world, and the concept has great potential. Technology will allow countries to move forward to create goods and services. However, the rate of change in workplaces sometimes makes it difficult to make extensive, long-term strategic plans that could still be in place five or more years from now.

Is strategic agility an oxymoron: a contradiction of terms? If you are highly strategic, you do not need to be agile, and vice versa: if you are highly agile, there is no need to be strategic. So ideally, the term strategic agility is an oxymoron, but in practice, you are never so strategic that there is no need to be agile; neither can you be so agile that you do not need to be strategic. This at least is the case in the institutes of occupational safety and health, as far as I know them.

Strategic agility is thus also needed in
OSH organizations. It is not only a challenge for institutions but also a major opportunity for smart, quick, committed actors. We need to cultivate a capacity to adjust to changes and developments as they come along. OSH institutions also face a real challenge of speed and complexity: the nature of emergent changes becomes more and more complex, and the speed of change is increasingly faster. Doz and Kosonen (2008) have inventoried a myriad of problems that are prevalent in large companies, and prescribed tools to move them toward more strategic agility. Many of those tools are also very useful in OSH institutes, which need to take quicker action and lower costs in order to move from rigidity to agility.

The implementation of the strategic agility concept in institutions would be facilitated by a new leadership approach. Mikko Kosonen has suggested that the concepts of leadership and management be replaced with something what could be called ‘communityship’ (Kosonen 2009). Communityship makes use of leadership, but in Kosonen’s words, “not the ego-centric, heroic king that has become so prevalent in the business world. We make a great fuss these days about the evils of micromanagement but far more serious is macroleading: the exercise of top down authority by out of touch leaders. Communityship requires a more modest form of leadership that might be called engaged or distributed management. A community leader is personally engaged in order to engage others, so that anyone and everyone can exercise initiative.”

Thus OSH organizations today need strategic agility, and this could be delivered through a participatory communityship style.

References:
Mikko Kosonen: “Finland as a lead market for next generation well-being services”, a speech at CKIR Workshop, August 27, 2009.
Traditionally, safety and health professionals have focused on worker safety and health in the course of project execution, operations and maintenance and not enough attention, until recently, have been given to worker health and safety in the pre-operational or construction phases such as building or product design, material selection and procurement. In the 1970s and 1980s the chemical and petroleum industries enhanced their focus on process design in addition to operational and maintenance safety to minimize process interruptions, catastrophic releases, fires and explosions. While select enterprises in other industries have approached the concept of “building in” worker safety and health in the design and subsequent phases, more opportunities exist which could significantly improve worker safety and health outcomes, lower operational and maintenance costs and improve productivity and quality performance.

At the end of the last century, many Governmental bodies devoted more resources to encouraging organizations to consider worker safety and health as early as possible into the conceptual design or design phases of a workplace, project or piece of equipment to assure that cost effective safety and health risk reductions are realized in the construction and operational phases of an activity. As a result, industry sponsored research and government funded efforts are effectively developing and evaluating such concepts, design features and methods which provide for more inherently safe workplaces. In the United States, the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) are helping to promote these concepts, and developing and fostering further research to enhance safety design and operational performance.

In the beginning of this decade, NIOSH under the direction of Dr. John Howard initiated a program entitled “Research to Practice (r2p)”. The initiative is characterized as a collaborative process between NIOSH and interested parties for the expressed purpose of generating knowledge and then reducing that knowledge to real world practice in order to reduce workplace injuries and illnesses. In essence, the agency sets priorities regarding the most important occupational health and safety issues in the United States, engages partners from both the private and public sectors to develop and apply research findings for the purpose of establishing prevention practices and procedures which significantly improve safety and health outcomes. Since its inception, the “Research to Practice (r2p)” has fostered many successful projects which have helped bring safety and health innovations into specific workplaces and
resulted in real reductions in workplace injuries, illnesses and fatalities.

Some of the success stories are:
- Developing a MBA Class on the Business Value of Safety and Health
- Engineering Noise Controls for Roof Bolters
- Handwipe Method for Removal of Toxic Metals
- Preventing Injuries Related to Motor Vehicle Equipment
- Handwipe Method for Detecting Lead
- Ambulance Crash Survivability Improvement Project

The concept of building in safety and health features into the design phase of a construction project was introduced in the United States as early as 1955 in the National Safety Council publication “Accident Prevention Manual”. The concept now call “Prevention through Design (PtD)” was significantly revitalized through the Construction Industry Institute's sponsored research of Professors Jimmie Hinze and John Gambatese in the 1990s. Industry interest in PtD increased dramatically after a 2003 symposium on the topic at the University of Oregon and subsequent publications of the symposium proceedings.

Through an Alliance with OSHA, a more formal relationship with labor, industry and educational institutions was established for the purpose of promoting occupational safety and health in the construction industry through PtD. By leveraging vital resources, best practices and technologies in PtD can be more effectively developed and disseminated throughout the range of stakeholders and the process of selling the value and benefit of PtD can be more appropriately demonstrated through relevant business cases. This discussion will address some of those best practices developed through this initiative and analysis some of the approaches used to overcome the problems associated with focusing on cost and benefit on a short term basis rather than cost, productivity, quality and workplace risks reductions on a long term basis.

In addition to governmental activities, this discussion will focus on PtD initiatives organized by educational institution like the Harvard University and for-profit organizations including equipment manufacturers.
SESSION 1

Interaction between different OSH services
Development of a Performance Measurement Report for the Prevention System in a Canadian Province

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1 Institute for Work & Health (IWH), Canada
2 University of Toronto, Canada
3 Industrial Accident Prevention Association (IAPA), Canada

Introduction
The objective was to develop a performance measurement report on the “prevention system” in the Canadian province of Ontario. The prevention system consists of public and not-for-profit sector organizations in the province concerned with primary prevention in occupational health and safety:

- Ontario Ministry of Labour (MOL)
- Workplace Safety & Insurance Board of Ontario (WSIB), Prevention Division
- 14 not-for-profit health and safety associations (HSAs)
- Institute for Work & Health (IWH), a research institute

The prevention system in Ontario oversees – to some extent – approximately 93% of Ontario workers.

Senior decision-makers from all the prevention system organizations comprise the Occupational Health and Safety Council of Ontario (OHSCO). The Council was established in 1998 as a forum for dialogue and coordinating actions to improve alignment in the prevention system. Several sub-committees related to OHSCO strategic priorities were formed, including one tasked with developing a set of performance indicators for the prevention system.

One of the early tasks of the system per-
formance measurement sub-committee was to develop and seek approval for a program logic model for the prevention system (see fig. 1). It depicts the major activities of the prevention system, their impacts in the workplace and on workplace parties (Reactions), and the longer term worker outcomes of ultimate interest.

Methods
Potential performance concepts were generated by applying four theoretical principles and common practices of organizational performance measurement, while considering the strategy and activities of the prevention system. The four approaches include the following: public sector practice (including program logic model development); business models and practice (balanced scorecard); integrative models based on the organizational effectiveness literature; and the principle underlying multiple constituency models (different stakeholders have varied, sometimes conflicting viewpoints on performance, but all are valid and can be included in the same framework).

Twenty-one potential performance measurement concepts were generated using these means. The initial set of 21 performance concepts was considered too large in number by OHSCO members and was subsequently reduced to ten, by considering the following criteria:
- OHSCO members’ preferences for concepts, determined through a survey
- Whether data of adequate quality were readily available to measure the concept
- Performance measurement principles of balance and representation of strategy

Indicator data were then developed for each of the ten concepts by the following means: collecting and integrating existing administrative data, collecting primary data from OHSCO members, and using publicly available documents. Whenever possible, data were selected and transformed to make year-to-year comparisons valid.

Feedback on the report was sought by the inclusion of an open-ended question in the annual data collection instrument, which is directed to key informants in each of the OHSCO member organizations; and through individual interviews with OHSCO members.

Results
A final set of ten performance measurement concepts were decided upon and indicators were developed for nine of these. The most important of the indicators were designated “key performance indicators” and are summarized in Table 1. A report of indicators measuring these concepts has been produced annually.
from 2003 to 2007; and the preparation of the report on 2008 is in progress.

Feedback from OHSCO members showed that 94% thought the performance measurement report was at least “somewhat useful.” They found the program logic model and the report to be useful conceptual tools; and the report to be a unique source of high level information about the prevention system. We note that the report has served as a reference when OHSCO organizations have modified the type of data included in their management information systems.

Table 1: Performance measurement framework for 2007

<table>
<thead>
<tr>
<th>Logic model domain</th>
<th>Performance concept</th>
<th>Key system performance indicators*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inputs</td>
<td>1. Monetary Resources</td>
<td>• Total System expenditures on prevention per Ontario worker (in 2007 dollars)</td>
</tr>
<tr>
<td></td>
<td>2. Legislation &amp; Regulations</td>
<td>• Significant changes regarding legislation and regulations (qualitative)</td>
</tr>
<tr>
<td>Outputs/Activities</td>
<td>3. System Alignment</td>
<td>• Significant changes regarding System alignment (qualitative)</td>
</tr>
<tr>
<td></td>
<td>4. Enforcement</td>
<td>• Orders per 100 OHSA-covered workers • Orders per field visit</td>
</tr>
<tr>
<td></td>
<td>5. Knowledge/Skill Transfer</td>
<td>• Participant-days in certification training Pt 1 per 100 Ontario workers • Participant-days in certification training Pt 2 per 100 Ontario workers • Participant-units of training materials provided per 100 Ontario workers</td>
</tr>
<tr>
<td>Reactions</td>
<td>6. Client Satisfaction</td>
<td>• No system-wide indicator available</td>
</tr>
<tr>
<td></td>
<td>7. OHS Values, Beliefs and Attitudes</td>
<td>No 2007 data available</td>
</tr>
<tr>
<td></td>
<td>8. Knowledge/Skill</td>
<td>• Persons passing Part One certification test in last 3 years per 100 Ontario workers</td>
</tr>
<tr>
<td></td>
<td>9. Hazardous Exposures</td>
<td>• Vehicle-kilometres (thousands) per Ontario worker</td>
</tr>
<tr>
<td>Outcomes</td>
<td>10. Occupational Injuries, Illnesses, Disabilities and Fatalities</td>
<td>• Lost time claims per 100 workers • Traumatic fatalities per 100,000 workers • MSDs as a % of lost time claims • Relative risk of lost time claim: 15-29 yr olds vs. 25-44 yr olds • Relative risk of lost time claim: 55-64 yr olds vs. 25-44 yr olds • Relative risk of lost time claim: 1 month job tenure vs. 13+ mos.</td>
</tr>
<tr>
<td></td>
<td>11. Cost</td>
<td>• Schedule 1 current year benefit costs per $100 of insured payroll</td>
</tr>
</tbody>
</table>

* Indicators are quantitative unless indicated otherwise.
Conclusion
This project demonstrates how a performance measurement report on an occupational health and safety prevention system can be developed through the application of current performance measurement theory and practice.

Acknowledgements
Others from prevention system organizations have made contributions to the performance measurement report. IWH receives core funding from the Workplace Safety & Insurance Board. Fig. 1 and a table similar to Table 1 have been published previously in Robson LS, Speers JC, Kusiak RA, Burns BB. Development of a performance measurement report for the Ontario prevention system. Policy and Practice in Health and Safety 2007;5(1):3-18. Permission to reproduce them here has been given by Institution of Occupational Safety and Health (IOSH).
New Challenges in the Field of Prevention in Small Enterprises

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BG Energie Textil Elektro (“Institution for Statutory Accident Insurance and Prevention in the Energy, Textile and Electrical Industries”), Germany

Supervision of small enterprises by inspection authorities (OSH)
Every year the trading supervision departments record more than 500,000 new businesses in Germany. In 2005 the Federal Statistical Office reported the establishment of 258,000 new small enterprises (with 10 to 49 employees). In the manufacturing industry 62,000 new small enterprises were recorded.
The supervision and advisory service for so many enterprises is a special challenge to the OSH advisors. In Germany the advisors are federal public authorities for occupational safety, institutions for statutory accident insurance and prevention in the different industries and guilds.
In addition to many activities on a regional basis the employer’s model (which means advice on safety and health-related issues for the employers) provides a successful contribution in common supervision of small enterprises. This model provides the rules and regulations of the institutions for statutory accident insurance and prevention and qualifies the entrepreneur to adopt and implement all regulations regarding occupational safety and health protection due to risk evaluations.

What is the objective of the employer’s model?
The most important aspect of the employer’s model is the creation of pre-conditions for a successful enterprise which means safety and health preservation of the employees.
The model is designed to preserve the health and thus the employees’ capacity to work. Especially small enterprises are strongly affected by staff absence and lost production due to accidents or disease of the employees; absent employees can hardly be substituted.
In most industrialised countries the employer is responsible for safety and health protection of his staff. Due to a highly technical work environment safety and health protection – in short: occupational safety at work – requires expert knowledge. In all countries of the European Union the employer is obliged to seek advice from safety experts. These experts are employees and works doctors qualified in occupational safety and health protection. They are the supervisors for the employer in the field of occupational safety. They advise employers on how to assume his responsibility correctly. However, they are not controllers or actors in the interest of any authority! They are not allowed to issue instructions neither to the employer nor to the employee.

In Germany the labour protection law determines that every employer appoints a safety officer and works doctor, the so-called safety-technical advisory service and occupational medical care. This regulation does not depend on a company’s size as long as at least one employee
works in the enterprise. For many years, works physician services and qualified safety officers have been recognized by large enterprises and they have been indispensable advisors for management and employees.

Important: Please note: The appointment of a safety specialist does not mean guidance on safety technology!

Small enterprises – special requirements, special solutions

In small enterprises the starting point is completely different in comparison with large enterprises as the employer is directly involved in the plant operations and he attends to operations directly. If special advice is necessary he has to seek external advice. This case is dealt with by the employer’s model.

Which enterprises can use the employer’s model?

The employer’s model is suited for enterprises with at least one to 50 employees. Employees working part-time are regarded as full-time workers. For enterprises without employees there is no requirement to act. Enterprises with more than 50 employees have to prove the support.

Advantages of the employer’s model

An enterprise may profit in many ways from the employer’s model as it offers:

1. specific practice-oriented information on occupational safety for the employer
2. free subscription of branch-related working tools and active assistance published by the BG for occupational safety in the employer’s enterprise
3. support service for the enterprise on request with company physician and safety officers according to the concrete requirements of the enterprise
4. improvement of the management
5. legal security

The high numbers of employers who take part in the employer’s model demonstrate the positive experiences that most of them make. In the field of competence of the institutions for statutory accident insurance and prevention in the energy, textile and electrical Industries more than 40,000 employers have taken part in seminars.

The employer’s model assists the employer to organise his enterprise in regard to occupational safety and thus meeting the legal requirements. Special requirements of the respective industrial branch are also taken into account.

The model stresses the special role of the entrepreneur’s self-responsibility. The employer often works in his enterprise or at least takes part in operational processes so that the operational requirements are manageable.

What are the duties of the employer within the employer’s model?

The details of the employer’s model can be found in appendix 3 of the accident prevention regulations “works physicians and safety officers for occupational safety” (BGV A2).

The employer’s model consists of the following components:

- One-time participation at special seminars or at telecourses (see below: courses for enterprises in the industrial branches textile, clothing, shoes, laundry and cleaning)
- Risk evaluation carried out by the employer in his own enterprise (if necessary also with external advice)
- Regular participation of the employer at training courses (e.g. every three years in group II)
- Demand-oriented supervision of the
enterprise by the works physician and safety officer at special occasions

The essential pre-condition to use the employer’s model is that the employer attends the seminars or telecourses on occupational safety determined by the institution for statutory accident insurance and prevention (BGETE). Thus the employer will be qualified to recognize the need for medial or safety-related issues and he will be able to seek advice in safety questions.

How can I find the seminar which is suitable for my enterprise?
The BGETE wants to offer its insured member enterprises branch-related seminars. Depending on the branch and company’s size the BG offers:

Either
A one-day basic course followed by one-day advanced course with subsequent implementation in the enterprise
Or
A course comprising 5 to 6 hours in which you have to be physically present followed by a telecourse
Or
participation in a telecourse for enterprises of the trades textile, clothing, shoes, laundry and cleaning

You will find the respective courses of the employer’s model for the different trades in the table.
The exact name of the trade and the risk category will be found on the last payments of the enterprise to the BG or on the total staff wages and salaries of the company.

Seminars for enterprises from the branches textile, clothing, shoes, laundry and cleaning
Enterprises that formerly (until 2007-12-31) belonged to the institution for statutory accident insurance and prevention in the textile and clothing industries attend both a telecourse with and without periods in which they have to attend physically.

Enterprises from the following trades shall participate in courses which demand physical presence: preparation, spinning company, production of felt and huts

And/or
Weaving mills
And/or
Finishing of textiles and fabrics, tobacco finishing shops.

The telecourse consists of two presence phases and one self-tutoring phase. The first presence phase with 8 learning units is designed to explain to the participants how the telecourse is carried out and to convey the basic knowledge of company organisation and raise the motivation and interest in the employer’s responsibility for safety and health protection and to motivate him to implement safety measures in his enterprise.

In the subsequent self-tutoring phase which consists of studying the employer’s handbook and additional literature the participants receive basic knowledge on issues relating to safety technology and occupational medicine. The participants can test their knowledge with questionnaires which they send to the BG. The questionnaires are the pre-condition to
attend the second presence phase. In the next phase the participants receive knowledge in the form of discussions which enables them to get actual knowledge and they have the opportunity to clarify the questions which arose during the telecourse.

A telecourse without presence phase may be completed by employers who do not belong to the branches stated above or by employers who belong to these branches but who completed studies or training as engineer or technician in the last 5 years (technical university or University of Applied Sciences) or employers who have already knowledge on occupational safety and health and who can give evidence to the BG that they have undergone a training in the last 5 years which included these safety subjects.

In doing so the employer has to update and to enhance his knowledge by studying the employer’s guideline on his own.

In order to check the efficiency the employer has to fill in and return forms to the BG at the latest 6 months after beginning the self-study.

The employer’s guideline is the basis for participating in the telecourses and it provides the employer with practical advice which allow him to

- Integrate safety and health protection as indispensable elements of the business,
- Ensure safety and health of the employees during work on the highest possible level,
- Recognize problems of occupational safety in the company and to react accordingly,
- To claim qualified advice on occupational safety and health protection according to the requirements of the company and systematically integrate the results into the decisions of the company.

The employer’s guideline is provided free of charge by the BG after registering for the telecourse.

**Where will the seminars be held, where can you register?**

The seminars have to be carried out by providers authorized by the institution for statutory accident insurance and prevention in the energy, textile and electrical industries.

In order to save time, these providers regularly offer the courses on a regional basis.

### Table 1: Content of the seminars

During the seminar the following topics will be dealt with:

<table>
<thead>
<tr>
<th>Not sector-specific</th>
<th>Sector-specific</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsibility of the employer for occupational safety</td>
<td>Performance of risk evaluation</td>
</tr>
<tr>
<td>Economic aspects of occupational safety</td>
<td>Sector-specific risks</td>
</tr>
<tr>
<td>Organization of safety and health protection</td>
<td>Protective measures to prevent risks</td>
</tr>
<tr>
<td>Guidance for employees qualified in occupational safety</td>
<td>Function of the company’s physician</td>
</tr>
<tr>
<td>Services of the BG</td>
<td></td>
</tr>
</tbody>
</table>
The costs of the seminars of the employer’s model will be paid by the BG. For each seminar the company took part in the company gets an expense allowance of 50 € per journey.

**Content of the seminars:**
The seminars of the employer’s model cannot be regarded as vocational training course to become safety engineer or a company’s physician. The employer will rather be able to organize the work protection within his company, to recognize the risk potentials and to develop solutions as well as establish the need for consulting and to claim for this need according to his requirements.
In the current economic situation – with a large number of small employing entities, flexible service and production structures adapted to the present and ever changing needs of the market and the accompanying massive turnover of the workforce, labour inspectorates have to face challenges which require the development of new tools in order to achieve the basic objective of their functioning: effective protection of labour.

Broadly understood prevention in the framework of labour protection means development of a safety culture in the crave for achievement of high work standards not only through supervision, but also through various forms of social communication and encouraging involvement of employers, employees and social partners in safety and labour protection issues. In the last few years the Polish Labour Inspectorate has been enhancing the preventive aspect of its actions, treating this form of activity as a process: consistent and long-term effort based on the analysis of available data, planning and followed by an evaluation which allows to include its results into further planning processes. The argument for inclusion of prevention into the mainstream of the labour inspectorate’s activity is the possibility to influence a broader scope of entities than by way of traditional supervision of working conditions, but most of all to achieve sustainable improvement of working conditions in workplaces where values related to work culture have been internalized. The conviction about the necessity to secure appropriate working conditions for employees on the one hand and the need for employees to participate in the implementation of appropriate OSH standards including psychosocial aspects on the other hand, are the functional basis of an unwritten ethical code in labour relations.

Actions undertaken by the National Labour Inspectorate in Poland either support its inspection activity in sectors marked by the highest intensity of risks and their consequences (accidents at work and occupational diseases) or constitute individual initiatives implemented in the form of special programmes or campaigns addressed to employers who are concerned with ensuring safe working conditions and adequate health protection of workers.

Still, it must be remembered that only strictly synchronized inspection and prevention activities can produce the effect of synergy. An important addressee of NLI’s preventive activity are young people – willing to take actions which are difficult or not fully comprehensible for their parents – a new generation of employees and employers which will heighten the standard of work culture on the labour market.

The presentation provides essential information about planning and evaluation of selected communication campaigns and
programmes of prevention which all have a common denominator – craving for development of such work relations which ensure high work safety standards.
Experts and researchers build new methodologies and concepts. But to reach companies and make these results efficient and usable, there is a real need for other skills, publishers, writers, mediators, web ergonomists, press mediators, consultants, documentalists, etc. Training, communication, technical assistance, legal advice, technical measures and consulting for companies are all good means of getting to know experts’, companies’ and workers’ needs. They are also very helpful for obtaining figures, alerts and statistics on risks and emerging problems. Indeed, to achieve efficient prevention, it is necessary to be constantly mindful of anticipation, in order to study hazards, prevent occupational risks and promote well-being in the workplace. Besides its practical knowledge of the companies, the interdependence of its modes of action establishes a strong specificity of INRS today.

I will use three examples to show how research and applications can interfere with and enhance each other. I will explain why researchers must work with specialists who will transform the messages, translate them and make them attractive, usable and efficient. It would be a big mistake to think that researchers CAN explain, write, teach and communicate towards all different audiences. This is the paper’s topic.

First example: Implement, teach and test the researchers’ results in companies and towards workers and confirm, adapt or reverse these results – Physiological constraints of push and pull efforts on beds, trolleys and pallet movers

In 2000, laboratory measurement results allowed the definition of pulling and pushing force limits for the initial phases and the maintenance of effort. During this period, INRS was asked for assistance in three different areas in order to compare these acceptable forces with the reality of a task. These studies were carried out in the laboratory with 30 subjects (15 men and 15 women) from whom were collected subjective indices, cardiac constraint, and the electrical activities of the muscles of the dominant leg and shoulders. The results of the measurements allowed the relationships between the forces applied to the mobile units and the loads shifted to be defined. The distribution of the orthogonal components and the force resulting from pushing or pulling show that the “parasite” forces are much higher with the bed than with the pallet truck. This could explain why, despite the much lower loads, the bed causes subjective, cardiac and muscular constraints that are not statistically different from those of the pallet truck. The results have permitted to better work on the new standards that were being drawn up. The results of laboratory measurements
Research on the effectiveness of prevention measures at the workplace

allowed a better definition of pulling and pushing force limits.

**Conclusion**
This assistance work and research study reinforced each other.

**Second example: Communicate on results and evaluate the impact towards public targets**
Looking at three different topics we will discuss the influence of different actions on our audience and the effect of coordination between them.

**MSD**
This graph represents the number of visits to the website, along with the number of brochures that have been downloaded.

We can see three different peaks, in October 2007, July 2008, May and June 2009. Now, we need to understand the reasons for these peaks. October 4, 2007, a ministerial conference takes place and Government decides to work specifically on MSD and PSR. At the same time the European campaign “Lighten the load” on musculoskeletal disorders (MSDs) is launched just after the Bilbao conference. Last but not least, a special newsletter is sent by INRS to 10,000 preventive services, safety representatives and practitioners. According to the figures and the number of direct clicks from the newsletter to the web site, we could conclude that this newsletter is very important for communicating to specialists. We could also conclude that this is a lot more efficient when it occurs while important communication actions are conducted. From May 11 to 15, 2008 the Government launched a major campaign (radio, television, posters, etc.). We can see that there is no direct effect, as we could have seen in October 2007. But the newsletter in June 2007 with a direct link on the Government and INRS websites, each of them providing a direct link to our brochures, is quite significant. The direct link to ED 957 is clearly visible. Finally, the Government launched the second MSD campaign in May 2009 with a direct
Research on the effectiveness of prevention measures at the workplace

link to ED 957 and INRS sent a letter to 25,000 people concerning MSD. During the same period the Government launched its website “workbetter.gouv”. This site emphasizes manual handling more than MSD and provides a direct link to ED 862.

Conclusion
When coordination exists and when actions are mutually supportive, messages better reach the correct target audience, are better understood and are more likely to give results. Another conclusion: manual handling should not have been the first brochure to be examined. This was not the goal. But, not being well “guided”, the public came to this part of the site. A question still arises: Does this action have a one-off effect or will there be a real enhancement of prevention for this disease?

Take a similar look at PSR
This graph shows one first interest in November 2007 and then a big one in January 2008. After this, the level drops again until end of March – April and stays at a higher level than before. Let us now look at actions on this topic. February 2007 Fourth European Working Conditions Survey – Dublin report. The press talk about this report. August, Nicolas Sarkozy entrusts a mission statement to Xavier Bertrand, Minister of Industry who sets up a working group. October, a press conference is held in which XAVIER BERTRAND insists on the importance of PSR. He indicates having asked for a report on that risk. Meanwhile, suicides are committed at Renault and PSA factories. Many newspapers cover it. March 2008, the report is submitted to the Minister. The report insists on the need for a national indicator of stress at work. Just after this report, INRS communicates on a new brochure on indicators. This is very well relayed by the press. September 2008, a national agreement is signed with social partners. National conference conducted by Anact in June, relayed on the government website that

![Graph showing website accesses for PSR]
also provides many links to INRS. The very good synchronisation of actions in January 2008 and the well-adapted bro- chures also achieved a good impact on requests for help. The average requests are in progression: 18% in 2008 compared to 2007 (January not included), 45% in 2009 compared to 2008, and a total of 137% in 2009 compared to 2007.

What conclusion can be drawn? On this topic, the government actions, when well relayed by the press, are quite efficient. What is highly significant is the impact of the brochure answering quite well the questions about indicators. When the messages are well accompanied, easy to understand and accompanied by “tools” that can be used immediately, the impact is major. That means that messages must be accessible to get the results we want, concretize and perenize them; and that skills are required to translate and mediatize research results and again, coordination of actions is necessary.

Influence of European rules on implementation of noise prevention
Relative to a globally stable assistance activity, the evolution curve shows a number of peaks that may be considered as jumps faced with the global evolution of interest paid to noise ¹.

The first, small peak, occurred in 1998, while the second, much more pronounced, occurred in 2003. INRS conducted a number of noise-related communication actions, the main ones being in 1987, 1997, 2001, and 2006.

There is no correlation between these peaks of interest and these publications. In order to be able to draw any conclusions, however, the evolution of brochure distribution should also be studied. Furthermore, we checked that there was no correlation between the evolution in the number of occupational diseases and the noise-related requests curve. It can be noted, however, that the dates concerned are those of the two central European directives on the subject: We can infer that

¹ Short P CANETTO study Etat des lieux sur la pratique industrielle de réduction du bruit.
it was most likely the regulations that attracted companies’ interest on the subject.

**Conclusion**
The impact of regulations attracts companies’ interest and is efficient when government does not communicate too much. Anticipation is necessary to be able to offer brochures, updated website with usable explanations, and ad hoc training.

Third example: conduct a study on the website to answer the visitors’ wishes and reach our target audience
The number of available books, reviews and brochures is constantly increasing. After a period of increasing web access, it seems that this figure is quite stable now. Moreover, INRS, as the other players in the world of prevention has changed its target audience. These are not only experts who need to know about prevention and not only big companies. We, as others, want to reach every employee and touch also the very small companies (less than 50 employees). This is why INRS has conducted two studies in 2005 and 2009 on the website. They indicated that users can’t find the information they need or look for, have some difficulty to build up an interpretation of what is explained, think documents are too long and give too many details.

**Conclusion**
To reach our target audience we need to enhance ergonomics and usability and give concrete, illustrated, pragmatic information. Besides the need for search engine and document download time enhancement, the real target is to provide improved data visibility: a more pragmatic, organized and ranked information. This is why a virtuous circle between research and applications is absolutely necessary.
Networking of Competencies: Reciprocal Action Between Prevention Services

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Institute Work and Health of the German Social Accident Insurance (DGUV), Germany

Any OSH institution or accident insurance employs a range of different services in order to achieve their prevention targets: training of the OSH experts in the enterprises, consultation, applied research, regulations, etc. The Social Accident Insurance Institutions in Germany (UVTs) carried out a research project entitled “Quality in Prevention” and investigated whether their services reach the companies and are performed in an effective way.

One sub-project studied the reciprocal effects of the UVTs’ prevention services in greater detail. An examination of these services reveals that changes to one prevention service frequently have ramifications for the others. They act reciprocally upon each other, and at the same time have a joint impact upon the company. The objective was to identify the actual effects, the services generating the greatest effects, and those most influenced by them.

1. Qualitative and quantitative assessment

In order to systemise the interrelations between prevention services, a distinction was made between qualitative and quantitative influences. The qualitative influences were differentiated in: (I) The influence is indirect, e.g. via other services or products or other intermediate processes; (II) one service influences the content of another, however, this does not result in any change in the structure or course of the second service; and (III) the influencing service influences the second service in its structure. The quantitative influences were rated on a scale of 1 (very small influence) to 4 (very large influence).

An additional aspect of reciprocal action is whether steps are taken in the influencing service specifically to produce a change in the other service. Finally, the reciprocal action between UVTs’ services and “external factors” was also considered. The UVT prevention network is not working in isolation but in conjunction with the prevention activities of ministries, legislation, labour inspectorates, associations, etc.

Initial assessments of the qualitative and quantitative influences were carried out in workshops with BG prevention experts. A summary of the workshop results produces the web shown in fig. 1.

1 Zieschang, H. (2007). Reciprocal action between BG prevention services. Sub-project 2 of the “Quality in Prevention” project (in German only). Published by Deutsche Gesetzliche Unfallversicherung
are influenced more than they influence other services. In fig. 1, most of the arrows point to these services.

2. Both, starting and ending arrows can be seen at the services “Research and development findings (R&D findings),” “investigation,” “inspection”, and “certificates”: Influencing and being influenced are in balance for these services.

3. “R&D findings” are in strong interaction with the other services, many arrows and thick arrows start and end here. Additionally, the red arrows indicate that “R&D findings” are often specifically initiated by other services and vice versa.

2. Influence analysis using an influence matrix

In an influence analysis, the services that characterise the overall system most were identified. Influence analyses are based on a matrix, the rows and columns of which are used to classify the qualitative and quantitative influences. The row and column totals produce values indicating the total overall influence on the other services and indicating the total degree to which a service is influenced by the others. For each service these values are plotted in fig. 2. Four different categories of services can be distinguished:

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Active influence areas: services located here influence other areas more and more strongly than they are influenced themselves. They drive the system but they themselves are hardly influenced at all, e.g. “external factors” and “certificates”.

Passive influence areas: services are influenced more strongly than they influence others. Here we find “training” and “occupational medical care and safety guidance”.

Critical influence areas: the services located here have many effects but are also strongly influenced themselves. In this context, the term “critical” is used as in “critical mass”, i.e. a reaction or chain of reactions is triggered and the direction of its overall effect is difficult to estimate. The “consulting” and “inspection” services appear to have the strongest critical influence tendencies.

Buffer influence areas: the services in this area have little effect on other areas but they are also only influenced to a small extent themselves.

3. Driving forces within the network of UVTs’ prevention services
For each service a “stimulus index” can be created by calculating the quotient of the values for the total overall influence on the other services and the total degree to which this service is influenced by the others. The index indicates the extent to which a given service provides stimuli for the overall system. Fig. 3 shows the order of the UVTs’ services based on the stimulus indices. The services that have more of an influence on others are the “R&D findings” and “external factors” services.
Conclusion

The findings of the present study document the current reciprocal action between the UVTs’ prevention services. A range of measures has been developed in order to study individual influences precisely and to estimate future trends. These measures provide a tool to identify the most relevant drivers and seem to be well suitable and transferable to similar networks or systems.

It goes without saying that changes to individual paths of influence affect the entire system of the UVTs’ services. Some of the services, however, have a more generic influence but it is not as intensive or far-reaching as other services’. Other services have specific target groups that are not particularly large. However, they can have a much further-reaching effect on those groups.

On this basis, a strategy should be developed to determine which services can systematically be used in what way in order to increase the effectiveness and sustainability of OSH measures in enterprises.

<table>
<thead>
<tr>
<th>Qualitative</th>
<th>Stimulus index</th>
<th>Quantitative</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. R&amp;D findings</td>
<td>High</td>
<td>1. R&amp;D findings</td>
</tr>
<tr>
<td>2. External Factors</td>
<td></td>
<td>2. Accident-prevention regulations</td>
</tr>
<tr>
<td>3. Certificates</td>
<td></td>
<td>3. External Factors</td>
</tr>
<tr>
<td>5. Accident-prevention regulations</td>
<td></td>
<td>5.</td>
</tr>
<tr>
<td>6. Inspection</td>
<td></td>
<td>6. Certificates</td>
</tr>
<tr>
<td>7. Incentive schemes</td>
<td></td>
<td>7. Inspection</td>
</tr>
<tr>
<td>8. Information and communication</td>
<td></td>
<td>8. Incentive schemes</td>
</tr>
</tbody>
</table>

Fig. 3: Stimulus indices of UVTs’ prevention services based on the qualitative and quantitative assessments
SESSION 2

OSH consultation and inspection
OHS Management Audits: The Importance of their Measurement Properties

Lynda Robson *

Introduction
Auditing is a means of monitoring the implementation and effectiveness of a firm’s occupational health and safety (OHS) management system. The auditing process typically involves gathering evidence about the management system through interviews, documentation reviews and work site observations, guided by an audit instrument. The evidence is then evaluated against criteria and a summary of the findings is produced as an audit report.

Ideally, an audit method would yield reliable and valid data; i.e., the audit report would consistently and correctly identify weaknesses in OHS management that pose risk of injury or illness to workers. Responsiveness could be important too; e.g., one would want audit scores to reflect improvement efforts in a firm. To the extent that the data provided by an audit are not reliable, valid, or responsive, organizational actions might be misdirected. These measurement properties are therefore important, especially when audit results are being used as a measure of firm performance: e.g. when tracking the performance of a firm over time, making comparisons between firms, or determining whether a firm reached a certain target. We describe below two projects concerned with the measurement properties of audit methods. The first was a literature review, 1 which has been updated recently. 2 The second was a mixed-method exploration of the audit methods used by the prevention authorities of the province of Ontario in Canada. 3

Study One – Objective
The objective of the first study was to review the research evidence on the measurement properties of OHS management audits.

Study One – Methods
Six bibliographic databases representing a variety of disciplines were searched using a common set of terms. Titles and abstracts were reviewed to identify research publications that had any information on validity, reliability, or responsiveness.

Study One – Results
- Seventeen distinct audit methods were identified, including some well-known methods (e.g. International Safety Rating System, CHASE)
- Inter-rater reliability had been formally tested with only three audit methods
- Construct validity was formally tested with only one audit method
- There were no studies of test-retest reliability or responsiveness
- The investigations of inter-rater reliability showed that it was often unacceptably low, even when auditors were experts
Study One – Conclusion and Implications for Practice
Research data on the measurement properties of OHS management audit methods is sparse. However, available data show that the consistency between auditors is sometimes low. We therefore recommend that, in the absence of information about the measurement properties of an audit method, it should be used with caution as a performance measurement tool.

Study Two – Objectives
The objectives of the second study included the following:
- Describe the audit methods of the Ontario Prevention System
- Examine their content validity

Study Two – Methods
The seventeen organizations of the Ontario Prevention System (i.e. Workplace Safety & Insurance Board, Ministry of Labour, Health and Safety Associations, Institute for Work & Health) were approached to determine whether they administered audit methods meeting the study’s eligibility criteria. The methods needed to have a substantial focus on a firm’s management of OHS and involve an auditor. For each of the eligible methods, data were collected through key informant interviews, a review of documentation, and where possible, observations of the audit process.

Qualitative cross-case analysis was carried out on all 17 audit methods (cases). Five cases were purposively selected for more intensive qualitative comparison in the following areas: the context of the auditing activities, auditing program features, auditor qualities, steps and methods of the auditing process, nature of the audit instrument, and transformation of the audit data (deep case analysis). Another set of five cases were selected for a quantitative analysis of content. The presence of particular content elements was determined with reference to a national OHS management standard released by the Canadian Standards Association (CSA Z1000).

Study Two – Results
Seventeen different audit methods, belonging to 10 different organizations, were found eligible for inclusion in the study.

Cross-case analysis
Nine of the audit methods had been developed with an aim of being comprehensive with respect to best OHS management practices. These methods tended to be used with firms that had already striven to develop their OHS management structures and processes. The other eight methods were simpler audits, typically used with small businesses or with firms starting to develop their OHS management system. Eight of the seventeen methods were considered by researchers to be used in a performance measurement application. The median amount of personnel-time required for the typical application of the audit methods was two days. The cost to firms of having an audit conducted ranged from nothing to thousands of dollars. The volume of activity per auditing program varied widely, with several audit methods being applied in hundreds of firms per year; a few with tens of firms per year; and several were used with fewer than 10 firms.

Deep-case analysis
The five audit methods included in this particular analysis were chosen because they were used by their respective auditing organizations in a performance
measurement application (implying that measurement properties were relatively more important to these methods). In this paper, we focus on one key finding, which was that there was little mention of the determination of inter-auditor consistency as a means of monitoring or evaluating auditing programs.

Content validity analysis
The five audit instruments included in this particular analysis were chosen because their organizations had indicated that the instruments were comprehensive with respect to best OHS practices. We found that on average 74% of the content of the instruments represented the content of CSA Z1000 either partially (40%) or fully (34%). The mostly weakly represented major element of the standard was “Management Review and Continual Improvement,” with 56% (partially or fully) for the group average; and there was wide variation among the five methods. At the level of minor CSA Z1000 elements, there was a striking result: on average, only 26% of the “Internal Audits” element was represented either partially or fully; and the representation of this CSA Z1000 element was markedly lower than that of any other minor element. The “Internal Audits” element specifies that routine and systematic in-house evaluation of the OHS management program be performed.

Study Two: Conclusions and Implications for Practice:
An examination of the OHS management audit methods used in prevention organizations in the broader public sector of the province of Ontario showed large variation. However, common to their respective programs was a lack of the measurement of inter-auditor consistency to monitor or evaluate auditing programs. Secondly, the content of some audit instrumentation showed weak representation of fundamental elements of organizational self-regulation and continuous improvement (e.g. management review, internal audits). We recommend the following:

- Those who manage auditing programs consider measuring inter-auditor consistency during auditor training and as a means of program monitoring, since research has shown the consistency can be surprisingly low.
- Those who use audit methods or their results compare the content of their audit instrument against a recent OHS management standard.

References

Acknowledgements
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*)

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Key Figures for Occupational Health and Safety – Making Occupational Health and Safety Measurable and Presentable

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Initial Situation
For a long time the measurability of occupational health and safety has been a matter of interest. However, the significance of the accident figures usually used is only limited. Among other things, comparing the different sectors or businesses and company sites respectively is possible only to a limited extent. Occupational health and safety deficiencies as the cause of occupational injuries and occupational illness are rarely pointed out. From an impartial point of view, using accident figures is not expedient in many sectors and companies, though there is also a focus on issues pertinent to health and safety, such as in call centres, administrations, IT sectors and modern manufacturing. In the case of small businesses there is no statistical significance, e.g. the projection of a small business compared to a rate of 1,000 employees does not give a reliable result. One occupational accident in a business with 10 employees already brings about an accident rate of 100 per 1,000 employees. Moreover, bodily injuries often happen accidentally and are merely the tip of the proverbial iceberg. Also, accident figures do not constitute a quality measure for specialists, company medical officers or the department for occupational health and safety. The informative value of these figures concerning the preventive effort of the company is rather limited. Up to now parameters other than accident figures have hardly been used in practice, and if so, they are often time-consuming or difficult to determine and very often without any preventive information in retrospect. In the meantime the need for manageable preventive key figures/parameters has significantly increased. Many companies seek to break new ground and search for applicable parameters for internal and external comparison (benchmarking).

Developing New Methods
In 2006 the VDSI founded the working group “Kennzahlen” (key figures) with the objective of finding figures which are practically applicable and easily generated and also scientifically tenable. The first meeting took place in January 2007; after the first six months promising results were presented. The first test series conducted in different companies will be completed in the middle of 2009. In autumn 2009 a first interpretation will be presented.

The Usefulness of Applicable Key Figures for Health and Safety
The purpose of key figures/parameters is to support the “Health and Safety Manager” (expert, safety engineer, company medical officer) and to demonstrate his/her performance and quality. At the same time they are to demonstrate
the advantage of occupational health and safety and support an impartial discussion with the entrepreneur and management on developments and the need for action as regards occupational health and safety.

Tasks of Key Figures
- to convince management and employees and to constitute trust
- to show improvements and to motivate
- to present achievements
- to support the work of leadership
- to make hazards traceable and transparent
- to be applied to external companies, temporary workers and freelancers
- to enable an objective evaluation and presentation of the quality of a company’s occupational health and safety
- to provide comparability:
  - internally with regard to the company’s history
  - internally with regard to prevention
  - company-spanning or between other sites/parts/units of the company
- to demonstrate the quality of health and safety actors, specialists, company medical officers and other specialised staff and to present their performance.

Application of Key Figures
- different sectors
- different company sizes
- different company structures

Basis for Suitable Parameters
During the search for figures/parameters the important question was put up for discussion as to how to determine preventive parameters, which ought to be as independent of the kind of company as possible. The working group decided to consider the value-added process of a company, as it is always identical in every company and constitutes the total work performance of a company irrespective of the use of a management system.

Determination of Preventive Indicators
For the value-added process illustrated above, firstly, indicators were searched for each process. It is essential that the indicators be oriented towards prevention. Some examples for processes and indicators:
- information/communication
  - briefing performed
  - effectiveness of briefings
- controlling
  - holding meetings with the committee of occupational health and safety
- controlling
  - recording accident rates and accident costs
- considering loss occurrences
- determining uninterrupted working hours
- offer/contract
  - identifying occupational health and safety when providing a cost estimate for orders

<table>
<thead>
<tr>
<th>Interested party</th>
<th>Marketing</th>
<th>Offer/Contract</th>
<th>Planning</th>
<th>Provision</th>
<th>Production/Performance</th>
<th>Marketing</th>
<th>Satisfied customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marketing</td>
<td>Offer/Contract</td>
<td>Planning</td>
<td>Provision</td>
<td>Production/Performance</td>
<td>Marketing</td>
<td>Satisfied customer</td>
<td></td>
</tr>
<tr>
<td>Information/Communication</td>
<td>Emergencyorganisation</td>
<td>Controlling</td>
<td>Management</td>
<td>Personnelmanagement</td>
<td>Marketing</td>
<td>Satisfied customer</td>
<td></td>
</tr>
</tbody>
</table>
occupational health and safety included in tenders

- provision
  releasing financial means and working materials by EHS
  appraising external companies under EHS aspects
- production/rendering of services
  methods implemented to identify faulty products or services
  methods available for identifying potentially disruptive factors in the fields of production or rendering of services

The example for “Controlling” does not aim at determining the accident rate, but is to state the availability of a business-appropriate recording system.

Developing the Questions
When determining these indicators it became apparent that the appropriate method of inquiry would be to interview/collection the data by questionnaire, audit or self-audit. The target groups for this inquiry would be employees, managers and the entrepreneur.

In the second step, precise questions were formulated for each indicator. Questionnaires for employees and also for the entrepreneurs were worked out. This included questions for the managers’ self-audit or preferentially the audit by actors in occupational health and safety together with the management.

Thereby, at least two questions for every target group concerning each process were developed, wherever applicable and expedient. An imperative condition for the audit/self-audit was that it had to cover all processes.

Evaluation
The evaluation of an answer or a circumstance is effected by assigning marks from 1 to 4. From 3 answer sheets you get 3 arithmetically averaged figures of each target group and each individual process. Additionally, it is possible to perform an evaluation of the sum for every process and the whole value-added process, i.e. the company as a whole can be evaluated.

By this method it is possible to determine the requirements for safe and healthy working and to show improvements. It also allows a comparison between different undertakings, sites or companies as well as considering the company’s history. As the focus is not on the occupational health and safety deficiencies but on the mentioned requirements of a particular process, this method also permits to compare different companies and sectors.

Practical Tests
Having performed several preliminary tests, this method is currently tested in several companies. Subsequently, after a reassessment and if necessary, there will be a reevaluation of the method and the questions. Tangible results are expected in autumn 2009.
Introduction
Occupational safety and health (OSH) monitoring is a critical process in OSH management. Major accidents, such as Texas BP fire and explosion (Baker, 2007), Singapore’s Nicoll Highway tunnel construction collapse (Magnus, 2005), and Australia’s Moura coal mine explosion (Hopkins, 1999) have taught us that failures in OSH monitoring can be disastrous. However, OSH monitoring is not a clearly defined process. Based on current OSH management system standards (for e.g. Standards Australia and Standards New Zealand, 2001), OSH monitoring encompasses a broad range of activities including workplace inspection, exposure monitoring, tracking of accident statistics, and management system audits. These processes appear to serve overlapping but different purposes. Furthermore, monitoring activities can be conducted at different levels of an OSH management system, for e.g. activity, functional and management system levels. To complicate the matter further, current research also indicated the confusion between leading and lagging performance monitoring indicators (Hopkins, 2009). The current lack of clarity can confuse organisations and impede efficient and effective OSH monitoring.

Lessons from Major Accidents
In Texas BP, failure of key safety and monitoring devices (including level indicators and safety valves) caused a raffinate splitter tower to be overfilled and resulted in a flammable liquid geyser from a blowdown stack (Chemical Safety Board, 2007). The release of flammable substances led to a major fire and explosion killing 15 people and injured another 180. Among a range of issues, the independent safety review panel for the BP Texas accident (Baker, 2007) identified that BP had over-relied on occupational illness and injury rates and this distorted their perception of the risk of major accidents. BP Texas highlighted the importance of reliable operational hazard monitoring and use of appropriate performance indicators to monitor the effectiveness of OSH management.

For the 2004 Nicoll Highway tunnel collapse in Singapore one of the key reasons for the accident was a lack of careful monitoring of warning signs of a failing support structure (Magnus, 2005). The collapse resulted in four fatalities and significant economic and social impacts. Even though the contractor was monitoring the inclination of tunnel walls as an indicator of the risk of collapse, the monitoring was inconsistent and the back analyses of the monitoring
data were abused to facilitate production. The contract also failed to implement necessary actions, for e.g. strengthening the supporting structure, whenever the inclination exceeded the pre-determined threshold. In addition, the inquiry highlighted the lack of incorporation of OSH performance indicators in the appraisal of management and workers performance. This inadequacy contributed to the low level of safety culture at the Nicoll Highway worksite.

The same theme of poor hazard monitoring and ineffective OSH performance monitoring can be found in the Moura mine disaster in Queensland, Australia, which killed 11 men. The Moura coal mine explosion in 1994 was a result of spontaneous combustion of coal which ignited methane gas trapped in the mine (Hopkins, 1999). Even though the mine had had a gas monitoring system to alert the mine operator when the level of carbon monoxide exceeds certain level of concentration, the mine did not have a set of pre-determined actions when the level of concentration was exceeded. The lack of response to the monitoring system (and other factors) led to the explosion. As in the case of Texas BP, Moura was using the lost time injury frequency rate as an indication of the overall OSH performance (Hopkins, 1999). Again the use of such frequency rates distorted management’s perception of OSH performance.

**OSH Management System Standards**

Another rich source of information on OSH monitoring is OSH management system standards. Table 1 lists the types of OSH monitoring activities identified in the Australian/New Zealand Occupational Health and Safety standard

<table>
<thead>
<tr>
<th>Clause</th>
<th>Monitoring activities mentioned/implied in AS/NZS 4801:2001</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.3.4</td>
<td>OSH management plans that contain time-frame for achievement of objectives and targets</td>
<td>Implementation monitoring</td>
</tr>
<tr>
<td>4.4.3.3</td>
<td>Reporting/Monitoring of incidents and system failures</td>
<td>Incident/failure monitoring; usually a form of performance monitoring</td>
</tr>
<tr>
<td>4.4.3.3</td>
<td>Reporting/Monitoring of hazards and risk</td>
<td>Hazard monitoring</td>
</tr>
<tr>
<td>4.4.3.3</td>
<td>Reporting/Monitoring of preventive and corrective action</td>
<td>Implementation monitoring</td>
</tr>
<tr>
<td>4.5.1.1</td>
<td>Monitoring of “key characteristics of … operations and activities that can cause illness and injury”</td>
<td>Hazard monitoring</td>
</tr>
<tr>
<td>4.5.1.1</td>
<td>Monitoring of “performance, effectiveness of relevant operational controls and conformance with the organisation’s objectives and targets”</td>
<td>Implementation monitoring Performance monitoring</td>
</tr>
<tr>
<td>4.5.1.1</td>
<td>Monitoring of “compliance with OSH legislation”</td>
<td>Implementation monitoring</td>
</tr>
<tr>
<td>4.5.1.1</td>
<td>Health surveillance</td>
<td>Hazard monitoring (to facilitate treatment and reduce of risk of hazard to other workers)</td>
</tr>
<tr>
<td>4.5.4  and 4.6</td>
<td>OSH management system audit and review</td>
<td>Implementation monitoring Performance monitoring</td>
</tr>
</tbody>
</table>
Research on the effectiveness of prevention measures at the workplace

AS/NZS 4801:2001 (Standards Australia and Standards New Zealand, 2001). Note that AS/NZS 4801:2001 has a “plan-do-check-act” structure like many other international OSH management system standards (for e.g. American Industrial Hygiene Association, 2005; British Standards Institute, 2007). As can be observed from Table 1, in AS/NZS 4801:2001 OSH monitoring can be broadly categorised into: hazard monitoring, incident/failure monitoring, implementation monitoring, and performance monitoring. This categorisation will be used to facilitate discussion herein.

Discussion and Recommendations

Hazard Monitoring
All three major accidents highlighted earlier had the common problem of inadequate hazard monitoring. In the case of Texas BP, the devices used to monitor the level of flammable liquid were defective, causing the operators to be ignorant of the impending dangers. In Nicoll Highway, the instrumentation data were not monitored consistently and interpretation of the data nullified the warnings that the data could have conveyed. In Moura, the gas monitoring identified high level of carbon monoxide concentration, but there was no policy on the necessary actions for such warning signs. Based on these three cases it can be seen that there are usually ample opportunities for companies to avert major accidents, but these opportunities were lost due to failure to ensure effective monitoring of major hazards.

From hindsight the lack of emphasis on effective monitoring of major hazards may appear counterintuitive, but during the unfolding of events leading to the accident, management and workers were in a very different context. Accidents are events that are inherently uncertain. The uncertainty is contributed by the inherent randomness of hazards and human activities, and the lack of information on the hazards (including the errors in monitoring tools). The uncertainty reduces the credibility of monitoring systems and together with the production pressure there is tendency for companies to reduce their emphasis on hazard monitoring and the data obtained from hazard monitoring. Understanding the tendency to discredit monitoring systems is critical in accident prevention because it emphasises the need to continuously ensure the credibility of hazard monitoring systems even before operation begins. Credibility is based on the technical validation of the monitoring system and companies will have to invest significant effort and resources in improving the reliability of the system. If the hazard monitoring system is credible, it will be easier for companies to ensure compliance to required actions at different threshold levels of the monitoring data.

OSH Performance Monitoring
Besides hazard monitoring, the major accidents discussed in this paper highlighted the importance of using appropriate indicators to monitor OSH performance. As compared to other types of monitoring, OSH performance monitoring covers a broad range of indicators and is not as well-defined. The overall purpose of OSH performance monitoring is to monitor the effectiveness of the OSH management system in preventing OSH incidents and it can include different combinations of hazard monitoring, incident/failure monitoring and implementation monitoring. Hopkins (2009) highlighted two fundamental dimensions of OSH performance monitoring: (1) leading vs. lagging and (2) personal safety vs. process safety. Hopkins’ (2009) evaluation of the Baker’s
report (2007) and the guide by Health and Safety Executive (2006) revealed the current lack of clarity of leading and lagging indicators, but concluded that the distinction between leading and lagging indicators is ultimately of little consequence. According to Hopkins, the key is to ensure that the indicators provide a reliable representation of the effectiveness of the OSH management system. Such assertion does not facilitate selection of OSH performance indicators. However, Hopkins’ remarks did surface the need for further research into OSH performance indicators.

OSH performance indicators should ultimately indicate the actual level of OSH risk that the organisation faces. To achieve this, a range of indicators should be used. Despite the inadequacy of incident rates, they are an indispensable indicator. It is recommended that incident rates should be used to alert management of poor OSH performance, but it should not be used to indicate good performance. Good performance would be better reflected by implementation of OSH management system requirements and plans, which include procedures for hazard monitoring. Implementation monitoring data should also be coupled with expert assessment of the OSH management system. The expert assessment is particularly important in assessing the effectiveness of the OSH management system because measurement of OSH performance is very complex. A direct correlation between OSH performance indicators and actual risk is unlikely to be established with confidence. Hence, this is where expert opinion coupled with indicators of implementation, incident/failure rates and results of hazard monitoring would form a richer picture of the effectiveness of OSH performance. It is recommended that further research be conducted on methods to integrate expert opinion and OSH performance indicators to provide a more reliable indicator of OSH performance.

References
Scope of the Study
The purpose of the study was to assess, evaluate and improve the Safety Climate within the Company’s worksites. The Health & Safety [H&S] Department began the survey by investigating the Safety Climate among ERGOSE’s Supervising Engineers, because they can influence the Safety Climate of the Contractors.

Organization
The first step of the survey was to record all factors that create a Climate of Safety among ERGOSE’s Supervising Engineers. Then it was necessary to issue a Questionnaire with which ERGOSE’s Supervising Engineers would assess the above-mentioned factors, i.e.:

- ERGOSE’s Top Management commitment to H&S issues.
- ERGOSE’s procedures for managing H&S issues at the worksites.
- Knowledge of the Contractors’ Safety Procedures by ERGOSE’s Supervising Engineers.
- ERGOSE’s procedure for the communication of H&S information among ERGOSE’s engineers.

For the purpose of the study, ERGOSE’s Supervising Engineers were divided into two groups, according to their responsibilities. As a result, two Questionnaires needed to be issued:

Questionnaire A referred to the higher level of Supervising Engineers [hereinafter Group A]. Questionnaire B referred to the lower level of ERGOSE’s Supervising Engineers [hereinafter Group B].

Presentation of Group A & Group B
Group A encompasses the higher level of Supervising Engineers, i.e. Project Directors and Contract Managers. They monitor the construction progress at the worksites under their responsibility.

Group B encompasses ERGOSE’s Supervising Engineers. In each one of ERGOSE’s worksites there is a group (3-8 employees) responsible for monitoring construction activities according to the specifications of the design. Since their duties also include monitoring safety issues, one employee from the group is assigned to this task.

According to the corporate Organizational Chart, Group A personnel are in charge of Group B personnel.

Presentation of the Results
Only a small number of employees from Group A answered Questionnaire A (3 out of a total of 15 employees who belong to Group A), while 77 employees answered Questionnaire B (out of a total of 121 employees who belong to Group B, which corresponds to 63%). Due to the
low response rate of Group A, the results of Questionnaire A are not considered representative. For this reason only the results of Questionnaire B are presented here below:

- 80% of Group B personnel feel that it is very probable that a serious accident will occur at their workplaces.
- 80% of Group B believes in the importance of implementing remedial actions after the occurrence of an incident.
- 80% of Group B believes in the importance of implementing remedial actions pursuant to the recommendations made by the H&S Department during the Department’s monthly audits at the worksites.
- All of the respondents within Group B (100%) stated that it is very important to implement preventive actions during all construction activities and not only when performing “dangerous activities”.
- At a percentage of 70%, Group B personnel believe that they are encouraged (by Group A) to report unsafe conditions in the worksite under their responsibility.
- 80% of Group B believes that the inclusion of H&S issues in the agenda of the meetings held between ERGOSE’s Supervising Team and the Contractors is highly important.
- Only 70% of Group B personnel said that they have been sufficiently informed as to the dangers of their working environment.
- At a percentage of 80%, Group B personnel are aware of their Contractor Safety Procedures, although only a small number (27%) knows these Procedures in depth and complies with them. This 27% consists of employees who are or used to be responsible for monitoring safety issues in the worksites.
- Only 30% of Group B personnel use Personal Protective Equipment [PPE] on a permanent basis.
- Only 30% of Group B personnel believe that they can influence the Safety Climate within their worksite at a “very high” degree. They claim that if they had more authority they would accomplish it.
- Younger employees [up to 30 years of age] and older employees [over 50] seem to be less afraid of an impending serious accident. In the case of the first age group, this is attributed to insufficient experience, whereas the second age group is used to working without safety measures. The latter may be attributed to the fact that H&S legislation in Greece is quite new.
- Employees at the age of 41-50 seem to be more sensitive to H&S issues. This is attributed to the emphasis that has been given in recent years in Greece to Occupational H&S.
- Irrespective of the above mentioned results, older employees seem to:
  ▶ be more sensitive and follow Safety Procedures at a higher degree,
  ▶ claim that they can influence the Safety Climate in the Contractors’ worksites at a higher degree,
  ▶ believe strongly in ERGOSE’s Top Management commitment to H&S,
  ▶ feel that they are more encouraged (by Group A) to report unsafe conditions.

Presentation of Remedial Actions

Taking into consideration the above-mentioned results, remedial actions were introduced in order to improve the Safety Climate in Group B:

- The organization of training programs concerning the use of PPE and the importance of implementing remedial
actions after an incident.
- The Top Management needs to compel Group B personnel to attend future training programs organized by the H&S Department.
- The Top Management of ERGOSE needs to show more clearly that H&S issues are considered equally important to the progress of the worksites’ activities. For this reason, in future visits to the worksites a presentation will be made by the Contractors’ Safety Engineers concerning the implemented safety precautions.
- Within the framework of the H&S Department’s future audits, presentations will be made to the members of ERGOSE’s Supervising Team (in cooperation with the respective Contractor’s Safety Engineer), concerning the Contractor’s Safety Procedures (which must be followed).
- Additional authority has to be given to Group B personnel to enable them to deal more effectively with Contractors’ unsafe working conditions in the future. Until then, Group A needs to encourage Group B personnel more clearly to report unsafe conditions in the worksite under their responsibility.
- A new procedure needs to be added in ERGOSE’s Procedures, which will stipulate that employees monitoring H&S issues in ERGOSE’s worksites shall change on a yearly basis. This will allow more employees from Group B to gain awareness on H&S within the life cycle of each worksite.

**Future Plans**

A second phase will follow, during which further investigation will take place among the entire workforce of the Contractors: Workers, Foremen, Supervisors, Engineers, Management, Safety Engineers, and Occupational Doctors.

Through this investigation several parameters will be assessed, such as human behaviour, personnel’s competences, the support of the worksite’s environment concerning H&S and the degree of influence of ERGOSE’s Supervising Engineers on the implementation of safety precautions at the worksites. Remedial actions will be recommended, according to the results.

Finally, all the measured parameters will be further assessed in order to obtain an overall evaluation and be able to improve the Safety Climate in all ERGOSE’s activities.

**Abstract**

ERGOSE S.A., a subsidiary of the Hellenic Railways Organization (OSE), was established in 1996 to undertake the management of the Organization’s Investment Programme which aims at the modernization of the Greek Railways. ERGOSE has committed itself to implement its Investment Programme under the safest working conditions. For this reason a Safety Management System has been developed and implemented since 2003. The corporate Safety Management System was first certified according to the OHSAS 18001:1999 standard and lately according to the amended OHSAS 18001:2007 standard.

In 2009, for the first time, a survey was organized by the Health & Safety Department in order to assess the Safety Climate among ERGOSE’s worksites. The first part of the survey focused on ERGOSE’s Supervising Engineers who supervise the Contractors’ worksites. The study presents the results of the survey and proposals that could be implemented in order to improve the Safety Climate of ERGOSE’s Supervising Team.
Process Observation at Machine Tools – Preventive Approach and Reality

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**Approach**

Process observation is caused by the tasks of related standardisation, in Europe especially the Machinery Directive. It is one of the interfaces between human and machinery which can be problematic. Without the possibility of process observation sometimes safeguards are defeated.

The machinery directive 2006/42/EC, clause 1.1.2 of Annex I “principles of safety integration” states that machinery must be supplied with all the special equipment and accessories essential to enable it to be adjusted, maintained and used safely. This includes the process observation.

Seen from another, but rather similar perspective, ergonomics shall also be taken into account. Here, discomfort, fatigue and physical and psychological stress faced by the operator must be reduced to the minimum possible, under the foreseeable intended conditions of use. 2006/42/EC takes into account ergonomic principles such as allowing for the variability of the operator’s physical dimensions, strength and stamina, providing enough space for movements of the parts of the operator’s body, avoiding a machine-determined work rate, avoiding monitoring that requires lengthy concentration, or adapting the man/machinery interface to the foreseeable characteristics of the operators.

These statements on prevention suffice to consider process observation as a manufacturer.

**Implementing process observation in industry**

Several manufactures of machine centres got negative response from the users of these machines. Standardization helps manufactures to manage these problems by addressing possible measures for observing processes. This happened e.g. in EN ISO 11161 “Integrated Manufacturing Systems” or in an amendment to EN 12417 “Machine Centres”. To implement the measures into this standards, in 2002 the team of machinery experts at the Berufsgenossenschaft Metall Nord Sued elaborated an informal abstract named “Fachausschuss – Informationsblatt” (information leaflet published by the technical committee), where problems and necessary measures were determined.

Process observation normally acts between automatic and manual tasks. In particular for automatic machines, there is a higher risk of hazards than for manually controlled machines due to the complex manufacturing process. The requirements in guidelines and standards take this fact into account by providing guards for automatic machines separating the working areas of machines and operators.

There are only a few exceptions, such as set-up operations or manual operations where the operator is allowed to observe...
the process while guards are open by applying alternative safeguards, e.g. an enabling switch. Observing an automatic process is not permitted in most of the standards.

This way of action is well-tried and sufficient for most machines since a high level of safety for the operator is achieved. However, for certain manufacturing processes practice showed that it is sometimes not sufficient to observe the set-up or the manual operation processes only. Sometimes the temporary observation of an automatic process is also necessary. This is required in particular if workpieces and materials shall be worked in the single part manufacture. Deviations from the predetermined process may be identified and the process can be optimised by specific input at the control device.

The single part manufacture at machining centres represents a working condition where the operator may be required to observe processes, such as e.g. a covered (hidden) cut at the workpiece or to find the zero reference point at geometrical complex workpieces from a very close position without any protective effect of the safety devices.

In such a case, the specified modes of operation “Setting” (mode of operation 2) and “Manual Intervention” (mode of operation 3) with the corresponding velocity data and safety devices are applied in accordance with standard DIN EN 12417, as far as applicable. However, it may be possible that for certain processes, e.g. the velocity data provided by the standard, are insufficient or that the use of the enabling switch over a longer period is not feasible due to ergonomic reasons.

Releasing the enabling switch may lead to a considerable damage of the material/or the machine. Therefore, it is necessary to provide a further mode of operation.

The principles for the realisation of such a further mode of operation are described in a flowchart and by means of nine criteria (see fig.).

The additional mode of operation is to be understood as a combination of technical safety measures and requirements for safe behaviour that offers maximum possible protection for the operator, according to the state of the art. However, prior to its application, that specific mode of operation must prove to be “unavoidable”. The technical safety measures shall be carried out in such a way that even foreseeable misuse will be prevented.

Limiting the velocities and transverse paths and the disconnection of movements which are not required for the additional mode of operation, such as those of the tool changer’s rotary axis, would represent a suitable measure to avoid permanent operation whilst doors are open.

For the scope of this article, it is not possible to mention the measures for the additional mode of operation “Process observation” in a detailed and complete manner due to the large variety of situations requiring such a mode of operation.

The features indicated in the flowchart and the nine criteria represent suggestions for responsible action if the manufacturer realises (after carrying out the hazard analysis in accordance with EN ISO 12100 and EN ISO 14121) that the measures by design, specified for the intended use in guidelines and standards, and measures by guards cannot be fully applied to reduce the risk.
Research on the effectiveness of prevention measures at the workplace

SESSION 2

Fig.: Flowchart for additional mode of operation “Process observation”
This way of action shall be subject of intense contact with the future user in order to be able to analyse the requirements for the behaviour of the operating personnel and translate them into action. On no account, a bridging of the safeguards without additional safety measures shall be carried out, even not with hidden fastened key switches.

Particular working processes, such as e.g. working of hidden (covered) contours or a process observation for workpieces of complex geometry in metal working machines, possibly require an additional mode of operation in addition to those defined in the European standards which permit the temporary observation of an automatic process while guards are open by applying additional safety measures. Manufacturers are quite often surprised of this possibility; they are sometimes even surprised that they have to implement extra measures for the machine.

**Reality**

The reality we are facing shows that a lot of safeguards are circumvented to get an “easy” process observation mode.

The best solution is sometimes the most expensive one. Sometimes manufacturers try to circumvent that problem by shifting responsibility. The expert committee of the BGs provides information as well as personal assistance. As we have seen before, responsibility lies with the manufacturer of a machine in accordance with the machinery directive.

But the best solution is not necessarily the most expensive one – the keyword here is to communicate first and then to start building the machine! This sounds very easy; it can be only easy, when it is worked out in an appropriate way.

Example: A user of huge machine-centres communicates with his supplier long before the machine is built and tells him the tasks of the process he wants to have. Out of this information, the manufacturer of the machine centre does not offer a process observation – a simulated system of the related tasks in the electronic system of the machine and programming the workflow in a proper way makes process observation unnecessary. The expert committee of the BGs provides personal assistance to the user.

Another example is that a user of production machinery implemented a special mode of operation. He named it “mode 5”; it describes measures to avoid harm by asking for internal technical measures inside the machinery. This approach was defined in EN ISO 11161, the user specialised it for his needs in collaboration with the expert committee of the BG.

Nevertheless: Prevention in this field has to continue and has to be supported by expert teams. They have to elaborate the field of standardization as a basis for their work, assist manufacturers and users by reflecting on and answering their questions and teaching all persons the user in managing the duties enshrined in the machinery directive as well as the occupational health and safety directives.
SESSION 3

OSH research
Description
The sub-project 12 “Research and Development” was carried out in the project “Quality in Prevention” from 2004 to 2008.

Goals
The “Quality in Prevention” project’s “Research and Development” sub-project had several goals:
- The quality assessment of research and development was used to identify where action was potentially needed in order to improve the quality of research and development.
- The qualitative results of this assessment were used to adapt the quality criteria for the research and development prevention service and to optimise them for the accident insurance providers’ specific requirements.
- The interactions between the research and development prevention service and other prevention services were analysed in order to understand the relations between the prevention services.

Methodology
First of all, a literature survey was carried out to get to know relevant quality criteria for the area of research and development. An initial structured interview was used to interview several project managers about the quality of their projects (N=30). During the interviews, they were asked to give reasons for their assessment and identify areas which lend themselves for improvements. The experience gained from the pilot survey was used as a basis for the following surveys: For assessing the quality of research and development, the expectations regarding the quality of research and development projects (target value) and the quality of research and development (actual value) were to be assessed with the help of two questionnaires. The expectations of the prevention managers of the 25 German statutory accident insurers for the industrial sector (N=23) were captured to design the research and development projects. In addition, the research and development projects (N=161) conducted by the statutory accident insurance institutions between 1999 and 2002 were assessed by their project initiators. In order to identify where action was potentially needed, the target value was compared with the actual value. Additionally, the free-text answers regarding the evaluation of individual criteria and suggested improvements were analysed to adapt the quality criteria in research and development prevention service and to optimise them for the accident insurance providers’ specific requirements. The final step was to identify the interactions between the research and development prevention service and other prevention services.

Quality assessment
The prevention managers’ expectations of research and development are especially...
Research on the effectiveness of prevention measures at the workplace

high with regard to time management, co-operation, and practical relevance, while their expectations in connection with publications are significantly lower than for any of the other aspects. The project initiators’ assessment of the research and development findings was uniformly positive, with all the evaluation criteria achieving a clear positive score. Four of the five quality indicators achieved a score of four on a five-point Likert scale. The highest scores were obtained by technical expertise (M=4.50) and cooperation (M=4.29). A comparison of the expectations of research and development with the actual evaluations of completed projects reveals that when it comes to technical expertise, publications, and co-operation, there is no or very little action required to bring actual quality in line with expected quality. It is only in the area of time management that weaknesses in research and development were ascertained.

**Quality criteria**

An analysis of the free-text answers regarding the evaluation of individual criteria and improvement recommendations derived thereof suggest ten basic questions that may be used to measure the quality of research and development and help to systematically bring about improvements. While the general quality criteria can be used to evaluate research and development in its entirety, the specific quality criteria are applicable to many but not every aspect of research and development.

### General quality criteria

- To what extent are the research and development outcomes a result of good scientific practice (research in advance, objectivity, reliability, validity and transparency?) (“Technical expertise”)

- To what extent are procedures and findings made public, e.g. in discussions, lectures and publications so that they are subject to critical peer review? (“Publications”)

- To what extent do research and development projects have plans that include a description of the different phases and milestones, schedules, ideas for implementing the findings and an evaluation of the outcomes; to what extent is the project manageable in terms of both its timing and its content? (“Time management” and “Practical relevance”)

- To what extent is the project initiator involved in project management, e.g. through regular discussions with a project working group? (“Co-operation”)

- To what extent is the target group involved in the research and development project, e.g. through site visits by the project leader, interviews, etc. and to what extent are the target group’s suggestions taken on board? (“Practical relevance”)
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Interactions
The research and development prevention service interacted particularly strongly with the following prevention services: “Consulting”, “Information, Communication and Information Material”, “Company medical support and guidance on safety technology” and “Investigation”. Furthermore, the “Quality in Prevention” project’s “Interactions” sub-project found that the research and development prevention service has a very strong influence on other prevention services, but is itself only moderately influenced by other services (Zieschang, 2007). These findings suggest that the research and development prevention service is a key driver of all the other prevention services.

Conclusion
The research and development prevention service is (to be) evaluated and is (to be) systematically improved by taking into account the quality criteria listed before. Due to its diverse interactions with other prevention services the increase in quality for the research and development prevention service will surely pay off.

Reference list
Application of a Hazard and Operability Study to Hazard Evaluation of a Chemical Unit of the Power Station

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Introduction
Today, Hazard and Operability Study (HAZOP) is recognized as one of the most accurate multi specialist team approaches to determine risks and hazards. It is applied in various industries including refineries, petrochemical, and metallurgical, pharmaceutical and chemical industries.

Material & Methods
This technique was used to recognize the hazards and problems of operations in the chemical section at power stations and then evaluate important risk factors. In this study, 126 deviations were recognized with various causes and consequences.

Results
Ranking and evaluation of identified risks indicate that the majority of deviations were categorized as “acceptable” and less than half were “unacceptable”. The highest calculated risk level (1B) related to both the interruption of acid entry to the discharge pumps and an increased density of the acid. About 27% of the deviations had the lowest risk level (4B).

Conclusion
In conclusion, HAZOP can be considered as an effective method for the recognition and prediction of hazards in chemical unit of power plants. This technique, therefore, may increase the safety levels, prevent accidents and increase the reliability of systems via the reduction of operational problems.

This investigation was sponsored by Esfahan University of medical sciences.
Non water-soluble, flammable metalworking fluids are increasingly used in the metalworking industry to implement efficient and economic production. This trend brings the topic of fire and explosion protection and prevention for machine tools to the fore. Depending on the type of machining, violent reactions of the oil/air mixture may occur in the interior of the machine tool, which can be followed by a fire and severe accidents with burns and high material damages due to fire propagation.

In order to protect the machine operator against such fire and explosion hazards, the VDW (German Machine Tool Builders’ Association) and the BG (Statutory Accident Insurance Institution) in cooperation with the companies INDEX/Traub and others carried out a project with the aim to investigate specifically the impact of such fire and explosion hazards.

For this purpose, ignition tests were carried out in a machine tool during turning and grinding operations of workpieces by using non water-soluble metalworking fluids (MWF) at IBExU, Freiberg (Germany).

It was determined what kind of pressure effects and flame propagations may result from ignitions in the machining area during turning and grinding of workpieces.

At the ignition of explosive partial volumes in the machining area, strong flames escaped within the operating area of the machine in case of unfavorable labyrinth geometry.

Furthermore, it could be determined that a flame ejection in the extraction must

![Fig. 1: Flame ejection in the door area during deflagration in case of an unfavorable labyrinth geometry](source: BGI 719)

![Fig. 2: Flame propagation in the extraction](source: Fire and explosion tests at IBExU)
be expected if no suitable measures are taken. Initial provisional measures, such as fixing a baffle plate in front of the extraction opening, installation of a pre-separator and the sealing of the door areas with sheet metal strips showed initial successes in the fight against flame ejection.

During the tests at points of flame ejections, e.g. by attaching angled sheet metal strips at the chip removal box. Furthermore, several flame arresters of different design were tested with regard to their resistance against flame ejection.

In a further test series, FWF, BGM, INDEX/Traub in cooperation with other companies joined again in order to develop efficient protection systems against flame ejections in the work zone of the operator and the extraction circuit. For this purpose, a reworked machine tool was provided by the company INDEX by means of which different designs of door labyrinths could be tested. In addition, further sealing measures were carried out during the tests at points of flame ejections.

With the flame arrester of INDEX-Büchel (see fig. 3) a flame resistant device for the installation in extraction systems was developed which is suitable to prevent flame ejections from single machines into the central extraction. In addition, sealing measures at the machine and further sealing plates during
the test restricted flame ejections in the operating area to an extent that no hazard by flames could be detected any longer.

The tests showed that it is possible to prevent flame ejections at the machine tool in the operating area to a large extent by means of improved sealing at housing gaps and reworked door labyrinths.
**Interventions for Preventing Exposure to Chemical Substances Known to Cause Health Hazards in Workers: A Cochrane Systematic Review Protocol**

Marika Lehtola *)

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**Background**
In Europe, 19.1% of all workers are exposed to chemicals by inhaling smoke, fumes, powders or dusts and 11.2% to vapours such as solvents and thinners (Parent-Thirion et al., 2007). Chemical substances are known to cause different types of health hazards (asthma, skin irritation, mesothelioma, cancer etc). Many exposure studies have been done before, but the effectiveness of different prevention methods in real life situations often remains to be studied and is thus unknown. Therefore we will undertake a Cochrane systematic review to synthesise all relevant evidence with sufficient quality about interventions preventing or reducing the exposure to chemical substances that are known to cause health hazards in workers.

**Methods**
A systematic review is an overview of literature that is prepared by using a systematic approach to minimise bias and random error. The Cochrane Collaboration has elaborated its own approach for making high-quality systematic reviews. Cochrane reviews entail three steps starting with registration of a review title with a Cochrane Collaboration Review Group (CRG) to avoid duplication. The second step is writing a protocol and having it peer-reviewed and accepted by the CRG. The third step is carrying out the protocol, writing the review, having it peer-reviewed and accepted by the CRG. After this, the final review is published online in the Cochrane Library. Often Cochrane reviews are also rewritten in a shorter format and published in a paper journal.

At the second step of protocol development, the following methods are used as prescribed by the Cochrane Handbook (Higgins & Green, 2008). The research question is defined according to the PICO concept: population (P), intervention (I), comparison (C) and outcome (O). This, together with included study designs, is used to define clear study inclusion and exclusion criteria. These are then translated into a comprehensive literature search strategy. How study quality will be assessed also has to be clearly prespecified at this stage. The protocol concludes with a description of the methods that will be used for pooling the results.

**Results**
The protocol for this review will be ready to be sent to the CRG after the challenging search strategy is finalized. The PICO definitions are the following:

P = healthy or unhealthy workers or workplaces where exposure to hazardous chemical substances exists. Workers that are exposed to pesticides will be excluded from this review since they will be included in a another Cochrane review;
I = interventions deliberately applied to decrease the level of exposure that will reduce in real life situations the rate or severity of injuries and health problems caused by chemical substances. Measurements performed to study to which chemical substances or to what exposure levels the worker is exposed to are not considered as interventions. Interventions will be categorized into three levels: the first level such as legislation and regulations, the second level which includes interventions that have been implemented at the company level and at the third level interventions are aimed at workers or workplaces e.g. personal protective equipment (PPE);

C = preferably a randomised no-treatment control group;

O = changes in exposure level or time and health effects. Studies that measure the outcome by self-reported questionnaires will be excluded. The following definitions for the outcome measures will be used:

a) Exposure: studies in which either environmental or biomonitoring (biological monitoring) measurements have been done, minimum of two-hour measurements have to have been carried out in the study, short measurement times (< 2 h) are accepted for studying acute or short time exposure or in case of samplers that work only for one hour;

b) Health Effects: all kinds of immediate or long term health effects that are objectively measured including reproductive health effects (e.g. incidence of spontaneous abortions, malformations, sperm count and hormonal disorders), fatal and non-fatal injuries are also considered to belong to the category of immediate health effects though here self-reporting will be accepted.

Acceptable high quality study types are randomised controlled trials (RCTs), controlled before-after studies (CBAs) and interrupted time-series (ITS) studies. Studies will be searched from electronic reference databases (MEDLINE, EMBASE, OSH UPDATE, Cochrane Central Register for Controlled Trials (CENTRAL), The Cochrane Occupational Health Field Database) and conference proceedings.

Studies will be assessed in terms of their risk of bias. High quality study results are then pooled in a meta-analysis. If no sufficiently homogeneous high quality studies are available, studies will be categorised according to the type of intervention and the exposure route, and summarized narratively.

Conclusions
The protocol will result in a review of the evidence on measures to prevent occupational chemical exposure including implications for both research and practice.

References

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Development of the Construction Safety Audit Scoring System (ConSASS) in Singapore

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Abstract
The Construction Safety Audit Scoring System (ConSASS) is an audit tool that provides an assessment of the occupational safety and health management system (OSHMS) at a construction site. It is the first attempt by the construction industry in Singapore to formulate a more universal audit tool that may be applicable to most worksites.

Central to ConSASS is the audit checklist and scorecard that are used for the evaluation of the effectiveness and development status of the worksite's OSHMS being audited. These were developed in partnerships with academic institutions and various stakeholders such as the Building and Construction Authority, Nanyang Technological University, the then Workplace Safety and Health Construction Advisory Sub-committee, and various auditing companies. The checklist, containing approximately 300 questions, was referenced after local OSHMS standards and the Universal Assessment Instrument (UAI) tool developed by the University of Michigan and published by the American Industrial Hygiene Association (AIHA). Dr Charles Redinger, the co-author of the UAI was also invited to provide consultancy services to this project. During the final phase of development, trials were carried out with over 24 worksites with the assistance rendered by private auditors. Training on the use of ConSASS was also provided to auditors.

With a standardised audit checklist and a common audit scoring system, ConSASS would enhance the consistency in the auditing process. By providing a clear overview of the strengths and weaknesses of their OSHMS, this allows for cross comparison across worksites in terms of the capabilities in managing safety and health risks. It would also help in promoting and raising OSH standards in Singapore by enabling stakeholders to create a profile of OSH performance for the construction industry.

Development of the ConSASS in Singapore

Introduction
1. In Singapore, construction worksites with contract sums higher or equal to S$30 million are required to appoint an independent external auditing organization to audit the OSHMS of the worksite at least once every 6 months. Approved safety auditing organizations are required to adhere to an established audit protocol when conducting an audit of the OSHMS in a worksite. However, the existing auditing checklists, which vary among the audit organization, do not provide a good and consistent indication of the level of safety maturity of the contractors. Therefore, the capability of the contractors to manage occupational safety and health...
effectively remains unclear. As approved auditing organizations use their own scoring system to grade the performance of the implementation of OSHMS at different worksites, developers are also unable to identify the better contractors during the tendering process. As a result, there is a lack of strong business imperatives for contractors to take a serious view towards safety audits.

2. Although there are various rating systems available in the industry, there was variability in the quality of the audits submitted. The use of different checklists and a lack of a standardised scoring systems pose challenges when differentiating worksites in term of their effectiveness and implementation of OSHMS. In addition, the construction sector remained one of the riskier sectors in Singapore. Over the past three years, the industry accounted for more than one third of all workplace fatalities, with a fatality rate of 6.9 per 100,000 workers in 2008. The apparent lack of sustained improvements in OSH performance coupled with a weak OSH culture in the industry has made it more important to increase our efforts to improve the OSH performance of the industry. This has brought on impetus for the development of a robust and comprehensive rating system to raise standards of the construction sector.

Research objectives
3. In order to address these challenges, this has prompted us to embark on the development of a safety rating system for contractors which would bring about the following benefits to key stakeholders in the construction industry: (i) For developers: a simple and clear indication of the effectiveness of the contractor’s OSHMS which can be used for consideration during the project tendering; (ii) For auditors: an objective assessment method to remove the inconsistencies in the existing audit process due to varying audit standards adopted by different audit companies; (iii) For contractors: a clear overview of the strengths and weaknesses of their OSHMS so that improvements in the weaker areas could be made; (iv) For the legislator: monitor the OSH performance of the construction industry based on the profiles generated.

Methodology
4. The project, divided over 3 phases, was completed over 2 years. Phase 1 involved the development of a quantitative checklist to assist auditors in auditing the contractors’ OSHMS while much of Phase 2 was devoted towards the development of a rating system that makes use of the results from the checklist to measure contractors’ performance appropriately. Key stages of the each developmental phase include (i) literature review and comparative analysis, (ii) survey, (iii) visits to worksites and auditing organizations. The last phase, Phase 3, involved extensive consultation through focused group discussions and dialogues and pilot testing with the stakeholders.

Development of auditing checklist
5. The initial work involved comparing questions from existing SS506: Singapore Standards for OSHMS and CP 79 audit checklists. Duplicate questions were removed. These were used as a basis so as to contextualize the final product to local standards. It also provided the convenience to auditors who could use this checklist to rate the contractor’s OSHMS as well as to audit for OHSAS 18001’s certification.

6. Although there has been much
emphasise on OSHMS, little attention is given to assessing the effectiveness of implementing the OSHMS. The Universal Assessment Instrument (UAI) developed by Charles F. Redinger and Steven P. Levine is one of the few published OSHMS assessment or rating tools aimed at providing organizations with the means to measure the effectiveness of their specific OSHMS. The UAI principles have been adopted in the ILO Guidelines for OSHMS. The checklist questions were developed based on UAI as the UAI presented auditable clauses and associated measurement criteria that cover the requirements of the commonly used management systems found throughout the world.  

Comparisons between the UAI with the OHSAS 18001 and SS 506 revealed that both were in very good agreement. We have also compared MOM’s existing guidelines on OSHMS for other sectors with UAI and found that the UAI covered practically all the requirements of the OSHMS apart from a few detailed requirements which were not explicitly mentioned in the UAI.

7. The next step involved comparing questions from the UAI to see if they are relevant to the construction industry in Singapore. Two teams studied the questions simultaneously. One was the System Development Team (comprising three MSc students from the Human Factors Engineering course in the Nanyang Technological University) while the other team consisted of members of a Construction Subcommittee Work Group under the Workplace Safety and Health Advisory Committee who were professionals from the private and public sector. The questions were rated 1 to 8; 1 being totally irrelevant to 8 being very relevant. Questions that were rated less than 5 were discarded with reasons provided. This exercise yielded about 450 questions. 2 Thereafter, the development team devised audit instructions for each of the questions. The instructions are highlighted in red below every question in the checklist. Auditors are expected to follow the instructions provided so as to achieve greater consistency in their audit methods. [1]  

8. The structure of the questions and elements follow that of SS506 3 due to 2 main reasons, (i) the current construction industry has already gained much familiarity with it and (ii) the SS506 adopts Deming’s PDCA cycle which is the basis for successful management systems and includes reliance on the documentation pyramid as key to both the business process and value-added auditing.  

9. In line with industry practices, the audit protocol comprises three key components: (i) document review, (ii) personnel interview and (iii) physical inspection. To keep the sampling size small yet credible, a sampling size of three was recommended where appropriate. In

1 During the initial stage of development of UAI, 13 publicly available systems were reviewed, seven of which were OSHMSs. In the end, four models were selected as input models because they provided the most comprehensive management system approaches and encompassed the key elements of all the models reviewed. The four models were Voluntary Protection Programme (VPP) from OSHA, BS 8800:1996, AIHA’s OHSMS, ISO 14001:1996

2 This was subsequently reduced to about 300 questions after the 2nd pilot test.

3 The key elements in SS506 are (i) OSH Policy, (ii) Planning, (iii) Implementation and operation, (iv) Checking and corrective action and (v) Management review.
any item, if at least two out of the three sampled met the criteria, it is considered a “pass”. A similar sampling size approach has been largely adopted by various local auditors. The questions are banded from I to IV to reflect the increasing level of maturity of the element. The checklist has an inherent “show stopper” feature. To move from one band to the next higher band, the contractor needs to satisfy at least 70% of the questions within that band. 4

Development of rating system
10. A rating system provides a platform for ease of comparison of OSHMS performance among companies and provides easy reference to identify the strengths and weaknesses in the OSHMS. For simplicity, we have adopted a banding system to reflect the audit results rather than a quantitative score. The banding approach will also not give the misimpression that the assessment is an exact science. Another advantage to such a stepped approach is that this allows for quick and easy visualization of the maturity of the different elements in the OSHMS, thereby providing the management a clear overview of resource allocation requirements when strengthening weaker areas or elements in the system. [2]

11. Before the final product was completed, we also invited Dr Charles Redinger, the co-author of the UAI tool to provide consultancy services to the development of this toolkit.

Pilot testing and validation
12. An array of stakeholders from the construction industry was actively engaged in the development and testing of ConSASS. This includes developers, contractors and auditors. MOM-approved auditing organizations also participated in a pilot test to assess if ConSASS was usable, reliable and valid for over 24 worksites. The major players included Singapore Contractors Association Limited (SCAL) and the Building & Construction Authority (BCA).

13. During the one-month test period, briefing was provided to all test participants on the use of the toolkit. Feedback from the pilot exercise was subsequently gathered to improve the checklist and the grading criteria in the scorecard. A second and final pilot trial was conducted in early 2007.

14. Subsequently, a user guide was also published to provide clear instructions on the use of the audit tool. More than 156 approved auditors have been trained on the use of the system since 2007. [3]

Discussion
15. ConSASS is a key tool to use in working towards the achievement of sustainable WSH improvements. It has achieved its initial aim of providing a unified assessment method in terms of standardisation of audit checklists and adoption of a common audit scoring system. It allows contractors to systematically identify areas of weakness in safety management and take practical measures to improve their scores. It provides consistency to the auditing process and allows easy cross comparison of worksites in terms of capabilities in managing safety and health risk. Although ConSASS is a voluntary system, it already has the support of many industry stakeholders. Prior to its launch, major developers such as

4 This is based on ANSI/ASQ Z1.4 Sampling Procedures and Tables for Inspection by Attributes.
City Development Limited and contractors like Foster Wheeler, Straits Construction and Gammon Construction have pledged their support. Government agencies like Land Transport Authority (LTA) and Housing Development Board (HDB) have also committed to getting their contractors on board. Since its launch in November 2007, many other stakeholders amongst property developers, auditors as well as building contractors voiced support for the system and expressed that they would adopt ConSASS at their worksites. During its first year of implementation, a total of 37 audits have been conducted using ConSASS.

16. However, owing to its comprehensiveness, it may take a longer time for audits to be completed. Moving forward, we would continue to raise awareness by promoting the benefits of ConSASS and may consider further enhancements to the system to improve its user-friendliness. In addition, to further enhance the effectiveness of ConSASS, we would look into studying the possible correlation between the results of ConSASS and the actual OSH performance of contractors at various worksites.

References

5 For an established and mature OSHMS, it could take up to 5 man-days to audit whereas a young system may only require 2 to 3 man-days.
Biological or Airborne Al Monitoring in the Aluminium Industry?

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The aluminium (Al) industry is facing the presence of pollutants in the atmosphere of the workplace, principally two elements, Al in various forms and fluoride gas or particles. Monitoring the safety of workshops uses biological monitoring based on urine analysis in exposed workers. This is a preventive medicine approach. It is complementary to technical prevention. In the workshop atmosphere where Al is produced by electrolysis, the potroom, the major pollutant is airborne fluoride. The biological monitoring of exposure is ensured by the determination of fluoride in urine. The analyses are done at the beginning and at the end of the shift. The Al employee exposure in the other areas of plants was monitored only on the basis of air sample analyses.

The question of the neurotoxicity of Al during occupational exposure to aluminium compounds is still the subject of studies. At international level limit values of occupational exposure to Al have been laid down for the atmosphere of workplaces.

In occupational medicine the German BAT limit value of 60 µg of Al/g creatinine at the end of shift (DFG 2008) replace 200 µg/L (DFG 2006) and the Finnish BAL Al value is about 160µg/L before the shift (FIOH 2004).


The aim of the study was therefore to define a strategy to monitor employee exposure using an airborne or biological exposure indicator taking into account the diversity of the occupational exposure situations. The originality lies in abandoning a systematic approach using an airborne indicator alone by envisaging a choice of indicator according to sector as a function of the nature of the Al compound present.

The study was conducted in two industrial plants of the same company. The choice was made to consider the exposure of all the plants workforce.

The two plants included diverse primary aluminium production and downstream activities. For the metal production site (640 people): a potroom workshop, a casthouse, the maintenance departments, and the administrative departments. For the transformation site (1,420 people): two casthouses, two rolling mills, the finishing sectors, which include strap cutters generating Al particles, the maintenance sectors of the production sectors and the general departments.

The urinary Al concentration was measured at end of the shift on two consecu-
tive days, and during a second phase one year later. This was done to verify the temporal stability of the measurement. The plasmatic Al concentrations were also determined on samples during the first phase.

The airborne Al was determined on personal aerosol samples. Among workers taking part from sites 1 and 2 comprised 375 and 196 for phase 1 and 341 and 175 for phase 2, 203 and 147 airborne samples respectively were taken on volunteers.

The aluminium was in two different chemical forms. Most of the Al compounds present in the atmosphere of the workshops had been encountered in previous studies (Pierre 1995). These were: cryolite, Al fluoride and the secondary compounds of electrolytic vats, aluminium oxide (Al₂O₃), foundry dust of undetermined composition, and metal Al particles. Most were insoluble in water. A soluble fraction of Al was found in the potroom sector. The fraction of soluble Al in the personal air samples taken in the potroom sector was 23%.

Several threshold limit values have been adopted by the ACGIH; the TWA for metal Al dust and compounds was 10 µg/m³, for soluble salts 2 µg/m³, and 10 µg/m³ for aluminium oxide (ACGIH 2007), but in 2008 the ACGIH adopted a new TWA value for Al, compounds and Al oxide (metal Al and insoluble compounds: 1 µg/m³).

Examination of the results allows it to be considered that only five groups of exposed workers with characteristic functions, the casthouse operators, the rolling mill operators, the strap cutters, the potroom workers, the maintenance staff and one group not exposed, the employees of the general departments.

For airborne Al there is a statistically significant difference between the medians. The group of potroom operators is distinguished with the highest median value (229 µg/m³) from the casthouse operators (116 µg/m³), the rolling mill operators (51 µg/m³), the strap cutters (43 µg/m³) and the maintenance staff (107 µg/m³). Due to the low number of usable measurements, the general departments group was not taken into account. The exposure of the operators on the automatic strap cutters is the most heterogeneous; they are exposed to an aerosol of metal Al generated by high-speed cutting of strip sheet edges. This exposure is characterised by high but selective individual values (7.2; 2.1; 6.2 µg/m³) in a set of low values (25 measurements between 30 and 70 µg/m³).

For urinary Al, using the average of four measurements as the individual value, there is a statistically significant difference between the medians with a 95% confidence level. The group of potroom operators has the highest values in µg/g creatinine (median of 17.2 as opposed to 8.1 for the casthouse operators and between 5 and 6 for the other groups). For plasmatic Al, there is a statistically significant difference between the medians with a 95% confidence level. The potroom operators group is distinguished by the highest values in µg/L (median 12.7 as opposed to 7.8 for the casthouse operators and between 6 and 7 for the other groups).

The search for a relationship between the biological parameters and the airborne measurement, the only currently recognised indicator, was conducted by calculating the correlations that may exist between the measurements for all the
participants and for each function group. On account of the type of results distribution, the calculations were done using data logarithmic transformation.

Only the potroom operators have a good significant relationship. For the potroom operators $[r = 0.41, R^2 = 17\%, p = 0.0089, ddl = 39]$. The relationship takes the form: \[ \log_{10} \text{Al.U potroom} = 0.371 + 0.324 \log_{10} \text{Al air.potroom} \]

The potroom workers are exposed to partly soluble Al compounds (Alsol); this particularity was examined in the analysis of the relationships between the indicators. $[r = 0.61, R^2 = 37\%, p = 0.0015, ddl = 23]$. This relationship takes the form: \[ \log_{10} \text{Al.U potroom} = -0.003 + 0.661 \log_{10} \text{Al sol. potroom} \]

Within the limits of the study, two situations were identified: an urinary equivalence with an airborne concentration of 1 µg/m$^3$ of soluble Al can be proposed equal to 95 µg/g.crea., although the equivalence with 22 µg/g.crea. corresponds to an airborne concentration of 1 µg/m$^3$ of Al including a soluble fraction of 23% (situation of the study site). For the potroom workers only the urinary measurement has application conditions. Measurement of the aluminium concentration in an end-of-shift urine collection over the course of the week can be used as a biological indicator of exposure to soluble aluminium salts. A difference exists between these results and the justification of the German BAT because all studies taken into account were realized on exposure to Al welding fumes. These results are specific of Al exposure in Al primary industry.

Following these studies, the company responsible for hygiene at work changed the type of respiratory protective equipment, replacing simple masks. Two types of equipment are available to workers in different sectors. To replace disposable masks, it is proposed either “half mask respirators with filters adapted” or “powered and supplied air respirators with positive air pressure (battery operated)”, the latter being mandatory for people with beards. Measures of biological indicators of exposure (urinary fluoride) conducted since then, show a significant reduction (40 to 50%) of end-of-shift measures.
Research on the effectiveness of prevention measures at the workplace

References

American Conference of Governmental Industrial Hygienists (2007, 2008) Threshold limit values for chemical substances and physical agents and biological exposure indices ACGIH Cincinnati


Requirements of Funding Procedures to Support Knowledge Transfer to OSH Practice

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Research Funding of the German Social Accident Insurance (DGUV), Germany

Abstract
The three core services of the German institutions for statutory accident insurance and prevention are the prevention of occupational accidents and of work-related diseases, compensation for them, and rehabilitation. Prevention is the most important of these services, and it is powered to a great extend by research. Research funding with inherent requirements concerning transfer orientation is an effective tool to achieve research outcomes already adopted to be applied to other prevention services. Some good-practice examples are presented to show the practical orientation and the practical implementation of research funded by DGUV. The success of this approach depends on a number of factors such as strong involvement of the social partners, of the companies and of prevention service departments. This paper will outline the DGUV research funding procedure and the inherent transfer requirements.

According to their legal mandate accident insurers are obliged to
- prevent occupational accidents, occupational diseases, and work-related health risks
- investigate their causes
- provide effective First Aid
- ease the effects of occupational accidents and occupational diseases by all suitable means.

In order to promote occupational safety and health the accident insurers developed a full range of prevention measures such as consulting and inspection services, training, medical check-ups and research. Recently DGUV evaluated all these measures, and it turned out that research is the service which interacts most strongly with the other services: Challenges detected in other fields initiated many research projects and the project results were used for all prevention services (cf. contribution of Hanna Zieschang to Session 1 of this Colloquium).

It can easily be concluded that OSH research and its funding are not an end in themselves for social accident insurance but that they have to meet the objectives of occupational safety and health. DGUV research is generated in the field, for use in the field. The goals of the research are defined by the requirements within companies, and the results of the research
must in turn be transferred into company practice.

In 2008, DGUV funded 26 OSH research projects spending 1.8 million € in total (about 2.6 million US$) on the basis of the following general principals:

- knowledge transfer to prevention practice must be probable
- research topics have to be of common interest for different industrial and public sectors
- the focus lies on the demands of the accident insurers
- scientific excellence is required
- in general basic research is not supported
- the social partners decide on funding.

From DGUV’s point of view, a successful project needs close collaboration of different players: researchers, prevention services of the insurers, social partners, and the occupational safety and health services of the companies.

In such a team play two basic rules seem to be important: Researchers must be sensitive to and informed about the needs of both the companies and the accident insurers. These in return must be open to new – in some cases uncomfortable – questions and solutions.

Experience shows that the chances of transferring research to OSH depend very much on how target groups, their priorities, and existing prevention instruments can be taken into account during each stage of a project:

- Scoping, planning, and initiating
  The main target groups – prevention services of the insurers and of companies – are involved as early as possible when the project is conceived or when a call for projects is prepared. In some cases these parties themselves initiate the project. At the latest, DGUV includes them in the assessment of the funding applications. The decision on funding is taken by the social partners in the DGUV Management Board. Intensive consulting offered by the DGUV research funding unit enables the applicants to benefit from the experience of former assessments and funding decisions.

- Implementation
  As a general rule, DGUV sets up monitoring groups for funded projects. These committees are made up of experts of the insurers, and if possible also of the internal company OSH services. It is important that this group supervises the project in a committed and critical manner. At the same time, the research partners must prepare and present their results in such a way that their relevance to the company and to occupational safety is clear. Many projects are carried out in collaboration with DGUV’s own research institutes.

- Dissemination, transfer, and evaluation
  The knowledge transfer to OSH practice is very much supported by the fact that the accident insurers have many well-established prevention services at their disposal, such as measurements at the workplace or the set up of rules and regulations. The project results can be published in a number of information media or databases which are acknowledged by insurers and companies.

DGUV is very active in NEW OSH ERA – a consortium of 18 leading public
agencies, ministries and research organisations which aims to promote OSH research in Europe (cf. www.newoshera.eu). One of its activities was the publication of a trans-national call for research projects focused on psychosocial risks at work.
SESSION 4

Investigations, testing and certification
The Investigation Prevention Service

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2 German Social Accident Insurance (DGUV), Department Safety and Health, Germany

Introduction
The aim of the prevention services offered by the social accident insurance institutions (“UVT”) is to investigate accidents at companies in suspected cases of occupational disease (“BK”) and during prevention activities. The systematic analysis of the processes and evaluation of the results of investigations into accidents and occupational diseases are of major significance for the ongoing development of prevention activities and the acquisition of new findings.

The accident insurance institutions’ measurement system for hazard investigation (“BGMG”) and the tools developed by BGIA to assist such investigations are presented as examples of systematic, quality-assured approaches.

Quality of the investigation service: definition by internal and external customers
In the case of accidents and suspected occupational diseases, the direct and internal customers are the claims departments of the UVT who are responsible for recognizing claims and paying compensation. Indirect external customers are the employees and the employers involved, who may be affected by respective in-plant prevention activities as a result of the accident that has happened or the employee’s occupational disease that may have developed. Investigations for hazard assessment purposes are generally conducted in multiple plants; their focus is the prevention of future undesirable events, a fundamental assessment of the hazards involved and the presentation of recommendations for preventive measures. In this case, the employees and the companies would be the direct customers of the service.

Both internal and external customers of the accident investigation and prevention service have an interest in prompt and professional investigations. The accident insurance institutions have established well structured and documented internal procedures for the delivery of such an “investigation” service. The employees’ representatives and the employers on the boards of the accident insurance institutions have a substantial interest in investigations being conducted swiftly in the event of accidents and occupational diseases. It is also important to note that the results of such investigations may be used as evidence in cases of litigation.

Methods for assurance and evaluation of quality
Well-structured and measurable processes are an essential principle of quality assurance. Four different processes may be defined for the accident investigation and prevention service:

- Investigations into accidents
- Investigations into reported cases of
occupational disease
- Investigations into hazards
- Systematic processing of the results of investigations (into accidents and occupational diseases) in order to yield new findings for prevention

By way of example, fig. 1 shows the investigation into reported cases of occupational disease. As a prevention service, this would only encompass the clarification of the work-related conditions (e.g. exposure to noise or chemicals); it is no medical diagnosis. The medical consultant combines the results from the two studies.

The investigation begins with a request by the insurance department to the prevention department. As a first step the prevention department determines whether the existing documentation is sufficient for the assessment of the patient’s working conditions. In the majority of cases, the workplace(s) must be inspected; measurements and analyses or evaluations from databases may also be necessary.

The assurance of quality also comprises monitoring the process and quality assurance of the current studies of the work.

The process can be monitored and optimized by the measurement of parameters, for example the time required for the completion of the investigations. Employees who have reported an occupational disease have a right to swift clarification of their cases.

Possible quality parameters for the process as a whole are:

**A. Expenditure parameters:**
- Duration of an investigation (in hours)
- Number of investigations performed in period x
- Hours of investigation in period x
- Average duration of an investigation
- Proportion of total prevention resources

**B. Result parameters:**
- Number of investigations exceeding the target duration
- Proportion of investigations exceeding the target duration
- Number and proportion of the analysed investigation results

The objective to measure and improve the quality may be supported by the use of the “six-sigma” quality management criteria, especially of the metrics to control the investigation activity:

<table>
<thead>
<tr>
<th>Define</th>
<th>the service and the quality which shall be achieved</th>
</tr>
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<tbody>
<tr>
<td>Measure</td>
<td>the actual quality</td>
</tr>
<tr>
<td>Analyze</td>
<td>the delta between actual quality and target quality</td>
</tr>
<tr>
<td>Improve</td>
<td>or redesign the process</td>
</tr>
<tr>
<td>Control</td>
<td>the improved process</td>
</tr>
</tbody>
</table>
Request from the occupational disease case department: assessment of the working conditions in a case of suspected occupational disease

Start

Occupational disease file forwarded to occupational disease investigator

Assessment of the available information

Information sufficient for a comment on the working conditions?

Obtaining information:
- Plant inspection
- Consultation of insurer, employer, occupational physician
- Literature survey, involvement of specialist body

Yes

Documentation of the findings

Comments: Criteria relating to working conditions met: yes/no/open

Report to case-handling department

Documentation for prevention

Completion of investigation

End

Fig. 1: Process of “investigations into reported cases of occupational disease”
During investigations relating to occupational diseases in particular, the assessment of employee exposure (to hazardous substances, noise, heavy loads, etc.) is of decisive importance: did exposure occur, and if so at what level? The most important QA measure for this purpose is the standardization of the procedures for investigation and analysis.

Measurements of exposure to hazardous substances and noise are conducted by the accident insurance institutions by means of their BGMG hazardous substances measurement system, which is subject to comprehensive quality assurance. Exposure data has been measured systematically within the BGMG for decades. This data is used for both the investigation of individual cases of occupational disease and for occupational disease reports documenting representative exposure data.

BGIA provides the accident insurance institutions with a software to search for and calculate exposure dose values according to uniform criteria. Descriptions of all tools referred to can be found in the BGIA “work history ring binder”.

These measures have contributed to a greater transparency and thus a greater acceptance of the recognition or rejection of a case of occupational disease by external customers (employees, employers, social courts).

**Evaluation of quality: an immanent process**

The evaluation of the investigation quality is organized as an immanent process which continuously measures and examines both internal and external quality requirements. Its elements are:

- Internal process parameters for measurement and controlling
- Feedback from the public (employers, employees, social courts, the research community)

The most important quality criterion is whether something is beneficial in practice, i.e. whether investigations into occupational accidents and diseases result in new findings of use to plants.

For this purpose, suitable parameters must be defined, not only for the direct process characteristics, but also for the impact of the individual investigation processes. The resulting values can then be used for the continuous assessment and improvement of processes in line with the DMAIC and the Six Sigma methods.
Product Testing and Certification: An Efficient Means to Exert Influence on the Safety of Products

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German Social Accident Insurance (DGUV), Department Safety and Health, Germany

1. Testing and certification as a prevention service
The “BG” institutions for statutory accident insurance and prevention have been involved in product testing and certification for many decades. It is known that some BGs offered certification of the safety of tested work machinery as far back as the 1920s.
Together, the 18 BG testing and certification bodies form the BG-PRÜFZERT network. They now issue more than 3,000 certificates for safe and healthy products per year, with over 100,000 certificates awarded since 1965. Their work focuses on machinery, personal protective equipment and other work equipment.
What makes the BG-PRÜFZERT testing and certification bodies special in comparison to other testing and certification bodies is their sector-specific approach, geared to real industry practice. In addition, their work is closely linked to other prevention services, such as research and development, involvement in standardisation, provision of information and consulting.

2. Product improvement as a result of testing and certification
Do product testing and certification really result in safer and healthier products?
To answer this question, we will look at research conducted by the testing and certification bodies. We will also consider their relevance for the market, i.e. how much supply and demand is there for certified products and why? What are the consequences for the market? When examining these points, however, a distinction has to be drawn between compulsory testing and voluntary testing.

2.1 Compulsory testing and voluntary testing
Some EC single market directives stipulate that, for certain products, manufacturers must seek the services of a testing and certification body certified for these products.
However, the overwhelming majority (70 per cent) of BG-PRÜFZERT certificates are issued on the basis of tests that are voluntary for manufacturers. A large

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Fig. 1: Certification marks awarded by BG-PRÜFZERT

1 A fundamental study has been carried out by BG-PRÜFZERT as a sub-project in the framework of the project “Quality in Prevention” (Reitz 2006).
number of the manufacturers choose a certificate that also entitles them to affix a certification mark to the product. This mainly concerns the GS mark but also our own BG-PRÜFZERT mark (fig. 1).

2.2 Detection of product defects by means of testing and certification

Product testing starts by meticulously examining the types presented for testing. It aims to establish whether the products really meet the safety and health requirements applicable to them and whether they can be said to be safe and non-harmful to health. Our employees contribute a large amount of experience-based expertise to this process. The BG-PRÜFZERT testing and certification bodies then prepare detailed reports, which describe the defects identified. These reports and the talks with the manufacturer give the latter considerable support for their risk assessment.

In a study conducted by the BG for the foodstuffs industry and the catering trade (“BGN”), the defects identified in machinery tests were evaluated and classified (Wickert and Paquet 2007). According to the study’s findings and in the period under review, 49 per cent of the machinery had serious defects. BG-PRÜFZERT now plans to collect statistics about all products applying for a certificate. A pilot study from the first half of 2009 showed that 62% of the products had defects, 22% of them had serious defects. During the type testing, all of the products had their defects remedied and were thus awarded a certificate.

This result generally corresponds to the information given by the certificate holders. In 2007, 94 per cent of the certificate holders stated in a periodic customer survey conducted by BG-PRÜFZERT that defect detection by means of testing and certification was very important or important to them. According to the certificate holders, BG-PRÜFZERT can meet these expectations well: 95 per cent of certificate holders rate the BG-PRÜFZERT testing and certification bodies as very good or good with regard to this aspect. The manufacturers also consider it very important that testing and certification of their products enables them to

<table>
<thead>
<tr>
<th>In your opinion, how important are the following aspects of our services?</th>
<th>And how would you rate us with regard to these aspects?</th>
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<tbody>
<tr>
<td>“Very important” and “Important”/“Very good” and “Good” answers (as a percentage of all answers)</td>
<td></td>
</tr>
<tr>
<td>Testing and certification body serves as source of information on how to design products which are safe and not harmful to health</td>
<td>91%</td>
</tr>
<tr>
<td>Identification of safety and health problems with product</td>
<td>94%</td>
</tr>
<tr>
<td>Work with testing and certification body helps improve level of occupational safety and health provided by product</td>
<td>91%</td>
</tr>
</tbody>
</table>

Table 1: Benefits of testing and certification for certificate holders. Results of the BG-PRÜFZERT 2007 customer survey
improve occupational safety and health aspects and provides them with information on how to design safe and healthy products (see Table 1). Testing and certification thus makes a sizable contribution to ensuring that product defects are eliminated before the products are placed on the market, and that the products that reach the market are safe and not harmful to health. Consequently, product testing and certification can be described as “advance market surveillance”.

2.3 Supply and demand for certified products

Obviously the market is not good at guaranteeing safe and healthy products. Repeatedly there are cases of products that do not meet the essential safety and health requirements. This can be caused by manufacturers’ lack of knowledge or negligence and, in extreme cases, even fraud. Often, buyers of products are not able to judge the safety of these products themselves, at least not with a reasonable amount of effort. They have to rely on the vendor’s assurances. This is true both with regard to consumers and in the business-to-business (b2b) area. Economists refer to such products as having “credence attributes”. As explained above, manufacturers use testing and certification to ensure that defects in their products are detected and that they can eliminate them before they are placed on the market. For this internal purpose, test reports and certificates are sufficient. However, in Germany and elsewhere, certification marks, e.g. the GS mark or BG-PRÜFZERT’s BG mark are frequently used in addition to certificates. The benefits they offer are indicated by Auriol and Schilizzi (2003), who observed that a certification mark can help the buyer to choose a product by acting “to transform unobservable credence attributes into observable search attributes”. Thus, manufacturers can use certification marks as a symbol of the quality of their products in terms of safety. This can help ensure fairer competition. Certification marks are therefore a free-market tool for improving product safety.

3. Transfer to standardization

The majority of the employees at BG-PRÜFZERT’s testing and certification bodies do not only work in testing and certification. In many cases, they also work as inspectors, in training, consulting, research and development and, above all, standardisation. This fact reflects the mandate given to BG-PRÜFZERT when it was founded, i.e. to ensure that the knowledge gained during testing and certification be incorporated into other prevention work, particularly standardisation. Lessons learned from accidents and users’ experience, e.g. concerning the fitness for purpose of work equipment, flow back into testing and certification. The employees of the testing and certification bodies consider the resultant reciprocal action very positive. The managers of the testing and certification bodies approved these finding in expert interviews. This interaction between the various prevention services plays a particularly important role in supporting innovation. In the case of novel products, not only the buyers but also the manufacturers often have difficulties judging product safety. Thanks to their sector-specific approach, geared to real industry practice, the BG-PRÜFZERT testing and certification bodies very often test and certify innovative products for which there are no testing requirements as yet. The findings of such
tests are incorporated into standardisation work and can thus promote positive developments in the area of product safety.

An examination of the reciprocal action shows that testing and certification not only have a direct effect through direct product improvement but also an indirect effect. So the influence on the product can extend far beyond the certified products. The **chains of effect of testing and certification** therefore also include the indirect influence on product design as well as the effects on purchasing/product selection.

The close links between testing and certification work, standardisation, inspection services and research and development create a control loop, in which the BG-PRÜFZERT testing and certification bodies are embedded, that promotes products that are safe and not harmful to health (fig. 2).

4. Conclusion

The analyses demonstrated that product testing and certification make a successful contribution to prevention in Germany. A key reason for this is the close link to other prevention services.

The methods of proof are still very new. Generally recognised methods and indicators would be helpful in order to draw even better conclusions concerning the (cost) efficiency of testing and certification. Such indicators should not only cover the direct effects of the prevention services, but also the indirect influence on product design and the effect on purchases. Special attention should be paid to promotion of innovation.

**References**


URL: http://www.dguv.de/webcode.jsp?q=d13811

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**Fig. 2: Control loop for products that are safe and non-harmful to health**
english translation: No defects after the type test but what about beforehand?
URL: http://www.dguv.de/webcode.jsp?q=d32807
Development of Test Methods for PPE as Stimulation for Innovative Preventive Solutions

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Introduction
The development of chemical and material engineering as well as electronics and information and communication technologies makes it possible to improve the safety and comfort of workers by means of PPE using advanced technologies and materials as well as embedded “intelligent” systems of risk monitoring in the work processes. It requires at the same time the development of the system of testing and certification – development of new test methods which are not included in harmonised standards of the Directive 89/686/EEC and will enable the testing and certification of PPE for the conformity with essential health and safety requirements of the above-mentioned directive.

Test method for the efficiency of filtration and bioactivity against biological aerosols
EN standards lack methods enabling the assessment of filtration efficiency and bioactivity against biological aerosols. In the developed test method, the tests are carried out for E.coli and S.aureus bacteria sprayed onto the filtration biomaterials and control samples. The tests are carried out in the chamber with laminar air flow, equipped with HEPA filters and UV lamp. Bacterial aerosol is dynamically created through the atomizer and mixed with dry air flow. Bacteria are then directed to the assembly of filtration materials placed in the tight grip. The samples of materials are placed in the sterile Petri dish with a constant temperature of 37°C for 2, 4, 6 and 8 hours from the moment of spray application. The obtained results, presented as an average number of microorganisms for one sample, allow for the calculation of bioactivity expressed with two values as biostatic effect and biocidal effect.

Another assembly of filters is used to test filtration efficiency: the tested assembly of filtration materials and microbiological gelatinous filter, retaining all the bacteria that penetrated through the material. After having sprayed the bacteria onto the assembly of materials, the microbiological filter is taken off, placed on the surface of TSA and grown for 24 hours at a temperature of 37°C. After that the colonies are counted. The efficiency of filtration is calculated by comparing the number of bacteria retained in the assembly and on the microbiological filter.

The test method has allowed for the development of model filtration systems with bioactive modifier, with different filtration properties and at the same time retaining and destroying microorganisms from the stream of air. The systems are based on two technologies: classic non-woven with tribo-electric effect and melt-blown technology.
Test method for the efficiency of retractable fall arresters protecting against falls from a height installed in anchoring subsystems

Research carried out in the Institute has shown the phenomenon of intermittent performance of retractable type fall arresters protecting against falls from a height, which can constitute a serious hazard due to the prolongation of the braking distance. It can be caused by installing anchoring subsystems that are not flexible enough. Therefore a test stand was constructed with a flexible anchoring subsystem of experimentally adapted frequency of self-vibration and decrement. A test method for retractable type fall arresters based on the measurement of the fall arrest distance was also developed as well as the assessment criterion comparing the average value of the fall arrest distance of the test mass for a device installed in a rigid anchoring subsystem with the distance value for the device installed in a flexible (testing) anchoring subsystem. The test method and the stand are used for the assessment of retractable fall arresters which, according to the manufacturers, can be installed in flexible anchoring subsystems, e.g. flexible horizontal lines.

Test method for the efficiency and reliability of electronic systems embedded in protective clothing

In case of protective clothing with embedded electronic systems it is indispensable to test the efficiency and reliability of these systems. Therefore detailed methods allowing for verification of the scope and accuracy of measurements in real-use conditions for protective clothing have been developed. The systems for measurement of skin underneath clothing and environment temperature, heart rate and motion/motionless are examined first under laboratory conditions in order to verify their complex scope of measurement. Field tests are then carried out in order to confirm the reliability of the whole module in real-use conditions. The reliability of radio communication, used for the transmission of data from the sensors embedded in the clothing, is also assessed (propagation tests). These methods were implemented in the process of development of clothing for fire-fighters in which the module of electronic microsystems were embedded, enabling the monitoring of selected physiological and environmental parameters.

Test method of chargeability

A test stand to examine the tribocharging of materials and clothing was developed by the Central Institute for Labour Protection – National Research Institute. Its main elements are a mannequin to test whether an electrostatic charge can occur in the clothing and Faraday cage. The stands allows for the measurements of:
- electric potential of the charge on the mannequin surface while rubbing the outer surface of the clothing material,
- electric potential of the charge on mannequin surface while taking off clothing and the charged produced on the clothing with the use of Faraday Cage.

Triboelectric effect of clothing is obtained by rubbing, which is the most adequate among the methods developed so far to test materials for antielectrostatic clothing, because it corresponds best to real conditions in which the charges are generated in the working environment. It is the only method that enables the simulation of real-use conditions of the clothing exposed to triboelectric effect, regardless of material design.
Test method for transfer of heat and water vapour through “active” materials of variable thermal insulation
The developed method allows for testing of active materials in the following scope:
- heat resistance of materials, to assess their thermal insulation to ensure the appropriate selection for real-use conditions (environment temperature, exposure time, users’ metabolism),
- water vapour resistance, to assess the materials in order to ensure thermal comfort of the user.
The tests are carried out in a climatic chamber on a special stand of modular design. The basic elements of the stand are 2 exchangeable measuring plates (wet and dry) – thin-layer heaters with integrated temperature measurements, on which the tested material is placed. The stand, together with the test method, has allowed for the development of clothing equipped with heating systems with active thermoregulation for work carried out in cold environments, which ensures the thermal comfort of the user in changing conditions of exterior temperature and with changing energy expenditure. The assembly of materials with heating inserts placed in the selected parts of the clothing has been used.

Test method for electromagnetic shielding efficiency of materials
A test stand was designed to assess the shielding efficiency of materials designed for the protection against electromagnetic fields. It comprises a source of magnetic or electric field (system of coils, air capacitors, or open TEM lines) and the equipment for the generation and control of field parameters. The tests are carried out with 3 shielding chambers, in which one of the walls is covered with the tested material. The shielding efficiency of material is defined on the basis of field intensity measurements inside the shielding chamber, referring to the result of measurement carried out without material test sample. The method, as well as the stand have been used for the development of protective clothing against electromagnetic fields.

Summary
New test methods for personal protective equipment developed by the Central Institute for Labour Protection – National Research Institute have allowed for the development of innovative, more efficient PPE solutions. These methods are used in the Institute within the framework of PPE conformity assessment. Some of them have been presented and discussed during the meeting of vertical groups of notified bodies (e.g. test method for the efficiency of retractable fall arresters protecting against falls from a height installed in anchoring subsystems) or standard committees (e.g. test method of chargeability presented during the meeting of the technical committee IEC TC 101 Electrostatics).
In 1994, the BG in the Printing and Paper Converting industry carried out an extensive analysis of machine accidents. It appeared that by far the greatest number of accidents occurred on sheet-fed offset printing presses. This was due to the high risk potential implied in these machines, but also to the fact that a great number of these machines are used in member companies. The results were similar as far as the notification of occupational diseases is concerned. It was evident that our prevention efforts had to be strongly directed towards sheet-fed offset printing. In the following, we report on the prevention successes we have achieved.

For prevention work to be efficient, the inspection of member companies and insured parties is not enough. Effectiveness can be considerably improved by multipliers exerting a direct influence on the persons concerned. In order to achieve this, a well-functioning prevention network is a prerequisite.

An important pillar supporting this network is the service provided by the Technical Inspectors whose task it is to visit member companies and provide on-site consulting and inspection. This allows influencing users directly, but it also gives the chance of acquiring extensive expertise which can be used for the benefit of subsequent prevention work. To this effect, a so-called “expert system” has been implemented. The underlying idea is that all information available on a certain working technique is collected by experts of the institution for statutory accident insurance and prevention who are assigned to a specific area of application.

This information is accumulated by the Expert Committee Printing and Paper Converting. In addition to the classical technical aspects, information is gathered on other issues affecting health and safety in the workplace such as the handling of substances, noise, ergonomic requirements (for example manual lifting and carrying of loads), work organisation, hygiene and others aspects.

Where shortcomings are detected, we take it as part of our consultancy to try and work out a solution in cooperation with the manufacturer of the respective product, which is adopted on a voluntary basis. Subsequent certification of the improved work system is an incentive to motivate manufacturers to accept the personal and financial investment required for improvements on health and safety. Certification is not only a means to motivate manufacturers, but it also relieves Technical Inspectorates and user companies. Inspection of the certified product on the user premises is required only in exceptional cases, and retrofitting machines by user companies due to shortcomings is not needed.
Inspection activities, consulting manufacturers and certification require a set of standardised rules and regulations. In former times, we used to apply the national rules and regulations of accident prevention for the design and construction of machinery in Germany. Nowadays, this is covered by European and international standards. It is therefore increasingly important that institutions concerned with Occupational Health and Safety take part in these standardising activities in order to introduce their research findings in the field of accident prevention. Institutions concerned with Occupational Health and Safety, however, only rarely attend international standardising committees which often makes it difficult to highlight the issues of occupational health and safety in these areas.

It is only by closely combining “Inspection” and “Testing/Certification” with “Standardisation” that prevention objectives can be successfully achieved. The knowledge about accidents and working conditions in the field including the procedural interferences to be expected allows developing safety measures which are tailored to the needs of the individual user and will therefore find acceptance. This is what clearly makes the big difference between the test bodies established by the institutions for statutory accident insurance and prevention and those other notified bodies who judge without being aware of the field situation and without feedback from the side of the Technical Inspectorate about the measures taken. It also appears to be an advantage that testing by the notified body of the BG in the Printing and Paper Converting industry is carried out by the same staff who work as Technical Inspectors. They are familiar with the machines from their individual member companies.

The work done by the notified body is in turn an important precondition for effective contributions in the field of standardisation. On the one hand, testing helps to influence manufacturers with a view to building safe machinery. Awarding premium certificates is also a possibility to introduce higher standards, and this again influences the “state-of-the-art” definition which is the benchmark for all standardising work. On the other hand, testing activities are a good basis for establishing close contacts with manufacturers and for keeping abreast with the technologies applied to that respective industry. Both aspects are an important asset when fighting for a high acceptance of the position of Occupational Health and Safety in standardising committees.

Without being able to make successful contributions in European and international standardising committees we run the risk that the standards do not adequately reflect the requirements of Occupational Health and Safety in the workplace. Where manufacturers refer to such harmonised standards, it is in the first instance difficult for inspectorates to intervene in cases of hazardous machinery or working practices.

Not taking part in standardising work would also adversely affect the acceptance of the testing and certification body. They would have to interpret standards in the conception of which the manufacturer was involved but not the testing and certification body.

The successful implementation of this prevention strategy can be proved easily. Thanks to our contributions, the level of protection hitherto laid down in the national rules and regulations for accident prevention could be demonstrated and
partly even be extended to the international level. This effect together with testing and consulting provided for the major manufacturers of this industry finally resulted in a significant reduction of accidents which can be proved by the over-proportionately decreased number of occurrences and also the considerably reduced degree of severity of accidents.

The situation of the workforce could be substantially improved even beyond the classical safety issues. One aspect is the reduction of exposure to the emission of hazardous substances. By granting premium certificates such as the “emission tested” award, major manufacturers were provided with an incentive to reduce emissions to well below the legally required limit values. This resulted, for example, in reduced emission of hydrocarbon mixtures, ozone, dust or UV radiation. By using the premium certificate approach we were able to sensitise machine manufacturers to the issues of “emission of substances”, and the final result was that the ISO standard on safety requirements for graphic technology equipment and systems published in 2007 introduced revised guideline values for the emission of hazardous substances. These emission values are clearly below the internationally stipulated limit values for exposure in the workplace. By including these values in international standards, there is a binding commitment for all manufacturers worldwide to develop and supply products to international markets with a focus on low-emission technology.

Another example is the noise emitted by machinery. Up to now, noise emission limit values for the most important printing and paper converting machines were laid down in Germany in an annex to the accident prevention regulations. These values no longer apply as the EC directive on noise and vibration has been transformed into national law. But we have been successful in implementing international guideline values for noise emission in the ISO standard mentioned above. These guide values are 2 dB (A) below the former German limit values. Consequently, it was possible not only to maintain the level of safety on the international scale, but even to achieve substantial improvements in some areas.

**Conclusion**

The BG in the Printing and Paper Converting industry effort aims at promoting health and safety in the workplace in member companies on a nationwide basis with the help of external multipliers. In addition to offering classical methods such as training courses and media, the main focus is put on influencing external parties involved in the respective industry such as suppliers of machines and work substances. The idea is to place on the market mainly such machines, work substances and methods that have been certified before. This makes it possible to achieve a high level of health and safety at relatively low prevention cost. After all, this is to the advantage of the member companies they benefit from reduced risks for their workforce and at the same time from reduced financial burdens.
Safe human – robot cooperation

Collaborative industrial robots are complex machines that work hand in hand with people. In a joint working process, robots support and take the load off workers when for example, a robot lifts and positions a heavy workpiece while a person welds lightweight iron hooks. During this work activity, the person is very close to several robotic elements – for example, robot arm or tool – so robot and person may touch one another. A similar situation takes place with mobile service surroundings in close proximity to people.

Until now, guards were needed when using robots so the persons that were within the robot’s working range could be safely protected against the mechanical effects of fast-moving robot parts. When the industrial robot standards were revised and updated, the new application field of collaborative robots was added as a supplement.

Background

When collaborative robots are used, guards are no longer installed in certain working or collaboration rooms, so a robot-human collision risk cannot be entirely ruled out. Thus, technical protective measures other than guards must be taken to continuously determine the collision risk and minimize it as part of the

Fig. 1: Schematic diagram of the collision process between upper arm and impacting robot part.
Source: BGIA
When a workplace that includes a collaborative robot is planned, the user must carry out a risk assessment based on a legal framework such as the machinery directive and industrial robot standards that should also include an evaluation of injury risks caused by robot-human collisions. In the standards that apply to industrial robots, however, there are not enough occupational safety requirements for evaluating these injury risks. Acting on an initiative of the Expert Committee for Machine Construction, Production Systems and Steel Construction, the Institute for Occupational Safety and Health (BGIA) compiled in a development project the technological, medical/biomechanical, ergonomic and work schedule requirements made to such workplaces. They supplement and specify the requirements of the standards and were summarized in BG/BGIA recommendations.

Since a collaborative work process during intended use carries a collision risk between a robot and a person, the task consisted in limiting the straining effects caused by collisions so only small and tolerable injury severity or injury risk could occur. According to this, tolerable severe injuries are only skin and underlying tissue strains that do not penetrate the skin and tissue deeply and do not cause bleeding wounds. Fractures or other injuries of the musculoskeletal system must be ruled out (see fig. 1).

Injury severity can be depicted by limit values of related injury criteria. Limit values for the injury criteria of “impact force”, “clamping/squeezing force” and

Fig. 2: Dashboard assembly, Source: Daimler AG
“pressure/surface pressing” for all regions of a simple body model were established, based on injury data from external mechanical strains that the BGIA compiled from bibliographical references and databases. Guiding limit values were obtained on that basis for the maximum permissible injury severities according to body model and selectively verified by various laboratory control tests.

The results of the project were summarized in BG/BGIA recommendations for arranging workplaces with collaborative robots. It contains extensive aids for applying occupational safety measures in practice, as part of risk assessments. A team of experts with robot manufacturers and users collaborated in the development of the content.

Thanks to the BG/BGIA recommendations, workplaces with collaborative robots can be set up so that the potential mechanical effects on persons as a result of a collision do not exceed a tolerable level. These workplaces can be designed in a way to ensure the required occupational safety for the person in question. The BG/BGIA recommendations can be downloaded at: http://www.dguv.de/bgia/en/pra/kollaborierende_roboter/index.jsp.

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SESSION 5

OSH training
Training in occupational safety and health has several particularities. For a long time it has been the field of experts. Experts were teaching other experts. Nowadays, the problem of occupational safety and health is everybody’s problem. And everybody must be aware of the risks and what is to be done and what EACH OF US CAN DO. Nevertheless, the knowledge of experts must still be continually updated.

The type of training required varies according to target and objectives. Moreover, training efficiency indicators have to be adapted to different cases and their specific conditions. This is why we propose to distinguish between three types of training where we consider in each case: the target audience, objectives and indicators, concerns we may have and the type of evaluation we are conducting:

- Initial Training to fully integrate occupational health and safety into the curricula,
- Technical vocational training for experts (CRAM officers, company health and safety professionals),
- Important systems developed for teaching employees through national programs and processes.

In the following we will propose a methodology for developing knowledge in OSH. We will discuss the three different target audiences, the reasons why we have decided to train these particular audiences and how we measure efficiency and effectiveness of each action.

**Young people – Actions – Results – Evaluation**

In September 2006, several ISSA member states have shared a report and declared: “Young workers constitute a high-risk population with respect to occupational health and safety, because they are exposed to significantly more physical and more organizational constraints. They also sustain more accidents than older workers.”

**So, what have we done?**

In France, teaching occupational safety and health in general education is the result of a partnership between the Ministry of Education and CNAMTS. They have set up a national council to define a strategy. Based on this agreement, INRS has participated in work on diplomas and to date, 80% of the degrees have been reviewed in the industrial and construction sectors. 50% have been changed in the service sector, but only a few in commercial and administrative activities.

For engineers, we have built a common frame of reference for training which is based on the “BES&ST” prevention scheme. This action is supported by two ministries: the Ministry of Education and the Ministry of Industry. But statistics do not seem to show what we were hoping for.
As you can see, the frequency of accidents globally decreases with age. In 2006, 36.4% of the accidents involved people under 30 years of age. Considering the number of young workers the frequency of accidents for this age group is 63.1 for 1,000 people. But we are not really sure that the only reason for this finding is youth!

It is conceivable that one of the reasons is the number of temporary workers within the youth group but there are many other factors that could affect these figures.
Another problem is the evolution of accidents. The frequency of accidents has dropped slowly from 118 in 1955 to 39.4 in 2007. So we are actually talking about approx. 40 accidents for 1,000 workers; this rate is about 100 for 1,000 for people under 25, and there is bad trend.

**Would age and/or seniority (or any other factors) have a bearing on the occurrence of accidents?**

<table>
<thead>
<tr>
<th>Age</th>
<th>16 - 29 years old</th>
<th>&gt; 29 years old</th>
<th>All ages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seniority in the company</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 1 year seniority</td>
<td>117.9</td>
<td>99.2</td>
<td>108.8</td>
</tr>
<tr>
<td>≥ 1 year seniority</td>
<td>44.3</td>
<td>26.4</td>
<td>29.4</td>
</tr>
<tr>
<td>Every seniority</td>
<td>61.2</td>
<td>32.7</td>
<td>39.0</td>
</tr>
</tbody>
</table>

Statistics 2007, CNAMTS, INSEE

If we consider the total population we realize that there is a factor of 2.79 between junior and senior employees, whatever their age (108.8/39.0). This is to be compared to the factor of age which is 2.7 as shown before.

Some studies have been conducted showing that the conditions in which accidents involving young people are different to those accidents involving older workers. Several causes have been suggested: Irregularity of working hours, high proportion of temporary work, night work and repetitive handling work.

We can give some possible reasons:
- initial training does not correspond to workers’ first jobs
- there is no, or inadequate, support for workers entering the company
- young workers are assigned more frequently to tasks which expose them to hazards (e.g. manual handling operations)
- a first employment contract offers little job security (precarious jobs)
- other reasons?

This is why INRS is conducting a five years study that has begun in 2008:
Assessment of the impact of initial occupational safety and health training on the occurrence of accidents at work among the under 30-year-olds. The main aim of this study is to determine the impact of initial OSH training on the occurrence of occupational accidents among subjects under 30 years of age in their first job.

**What about engineers?**

In 10 years working with high schools and universities, we have tried different ways of teaching.
- Compulsory training during the students’ first year.
- Active classes and work on OSH during their practical work placements.

1 Stéphanie Boini, INRS, France – Impact of occupational health and safety training at school on the occurrence of work injuries in young people starting their occupational life
We have concluded that 18 hours is the optimum time for teaching and have developed a common repository for training material offered to each engineering school in France. This material has been approved by the commission des titres d’ingénieurs, a commission that is responsible for uniform standards in engineering schools. We nevertheless wanted to know the impact of OSH education in these schools to be able to propose a strategy to Ministerial Departments. So we have conducted a large quantitative study aimed at schools and at future and junior engineers, in the course of which their knowledge in OSH is also verified. We investigated all of the 226 engineering schools. In the first investigation, high schools evaluated the level of occupational safety and health training in their courses. The cover rate of this area of study was more than 85%, and the answers were given by general managers or department heads. All school sizes are represented from 9 to 4,250 students. Then, we interviewed 6,000 students and junior engineers and visited 22 schools for more detailed qualitative information. The purpose of the second investigation is for students and junior engineers to estimate the depth of the OSH knowledge they have acquired during their studies. Finally, they give answers to free-text questions in a specifically designed quiz.

According to the results, and with the support of the two ministries, we decided to continue and reinforce actions within a compulsory frame of reference, and to role them out to business schools.

### Technical vocational training for experts: Study – conclusions – actions

Technical vocational training is necessary to ensure a common language and approach in OSH to see to it that new concepts, new approaches and new solutions are taught and shared, and that appropriate skills are developed. Doctors’ and specialists’ work has changed. This is why we conducted a qualitative study on their needs in 2006. 9 groups of actors (58 people) participated in 3 different meetings conducted by 10 people. The meeting outcomes have been subjected to an in-depth analysis and have then been documented. So what are their NEW needs?

- Understanding a company (management, organization)

<table>
<thead>
<tr>
<th>High School</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ 14% claim teaching OSH is at very good level</td>
<td>▶ 3% think their knowledge is good</td>
</tr>
<tr>
<td>▶ 36% have begun awareness programs</td>
<td>▶ 48% think they have a basic but insufficient knowledge</td>
</tr>
<tr>
<td>▶ 33% teach OSH at a basic level</td>
<td>▶ 31% are aware and want to progress</td>
</tr>
<tr>
<td>▶ 16% claim that OSH is not taught</td>
<td>▶ 18% claim never to have heard of it</td>
</tr>
</tbody>
</table>

### Correlation

- Schools with whom INRS and CRAMs have worked obtain much better results.
- High level of correlation between frequency and intensity of program and results in the quiz.
- Auto-evaluation by schools correlates well with students’ own opinions
Cross-functional skills
(project management, team work, etc.)
Communication
Better knowledge of psychological and social risks
Cross-disciplinary work
To meet their needs we have developed a distance learning concept, we adapted the contents, opened classical classes up to different types of experts, and began to build a two-level training system.

Vocational training for everybody:
Act – verify – change indicators
It enables workers to relate and commit themselves to the relevant methods and tools, to make a meaningful and lasting impact on their environment, and to act in a continuous improvement approach.

The purpose is to reach everybody. Now that we have established a system to manage OSH training, we wish to know how many students that participated in the initial training continue their training once they work on the job, and how often they are able to participate in refresher courses.

Conclusion
We have to work according to which audience we want to train with what objectives. For this purpose we have to study the needs of the target audiences and use them to provide tailor-made contents. Afterwards the impact has to be evaluated which might lead to modification requirements.
Research on the effectiveness of prevention measures at the workplace

Quality Cooperation Qualification

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The statutory mission to provide qualification
In Germany, it is one of the roles of the institutions for statutory accident insurance and prevention to support their member companies by helping them to avoid or reduce accidents and occupational health hazards through preventive measures.

An important aspect of this support lies in providing qualifications for company experts and disseminators of information on occupational health and safety.

Each year, accident insurers organise approx. 20,000 seminars attended by over 400,000 participants. They are therefore the largest providers in this sector.

The measures are financed by the contributions from the insurer’s associated companies.

Qualifying the key parties involved in occupational health and safety as well as expertise in methodology and social skills through the professional training offered by accident insurers.

The complex field of “occupational health and safety” and the various target groups within companies demand an extensive range of courses and seminars reflecting aspects specific to the sector in question.

Qualification activities are considered successful if the qualified parties in occupational health and safety improve the standard of occupational health and safety in the particular company.

The quality framework model “Qualification”
In 2008, accident insurers decided to develop a quality framework model for the area of “qualification”. This was done to establish a common understanding of what is meant by quality.

The quality framework model is intended to help accident insurers to adapt and reflect on all the various aspects of their educational and organisational activities in the area of qualification when designing their standards. The accident insurers can and should breathe life into these standards in a variety of ways depending on the typical requirements of the sector.
Quality standards for core processes were established within the framework of the project as well as management and service processes for a quality management system for controlling and organising the qualification activities.

The quality framework model is a foundation on which appropriate sector-specific procedures can be built for the individual accident insurers.

The quality framework model can be divided into the following core processes:

- course planning
- course development
- marketing
- organisation
- implementation
- further development

For example, the requirements for the concepts and production of concepts in the core process “Course development” describe the following quality standards:

The requirements ensure that

- the qualification courses are developed systematically based on the need determined.
- they are developed using a standardised and systematic procedure.
- specific targets are defined for every qualification course and the concept adapted to meet the special characteristics and learning needs of the target group.
- the learning concepts are activity-based and focus on practical application.
- it is possible to integrate practical exercises wherever these are necessary to meet the objectives of specific qualification courses.
- the concepts state the expertise and qualifications required for teachers/instructors/trainers.
- the qualification courses are developed using knowledge and insights from associated areas of science.
- the results of the development are documented (e.g. learning objectives, content, methods, media, participant documentation, qualifications required for trainers, transfer goals).

They also provide examples of how the quality standards are to be achieved in practice by accident insurers:

- the objectives must be oriented strictly towards sector, company and target groups (activity profiles).
- the responsibilities for the developers of specific activities/products must be clearly defined.
- the requirements relating to the results of the development process must be described using various criteria. The development process must follow a series of defined stages.
- the focus must be on what the participant can implement in practice in the workplace.
- the integration of practical elements in the qualification courses, e.g. training hall/practical training rooms, must be documented in the trainer guidelines. Specific work group structures with defined roles and organisational structure for coordination and quality assurance must be established.
- we always integrate the latest insights from occupational science, occupational medicine and adult education as well as the sector and target group in question by ensuring that courses are developed by interdisciplinary development teams.
- trainer guidelines must be produced for every qualification offer.
The accident insurers implementing the quality framework model have undertaken to document its implementation, have it inspected through audits and further develop its quality through an internal process of continuous improvement.

**The quality association “Qualification”**

In December 2008, accident insurers founded the quality association “Qualification” (QVQ).

“Qualification” is a voluntary association of 35 institutions for statutory accident insurance and prevention and the DGUV (German Social Accident Insurance), represented by BGAG (Institute Work and Health), which implements the quality framework model “Qualification”. Its objective is to network members with the aim of ensuring and improving their qualification activities. It is pleasing to note that virtually all accident insurers have joined the quality association.

Members are required to provide regular proof that the quality framework model “Qualification” is being observed.

The members of the quality association are very diverse. They differ in terms of size and naturally sectors in which their various member companies operate, e.g. banks and insurance companies, construction industry or public administration. Furthermore, the association members are not all at the same stage of the development and implementation of a quality management system in the area of “Qualification”.

One of the QVQ’s most important roles is therefore to promote the exchange of experience through joint events, e.g. workshops. Tools are developed in projects and made available to all members. For example, this year sees the development of a model audit plan and a model audit checklist especially for the quality framework model “Qualification”.

Quality officers and auditors are being trained in the BGAG on the instigation of the QVQ. These seminars make it possible to qualify representatives of accident insurers specifically for the tasks resulting from the quality framework model.

Two projects are currently underway to produce a checklist for entry into a QM process and guidelines for implementing a QM system according to the quality framework model in the form of an implementation plan.

The quality association is setting up a communication platform, which all QVQ members can use to access information from other members and the results of the work conducted by the QVQ.

It is also worth mentioning that there are plans for a voluntary scheme to perform cross-audits between QVQ members. The QVQ is also expected to provide a forum for the presentation and discussion of new developments and research results.

**Conclusion**

With the quality framework model, accident insurers have created a foundation which can be used to make a common understanding of quality part of its members’ daily lives.

A common understanding of quality and the willingness to work together in the QVQ ensure that qualifications will continue to be relevant and of a high
standard going forward into the future.

The objective must be to help the parties involved in the companies to achieve and maintain a high standard of occupational health and safety using the resources available and taking account of the commercial considerations.
How to Ensure Transfer in Qualification Measures in the Field of Occupational Health and Safety (OHS)

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One key prevention service offered by the German Social Accident Insurance (DGUV) is a qualification scheme in order to decrease risks in safety and health. Such schemes are successful if participants learn how to implement the learning matters in their working environment. This topic has been analysed in many research projects conducted by BGAG (Institute Work and Health of the DGUV).

1. Subproject “Qualification” in the Project “Quality in Prevention” (QdP)

The goal of the subproject “Qualification” (Gallenberger, 2007) was to prove whether or not the basic and advanced training courses in the field of occupational safety and health (OSH) are effective and whether they fulfil the legal requirements. Participation in training courses/seminars is considered “effective” when, afterwards, the attendee shows a higher level of awareness and appreciation of OSH problems, when he/she displays a greater willingness to take action and has strengthened his/her abilities in the field of OSH. It is a fact that many companies have room for improvement in this regard. Prevention does not normally have a direct effect on the economic results of a company but is an element of a complex cause-effect chain.

Fig. 1: Cause-effect chain
Donabedian (1966) proposed a quality model comprising three key elements:

- Quality of the structure: prerequisites for example as regards personnel, material, organizational resources etc.;
- Quality of the process: actual provision of resources and
- Quality of the outcome: the results, for example achievement of OSH objectives.

Fig. 1 illustrates the assumed impact of the prevention service “training”. The time is plotted on the x-axis; quality elements and addressees are shown on the y-axis (on the right side).

The structure, process and outcome of OSH seminars were observed on the basis of a pre-post control group design. 126 participants had to fill in questionnaires before (t1) and after (t2) their OSH seminar and then three months later (t3). The speaker (N = 72) was also interviewed after the seminar (t2). The waiting group (N = 64) and the managers of the participants (N = 47) were interviewed before the seminar (t1) and three months later (t3).

The experimental and the waiting group are comparable in terms of company-related data (position, duration of employment, etc.). The effect of the seminars is represented by learning success, attitude change and transfer achievements. A significant increase in the participants’ knowledge was observed after three months (t3) compared to the waiting group (F (1,188) = 5.56, p < .05). In terms of attitude towards OSH activities no significant training effect could be observed (F (1,188) = 1.29, n.s.) in the experimental group. Both groups had displayed positive attitudes towards OSH before but they became even more aware of OSH.
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aspects after the course. After 3 months the participants showed greater OSH activity. A significant difference compared to the waiting group was found (F (1,187) = 6.14, p < .05). Therefore it can be stated that the seminars were effective.

In a second step coherences between the variables and transfer were analysed. Transfer was operationalized by the reported transfer achievement at time point t3 and the difference in OSH activity from time point t3 and t1. The method of partial correlation was used thus controlling certain variables such as knowledge, degree of OSH activity and the participant's attitude towards OSH at time point t1. Many significant correlations were found.

Correlations with reported transfer achievement at time point t3:
- transfer motivation after the seminar at t2 (.32**),
- support in the organization in terms of implementation at t1 (.31**) and
- satisfaction with the seminar at t2 (.25*)

Correlations with development of OSH activity at time point t3:
- support in the organization in terms of implementation at t1 (.39**) 
- transfer atmosphere in the organization at t2 (.23*)
- transfer relevance of the contents of the seminar (discussion of hands-on problems and possibilities of implementation) at t2 (.22*)
- participant activity at t2 (-.23*)
- attitude towards OSH at t1 (.19)

The results indicate that the supportive variables for transfer are located on different levels (as shown in fig. 1): characteristics of the participants, the design of the seminar and also organization-related structures. To achieve the best possible results participants should already have some ideas about their OSH challenges at work, so that they can discuss them at the seminar (transfer relevance). Speakers should try to design their seminars with the greatest degree of practical relevance possible and work on participants’ attitudes, satisfaction and transfer motivation. Last but not least, companies should try to offer participants a supportive environment when they return from an OSH seminar.

2. Evaluation instrument for OSH seminars

As already stated offering occupational safety and health training courses is one of the key prevention services of the accident insurance institutions. Training needs to be of high quality, which is why a standard to measure quality was required. The main question was: Which components of a seminar have to be observed in order to guarantee best quality, and how can they be reflected in a questionnaire?

2.1 Literature research

Literature research was conducted, and the results of the project: “Quality in Prevention” were integrated. 37 German standardized questionnaires of education events were analyzed; subsequently a pool of 1024 items was generated.

2.2 Criteria-based reduction

After a criteria based reduction of the number of items in the questionnaire, a preliminary evaluation sheet (ESA – Evaluationsbogen für Seminare im Arbeitsschutz) for OSH seminars was developed, comprising 58 items. These 58 statements were then combined with a six-stage Likert scale and a figural scale
from ‘strongly agree’ (+++) to ‘strongly disagree’ (---).

2.3 Components of the questionnaire
The statements concerning the
- organization of the seminar cover the
  quality of the structure.

The assessment of the
- seminar contents,
- transfer relevance,
- interaction,
- learning material permits certain
  conclusions about the quality of the process.

The areas of
- satisfaction,
- learning success and
- transfer motivation describe aspects of
  the quality of the outcome.

2.4 Analysis of items and subscales
An analysis of the item was conducted to
verify the quality of the questionnaire and
reduce the number of items again. Alto-
tgether 371 people assessed 27 seminars
offered by BGAG – Institute Work and
Health. The analysis of the items included
the determination of the index of popu-
larity (index of difficulty), discrimination
index and Cronbach’s alpha (internal
consistency). In addition a factor analy-
sis with orthogonal rotation (varimax)
was completed, and a solution with five
factors was found: 1. Contents of the
seminar and learning success; 2. Interac-
tion; 3. Quality of the learning material;
4. Transfer motivation; 5. Organization of
the seminar.

3. Online questionnaire for measuring
transfer
Besides evaluating a seminar immediately
afterwards by using the ESA evaluation
sheet, our customers also have the pos-
sibility to estimate the benefits from such
a prevention measure by using a ques-
tionnaire for transfer. All our question-
naires are created with a special software
solution for automated data processing.
This cost and time-saving method allows
data extraction from different formats,
i.e. from paper (via scanning or image-
import) or electronically in HTML and
PDF (eForms). Therefore the customers
can also use online surveys to evaluate
their seminars. One only needs the email
addresses of the participants, and they
can fill in the questionnaire three to six
months after the seminar. The underlying
theory is a stage model of transfer with
different levels. According to Kirkpatrick
(1998) the precondition for learning is
the participant’s satisfaction with a train-
ing course or seminar. On the next level
the assumed impact on the participants
can be observed, thereafter the impact on
the workplace, and finally, on the com-
pany itself. In the QdP project, 94.4% of the
126 participants tried to implement what
they had learnt. 73.4% initiated OSH
measures and 25% even passed on their
learning materials to colleagues.

This brief overview of the three projects
carried out by BGAG (Institute Work and
Health of the German Social Accident
Insurance) should make it clear that it
is possible and essential to combine re-
search and practical work. Incitement
from practical work can initiate new re-
search projects. On the other hand find-
ings from research projects will imme-
diately feed into consulting projects with
customers. In this way the methodology
of evaluating the impact of qualification
schemes will always be state-of-the-art.
Sources


In European educational policy, increasing teachers’ competency is a priority objective. This fact can be seen, for example, in the latest report by the European Commission on “Progress towards the Lisbon objectives in education and training” and the results of a research project carried out by Cedefop on the “Professionalisation of VET teachers for the future” in Europe (PROFF). But there is an increasing focus on teachers’ professional development all over the world, as shown by the OECD studies and the activities of ISSA’s “Education and Training for Prevention” section.

Teacher quality is now considered a crucial factor for successful learning and long-term transfer of knowledge to the workplace. As a result, there is a strong call for standards for teachers’ training. This paper begins by asking what a “standard of competence” is and how standards can contribute to teachers’ quality. The second section then looks at the example of a standard for instructors and trainers in health and safety.

2 Cedefop (2004), PROFF – Professionalisation of VET teachers for the future, Luxembourg
3 OECD (2009) Creating Effective Teaching and Learning Environments: First Results from TALIS, chapter 3
not guarantee the educational quality that has first to be created in each specific situation. Consequently, standardisation runs the risk of making something look like technology when it isn’t it or of self-reference. In such cases, the fact that a standard has been met signifies just that, i.e. nothing more than that the standard has been met. There is thus no automatic link between the standard and quality. Standards aim to create “sameness”, quality is about differences. Consequently, standards pose an inherent risk of making things uniform and evening them out. By contrast, the quality of a teacher’s activity could lie in his or her understanding of the special features of a specific situation and not in a reflected pattern of action, irrespective of the scientific evidence that support it.

The Standard of Competence for Instructors and Trainers in Safety and Health – an example
The European Network Education and Training in Occupational Safety and Health (ENETOSH) has developed a standard of competence for teachers in occupational safety and health. The ENETOSH Standard of Competence covers competencies both in educational methods and in the fields of occupational safety and health, health management and OSH management. The standard was developed on the basis of two different approaches – an experience-led, intuitive method (Phase I) and a work-analysis and empirical method (Phase II).

The ENETOSH EU project (Phase I) set up four working groups which prepared the first version of the standard. Beforehand, the project group produced two background papers. The results of an empirical requirement analysis were used for the area of educational methods and developed further on the project. The field-related competencies were developed on the basis of the experience of experts from the 10 European countries represented on the project. The development work drew on the categories and descriptors set out in the European Qualifications Framework (EQF). The

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7 Heid, loc. cit.
9 Reh, loc. cit.
10 The transnational network project ENETOSH was funded by the European Commission as part of the EU’s LEONARDO DA VINCI programme (146,253, 10/2005 – 09/2007). The core network comprised 13 partners from 10 countries. Today, 41 members from 16 European countries and South Korea cooperate in the network.
ENETOSH Standard of Competence has been recognised by 14 institutions from 10 European countries and is available in 11 languages.\(^{14}\)

Work on developing the ENETOSH Standard of Competence further began in April 2008 (Phase II). This development work is being done on the basis of the Critical Incident Technique (CIT)\(^{15}\), which had already proved successful in the empirical study on general trainer competencies. The necessary data is being collected with the aid of the Task Analysis Tool (TAToo©). The survey asks participants to cite critical teaching/learning situations and successful responses displayed by an instructor or trainer in these situations. These descriptions are then used to identify the competencies behind the response in a three-phase inductive procedure.\(^{16}\) To date, the “Workplace health management” and “OSH management” areas of competence have been revised. This was done by surveying a total of 44 experts, again from 10 countries, though some of the countries were different to those in Phase I. The experts are nominated by the members of the ENETOSH network. The survey is carried out using on-line questionnaires and a partially standardised, structured interview. In the first step, the participants are asked about work situations that they have experienced and observed in the past and that were handled successfully by an instructor or trainer. They are asked to explain how the situations arose, what precisely happened, what the instructor or trainer did in the situation and how the situation ended. They are also asked about their prior qualifications and knowledge. In the second step, the descriptions of the instructors/trainers’ response are grouped according to their similarity with competence requirements. The third step involves the participants evaluating the behaviour-related competence requirements, the prior qualifications and knowledge and answering questions concerning the completeness and meaning of the results. This evaluation is based on the criteria of importance, trainability and compensatability.\(^{17}\) In the area of OSH management, for instance, the percentage of cases in which the competence requirements corresponded to an instructor’s or trainer’s activity was 88%.

The survey concerning the “occupational safety and health” area of competence is currently getting underway. The “educational methods” area is being evolved on the basis of the modular “Train the Trainer” strategy employed by the Institute Work and Health of the German Social Accident Insurance (DGUV).

**Conclusion**
The purpose of the ENETOSH Standard of Competence is to create a common basis upon which to improve the quality of teachers in occupational safety and health in Europe. The standard is a recommendation and can be used both for recruitment and for CPD for teachers. It improves teacher quality if it enables

\(^{14}\) The standard can be downloaded from the ENETOSH internet platform: www.enetosh.net


teachers to take a critical look at their own behaviour in a specific situation and a reflective approach to their knowledge of educational methods and of their specific subject area in occupational safety and health.
Work, Risk Evaluation, Professional Training – Between Prescriptions, Activities Performed and Activities Prevented

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Abstract

Based on experiments in the field, we wish to show the connections between theoretical models and work which might provide the keys to understanding and a guarantee of effectiveness for the analysis of work, risk prevention and training. The aim is to create a dialogue between the prescription and the actual and prevented performance of work, prevention and training activities, with the objective of formulating theoretical and methodological hypotheses within research in progress.

Work, risk prevention and training are frequent research topics but are rarely examined together. An identical process linked, amongst other things, to the French system of subject disciplines leaves little room for cross-disciplinary university research, despite its well-known heuristic fruitfulness. One of the many possible benefits of this colloquium would be to leave behind this ‘organ pipe’ logic and to bring together research, risk prevention and training, the common and shared operational reference (‘référentiel opératif commun et partagé’, Leplat, 1997. P. 202) may have been subject to different design processes depending on the time, the participants, the resources, etc., overall it was viewed as an objective to aim for. Whether relative or absolute, however, this prescription nonetheless originated solely from representations and speeches by professionals on the practices which are expected from these fields, their social ramifications and the individual and collective ramifications for the subjects, whether prevention practitioners or learners, who apply them. All the while, the necessary requirement for optimisation must be upheld, because where work, prevention and training are concerned, if thinking is an absolute necessity, should the carrying out of operational scenarios not still be an obvious thing to do?

We aim to show that a dialogue involving a triple theoretical framework can open up certain prospects between the analysis of work, risk prevention, and the training of adults, which should more often be planned jointly rather than separately in order to improve the effectiveness of each.

Through our professional experience in the civil service (State and Territorial), we have observed that, even if work prescription, risk prevention and training, the common and shared operational reference (‘référentiel opératif commun et partagé’, Leplat, 1997. P. 202) may have been subject to different design processes depending on the time, the participants, the resources, etc., overall it was viewed as an objective to aim for. Whether relative or absolute, however, this prescription nonetheless originated solely from representations and speeches by professionals on the practices which are expected from...
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a social or political point of view, or their own practices.

We have always seen a discrepancy between the socially expected activities and skills and those implemented in situ in the immediate reality of the action: was putting the practices of informed professionals into words not sufficient either to convey this reality or to design prevention or training mechanisms? What about all the professional actions and decisions made on the spot in the midst of the action versus the specific oppositions of the moment?

Based on the work of Leplat/Pastré/Clot, and by way of example, we consider that, between the risk evaluation prescription and what happens at a given time in a particular context, keys to understanding (in terms of a method) can be found by making a distinction between the prescription, the expected task, the task performed, and the reality of the activity (prevented activities), and by looking for operational invariants, schemes, and conceptual and situational structures.

This distinction makes it possible to consider different grain sizes (Jackson, Pettit) when analysing and clarifying prescription and work situations. The prescriber thinks up, defines, and sets the task, and waits for a completed task (coarse grain), the observer (preventer, ergonomist, researcher) analyses the activity performed (medium and/or fine grain) and the person working carries out the prescribed task (medium grain) and describes the reality of his activity (fine grain).

The grain size of the analysis is chosen according to the objective (the ‘problem to be solved’), to give rise to either standards, instructions, etc. concerning risk prevention, or to gain access to non-observable behaviours which might nonetheless generate a risk of accident or a threat to health in the workplace.

Our aim was therefore to build a method that could combine these three perspectives based on three approaches, which can be very broadly referred to as an ‘analysis of work’ through professional didactics (analysis of work with a view to training) and the clinical study of the activity (process of verbalizing, clarifying, and training concerning the prevented activities).

From the epistemo-methodological point of view, we adopt a Bachelardian, Transversalist and Socio-constructivist approach in the context and given the social and professional aspects of the production of our work in progress, considering not that everything is relative, but that the relationship between science, technology and society can be extremely productive.

To understand the interactions between what is prescribed, the activity performed and the reality of the activity, we assert that the approaches and models proposed by professional didactics and the clinical study of the activity are equally valid in the given context of our work and for the use we wish to make of them, but we also wish to rely on validity criteria which would allow us to contribute new, operationally applicable knowledge in the field of prevention and training.

In conclusion, we wanted to demonstrate the interest as well as the limitations of prescription and distinguish the elements arising from prescription and from the activity performed. We have formulated the hypothesis that there is a link between the degree of quality required of the
work, risk prevention and training, and that of the evaluation of the work activity in its ‘prescription/actual activity/real activity’ triptych to conceptualise, design and perform a job, an evaluation procedure or a professional training mechanism.

In our opinion, the fruitfulness of the combination of ‘downstream’ prescription (the social expectations of work, prevention and training) and ‘upstream’ prescription (the expressions of practitioner and/or learner subjects) can enhance the effectiveness of risk prevention and training approaches. Their value will depend on the ability to mobilise the proposed ‘triptych’ more or less precisely in accordance with the work and situations concerned.

We consider that the process of opposing the conceptualisation of a training mechanism or risk assessment approach (the reasons why, the intentions, the principles, etc.) to the pragmatic application (the attempt to ‘operationalise’ the thought) cannot have optimum conditions for success unless the participants (developer, trainers, preventers, etc.) are individually and collectively mobilised and unless the agents (cultures, knowledge, skills, etc.) are identified and called upon.

Partial bibliography


Long-Term Study of the Effectiveness of the Work of Safety Specialists

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2 University of Jena, Germany

Safety specialists in Germany
In Germany, over 80,000 safety specialists are currently working in companies, in the public service and as self-employed management consultants. Together with company physicians, they play an important role in the creation and maintenance of safe and healthy working conditions in companies.

In 1974, the Arbeitssicherheitsgesetz (German Occupational Safety Act) in the Federal Republic of Germany made the appointment of safety specialists and company physicians binding for industry and the public service. After German reunification in 1989, this legislation also took force in the eastern German federal states.

Safety specialists (“Sifas”) provide advice to companies on all matters connected with occupational safety and health. The company is responsible for the safety and health of its operations and employees. The four main tasks of a Sifa are:
- To identify and evaluate work-related accident and health risks
- To prepare and design safe and healthy working conditions
- To continuously improve safety and health in the workplace
- To integrate safety and health aspects into management systems and management processes

In Germany, companies can choose whether to employ Sifas on a permanent-contract basis or to avail of external service providers. The “working time”, i.e. the number of hours a Sifa must be available to a company per year, is stipulated by the German statutory accident insurance institutions. Here, the number of employees, the industry and the degree of risk for the employees is taken into account.

To become a safety specialist in Germany you must fulfil the following requirements:
- You must be a qualified engineer, a technician or a Meister (Master technician)
- You must have at least two years work experience and
- You must have gained the necessary specialist skills in the area of safety engineering through participation in a recognised training course.

In Germany, training is carried out by the accident insurance institutions as well as by independent training companies. The training course to gain the requisite qualification in safety technology takes 12 weeks to complete. Since 2001, in the industrial sector, this course has taken the form of six weeks of attendance courses, combined with an electronic learning programme that takes another 6 weeks to complete. In addition, several weeks of practical experience culminating in a written report are mandatory. In the public service, there are two weeks of attendance courses combined with a remote
learning course of 10 weeks. Both training systems are to be merged into one joint training system for all Sifas by 2013.

Objectives and design of the study
There has never been much information and empirical data on Sifas’ activities in their day-to-day work after their training has finished, or on how effective their work is. However, considering the high number of Sifas in Germany as well as the costs of having the accident insurance institutions train and supervise them, this question is of high importance. Services in the area of prevention should be subject to evaluations, since those responsible need to know whether the investments made in this area are worthwhile. For this reason, the former German Federation of the Statutory Accident Insurance Institutions for the Industrial Sector – now renamed the German Social Accident Insurance (DGUV) after merging with the Federal Association of Accident Insurers – decided to commission a long-term study between 2005 and 2011 to examine the effectiveness of the work of safety specialists.

After an international invitation to bid, two institutes of the technical university of Dresden, Jena university and a consulting company from Cologne were commissioned to carry out the study under the supervision of Professor Trimpop (Jena). A group of decision-makers from the German Statutory Accident Insurance Association as well as an expert advisory board made up of prevention experts from the accident insurance institutions is monitoring the progress of the project.

The main questions the project is posing are the following:
- In which areas are Sifas working?
- What effect are they having in these areas?
- What is the role played by personal characteristics and competencies in these areas?
- How do general prevailing conditions of the company impact effectiveness?
- How do social and political changes impact the activities of the Sifas?
- How do the Sifas themselves judge their effectiveness and how do they see the role of other players in the company?
- How does the work and effectiveness of the Sifas change in the first several years after their training?

Around N = 2,000 Sifas agreed to take part in the study, all of whom had completed their training after the new training concept had been introduced in 2001. This random sample is representative for all Sifas trained since 2001. In addition, 300 companies took part in the study. The managing directors, works council representatives and company physicians of these companies evaluated the work and effectiveness of the Sifas from their point of view.

In 2008, N = 300 Sifas from the public service were added to the random sample. These Sifas only took part in the second wave of information gathering. Here again, company partners of the Sifas at the companies/offices selected also provided their answers.

The overall project is divided into the following individual surveys:
- Basic study: the Sifas are asked about their work and their assessment of their effectiveness.
- In-depth study: the Sifas are asked about their motives for doing their work.
- Validation study: the other players in
the companies (Managing Directors etc.) assess the work and effectiveness of the Sifas.

In all three surveys – which took place at different times – electronic online questionnaires are used. The respondents remain anonymous as a data protection concept is in place to ensure that the respondents cannot be identified in spite of the fact that they are completing the questionnaires electronically.

The questionnaires are extensive. The basic and in-depth studies include 268 and 141 individual questions respectively, the validation study contains 115 individual questions.

In addition, an internet platform was set up for the project (Sifa-Community) to provide information and a forum for exchange of experience for the participating Sifas. The study also assesses how the Sifas work with this electronic information system.

The long-term Sifa study is the most comprehensive scientific study of the work and effectiveness of occupational safety and health specialists ever carried out in Europe. There has probably been no comparable study of this scope carried out for other occupational groups either.

Results
The first basic study was carried out between January 2005 and December 2006. N = 1,926 Sifas took part in this study. The second basic study ran from mid-2007 to mid-2008. N = 1,003 Sifas took part in this second study, which still constitutes a representative random sample.

Status of study – study schedule

In addition, an internet platform was set up for the project (Sifa-Community) to provide information and a forum for exchange of experience for the
What are the main areas of Sifas’ work?
27% of all Sifas work full-time, 73% work part-time, 69% are employed by the companies, 10% are external service providers, 21% are both internal and external.

Around 40% of each of these groups have a university degree (engineer) or are qualified technicians and Meister (master technicians).

Over one third of all Sifas also have a managerial function in their company. Around 40% carry out other official functions in addition to their work as occupational safety and health specialist, e.g. as environmental protection officers, fire protection officers, hazardous substances officers etc.

The activities of the Sifas are prioritised as follows:
- Review of equipment, work areas, and workplaces
- Operating and other instructions
- Risk assessment
- Use of personal protective equipment
- Providing advice to employers

Workplace design, participation in investment and HR decisions, restructuring the workplace are rarely named.

Design of work systems based on the needs of workers is usually named as being more low priority. In this, the specialists from the industrial sector do not differ in their responses to those working in the public service.

How do Sifas assess their effectiveness?
One third of all Sifas assess their effectiveness in the company as low, in the second basic survey, this percentage dropped to 25%.
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### Type of work

<table>
<thead>
<tr>
<th>Type of work</th>
<th>B2 BG</th>
<th>B1 UK</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1 Behaviour-related organisational protection measures</td>
<td>3.84</td>
<td>3.63</td>
<td>***</td>
</tr>
<tr>
<td>T2 Analysis of risk factors</td>
<td>3.79</td>
<td>3.60</td>
<td>***</td>
</tr>
<tr>
<td>T3 Management of occupational health and safety</td>
<td>3.36</td>
<td>3.26</td>
<td></td>
</tr>
<tr>
<td>T4 Design of work systems in terms of technology and organisation</td>
<td>3.21</td>
<td>3.01</td>
<td>***</td>
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<tr>
<td>T5 Design of work systems in terms of HR</td>
<td>2.50</td>
<td>2.53</td>
<td></td>
</tr>
<tr>
<td>T6 Dealing with chemical and biological risks</td>
<td>3.32</td>
<td>3.26</td>
<td></td>
</tr>
<tr>
<td>T7 Analysis of incidents</td>
<td>3.13</td>
<td>2.83</td>
<td>***</td>
</tr>
</tbody>
</table>

(*<.05 **<.01 ***<.001)

### Comparison of Sifa types

#### Basis 1 BG

- A – the internal part-time Sifa with low intensity
- B – the internal part-time Sifa with high intensity
- C – the internal full-time Sifa
- D – the external Sifa
- E – the internal full- or part-time Sifa, who both...

#### Basis 2 BG

- C5
- C3
- C4
- C2
- C1

#### Basis 1 UK

- UK 5
- UK 3
- UK 4
- UK 2
- UK 1
The key personal success factors for Sifas are:
- Their role as a consultant to the company
- Identification with the company
- Cooperative focus on objectives
- Personal resources

The following success factors can be identified from the analysis of the assessed success and the personal and operational conditions. Accordingly, Sifas are successful in their company if
- they derive measures from an overall concept of the risk assessment,
- they have a cooperative relationship with management,
- there is a good culture of safety and health in the company.

The size of the company has no influence on success, there are highly committed Sifas in small companies, too. The extent of expertise is also only relevant if it is combined with the above success factors.

The first in-depth study took place between October 2006 and June 2008. Around 50% of the participants in the basic study took part in the in-depth study. Due to time pressure, it is not possible to report on the results of this motivation analysis of the Sifas here. Just one comment on the overall result: the main motivating factor for the Sifas is their conviction that the measures they initiate are effective in terms of employee safety and health. Sifas “act on conviction”!

Validation study
The first validation study was carried out between October 2006 and June 2008, i.e. in the same period as the initial in-depth study.

Managing Directors, works council representatives and company physicians from 309 companies took part. Recruiting participants for this random sample proved to be very difficult. As we needed employees from companies in which at least one Sifa had already taken part in the random sample questionnaire, the Sifas who had filled out the questionnaire were asked to persuade their company partners to participate in the study. However, the Sifas from the random sample were very reluctant to do this even though they had been assured that data protection regulations would guarantee that their answers could not be compared with the answers of their company partners.

The answers provided in the validation random sample study allow comparison with the overall random sample of the Sifas questioned but do not allow a direct comparison with individual Sifas from the respective companies!

The results of this study were surprising: All company partners questioned provided a more positive assessment of the intensity of the Sifas’ work than the Sifas themselves!

This is especially true when it comes to involvement in planning processes and in changing existing work processes, but not when it comes to taking action in the area of mental stress and strain.

The same goes for the assessment of the effectiveness of the Sifas. In the following areas, the Sifas’ company partners provided a more positive assessment than the Sifas themselves.
- Risk reduction
- Organisation of occupational safety and health
- Benefit to the company
There were different assessments only in the area of “decent working conditions”. Company partners also assessed their interaction with the Sifas more positively than the Sifas themselves. However, both groups provided a similar assessment of the safety and health culture in the company.

**Sifa-Community**

An information and communication platform was set up for the long-term Sifa study. It has been available to all participants at www.sifa-community.de since 2005. This homepage provides participants with the following:

- Regularly updated job-related information,
- Answers to the participants’ questions, provided by representatives of the researchers
- Opportunities for participants to communicate with each other about job-related matters.

This homepage, which was originally designed to simply complement the study, has since developed into an independent part of the study and has been very successful. The platform is now made available to all safety specialists once they have registered.

Today, there are almost 2,000 participants and over 2,500 contributions to the forums. New specialist reports continue to be uploaded, but the communication between the participants themselves has increased hugely. In 2008, a total of 590,00 and around 27,000 intensive visits were registered.

Thus, one of the most important results of the research is that the Sifas are very interested in receiving new information via internet and that they have a strong wish for electronic communication with each other.

**Practical conclusions**

The study results analysed so far provide important information. The success of the Sifas in their companies can be improved in the following ways:

- By selecting suitable people and providing them with specific further training/HR development
- By introducing a general concept for risk assessment and deriving suitable action from this
- By involving Sifas more intensively in the company organisation
- By developing general concepts for safety and health in companies
- By supporting Sifas with internet platforms for information exchange

Implementing the results gained from the research project will be one of the main tasks going forward.

**Further reading**

For more information about the project, go to www.sifa-langszeitstudie.de

An initial report on the study is to be published this year. It should be available from around mid-year. If you are interested in receiving this report, please contact the writer of this paper.
In Canada, in the province of Québec, the Commission de la santé et de la sécurité du travail (CSST, workers’ compensation board) is an organisation to which the Québec government has entrusted the management of the Québec occupational health and safety program. The CSST provides an insurance service to Québec companies that allows workers to be compensated following an industrial accident or an occupational disease (Web site: www.csst.qc.ca ). The CSST’s statistical data indicate that musculoskeletal disorders (MSDs) account for 37% of the injuries accepted in Québec from 2003 to 2007, or 210,458 cases. Of this number, the proportion of accepted MSDs due to manual handling was 50%, or 106,325 cases. For these injuries, the CSST makes payments of approximately $600 million Canadian (approximately $120 million annually), with this amount not including the costs over the medium and long terms. In addition, 65% of the accepted handling-related MSDs involve the back, for 69,000 cases in 5 years. Of the sectors most at risk, health and social services, food industries, retail businesses, transport, and wood industries are the sectors most affected. These five sectors alone represent 44.1% of the MSDs. The groups of professions with the most cases are specialized personnel and nursing or therapeutic assistants as well as manual material handlers, with approximately 16% of the cases each (Duguay and Boucher, 2009 1).

The Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST, occupational health and safety research institute) is a private non-profit organisation. The CSST provides it with most of its funding from the contributions that it collects from employers. Its mission is to contribute, through research, to the prevention of industrial accidents and occupational diseases, as well as to the rehabilitation of affected workers. Considering the extent of musculoskeletal injuries in handling, the IRSST has established a research program specifically dedicated to MSD prevention in handling, and more specifically to the training of handlers. The objective of this paper is to present this research program in handling as shown in fig. 1.

There are two major steps in this program. The first one is to identify and validate principles in manual material handling (fig. 1 #1) and thereby develop new ones. Principles can be seen as the safest and most efficient way for the body to move. For example, one of the most important principles is to keep the load

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1 Data available on this Web site: www.irsst.qc.ca/manutention
Fig. 1: Presentation of the research program on handling
Research on the effectiveness of prevention measures at the workplace

close to the trunk. In order to validate these principles, several research projects are in progress. For instance, handlers and novice workers have been tested in our lab while performing a series of box transfers under conditions similar to those in big distribution centres. Ergonomic observations and biomechanical data allowed the subjects’ handling methods to be observed and quantified. This is an original part of this program where ergonomists and biomechanicians work together to better understand the handlers’ strategies and to define the new principles. While various handling methods were used, experienced handlers worked differently from novice ones and followed basic principles. From these results, a new training content (fig. 1 #3) that will be transferable to the workplace is documented. This will be the second step in the current research program. First, relevant existing training content is reviewed and combined with recent information available from the literature and past research in our lab and other parts of the world (fig. 1 #2). The resulting new content will consequently be validated with novice handlers to verify whether they have applied the principles taught in the program (fig. 1 #4). At the same time, new tools are developed to measure physical exposure in order to be able to study workers in the field (fig. 1 #5). It is hypothesized that this novel approach based on the observation of expert handlers and principles will be more effective than the existing programs in reducing the rate of injury in the work field. Although recent studies have challenged the effectiveness of technique- and education-based manual handling training, we believe that training content better adapted to the work context and based on expert handlers’ techniques have more chance of being successful.

The research program is also accompanied by methods of knowledge dissemination (fig. 1 #6) aimed in particular at occupational health and safety professionals. First, a Web site specifically addressing handling was opened in the fall of 2008 (www.irsst.qc.ca/manutention; fig. 2). Its goal is to help professionals find

Fig. 2: Opening page of the Web site (www.irsst.qc.ca/manutention) on manual material handling.
relevant information on how to prevent MSDs in handling. The content is varied and based for the most part on the information available in the scientific literature. Great emphasis has been put on the identification of the risk factors and the means of technical prevention (engineering controls), administrative prevention (administrative controls) and behavioural prevention through worker training. A second means was the introduction of a semi-annual newsletter (Bulletin du réseau d’échanges sur la manutention) that informs the network’s members about all recent handling-related information. This newsletter is available to anyone interested in the prevention of handling injuries; to receive it, you just have to register on the IRSST Web site. This newsletter is accompanied by semi-annual lectures dealing with subjects as varied as, for example, women and handling. Finally, a discussion forum (accessed from the IRSST Web site) will soon be introduced to discuss the successes and failures of MSD prevention programs in handling. We believe that this research and knowledge translation program will allow occupational health and safety professionals to be better informed and thus have real impacts in the workplace.

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Impact of Occupational Health and Safety Training at School on the Occurrence of Work Injuries in Young People Starting their Occupational Life (Study Ongoing)

Stephanie Boini *)

Lots of studies highlighted the fact that the youngest people are proportionally more often injured at work, so that this situation becomes a concern not only in France but also in Europe, in the United States and Canada [1-6]. In France, for fifty years, the injury rate of young workers, although decreasing, has been higher than the overall rate. Young people constitute a priority target for preventive measures.

Results of studies focusing on the determinants of work injuries permitted to establish a characteristic profile of the victim: to be a man, blue-collar worker, young, temporary or recently employed [7-9]. The role of the type of employment, the branch of industry, the accumulation of occupational hazards, the intensity of work on the occurrence of work injuries seems well established. But other relations must still be studied: the length of service, the work-experience, the work supervision by a senior, the use of psycho-active substances [10-12]. Consequently, in Canada, prevention was centred on occupational health and safety training for young people [13]. In the United States, many approaches were targeted specifically on the occupational health and safety of young people but also new employees. However, few evaluation studies of these programs exist [14-17].

Thus the main objective of this study is to determine the impact of the occupational health and safety training at school on the occurrence of injury in young French people who start their occupational life. Secondary objectives focus on the role of other factors influencing injury occurrence in this same population: the effect of the type of contract, type of employment and activity sector (particular professional status, professional precariousness); the experience, know-how, seniority in opposition with the age; the continuing formation/information; the discrepancy between initial training and employment and the over-exposure to certain occupational risk factors (chemicals, manual handling).

About 2,500 people aged 18 to 30, leaving school to work in 2009 or 2010 and having completed a curriculum involving training periods in companies, will be included in this multiregional cohort study. At inclusion, information about their school course and personal characteristics will be collected. Then, during the two years of follow-up, a half-yearly contact will allow the recording of information about their occupational life and the update of some of the inclusion data. During the follow-up, occurrence of occupational injuries will be identified by matching with the database of compulsory declarations of work injuries managed by the Regional Health Insurance Funds. The relationship between injury occurrence and professional and personal
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factors will then be studied.

Results will be helpful for a better comprehension of the higher injury rates of young workers. The role of the occupational and personal factors will be clarified. In particular, a positive impact of initial safety training program is sought for. The identification of modifiable factors which influence the occurrence of work injury is a first step to allow for the proposal of adequate prevention strategies in younger workers.

Bibliography


Research on the effectiveness of prevention measures at the workplace


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SESSION 6

OSH information and communication
The aim of the present project was to investigate the quality and effectiveness of I & C products of the social accident insurance institutions and to deduce recommendations and opportunities for improvement. It was a sub-project of the project “Quality in Prevention – Effectiveness and Efficiency of the Prevention Services of the Social Accident Insurance in Germany”. It was divided into the following phases:

1. Literature search and review regarding the effectiveness of I & C products in the field of health and safety.
2. Survey of companies’ satisfaction with the products.
3. Collection of quantitative data from the social accident insurance institutions.
4. Evaluation of individual products provided by the social accident insurance institutions.
5. The social accident insurance institutions were questioned about any previous evaluation studies of I & C products.

The literature search and review showed that there are actually only a few studies that examined the effectiveness especially of OSH media. Otherwise, an almost bewildering number of books and essays on good graphic design of media exist. It is not certain whether they are based on assumptions, experience or empirical findings. Nevertheless, the results of studies allow a number of recommendations to be made, e.g. that it is important to explain the desired behaviour (through specific instructions on what to do and specific information about how to behave) and the advantages of the preventive behaviour. The desired behaviour should be derived from a model that is relevant to the target group. Furthermore, films are more effective when shown in a training context. And the impact of confrontational devices (negative, threatening or frightening content) is heavily dependent on the target group (age, gender, knowledge level) and the specific content. On the whole it can be stated: When used in isolation, i.e. a single brochure or poster, virtually all media have only a small impact on attitudes and behaviour with regard to health and safety. Media for the promotion of health and safety will only achieve maximum effect through interaction with other media and other prevention services.

The survey of companies’ satisfaction with the products showed that all the participants know of and use I & C products produced by the social accident insurance institutions. Journals are the most widely used product, but online resources are also used by the majority of participants, although not everyone has an Internet connection (this applies mainly to SME). I & C products are regularly sent to companies by the social accident insurance institutions, but are also actively
requested by the companies in the survey. In terms of the future format of I & C products, people continue to want both paper and electronic versions (CDs, online). There is still not much demand for products addressing psychological issues. It should be stated, however, that only few products on such topics are currently available. Regarding the interests of the employees, they are mainly interested in interactive I & C products that encourage them to act and show them what to do so they can copy it.

The collection of quantitative data from the social accident insurance institutions revealed that a huge number of I & C products are sent out and ordered. The high level of interest on the part of the insured parties is demonstrated by the high number of website hits and I & C product downloads. Fluctuations in the number of some I & C products that are sent is due to different reasons. Training courses, for example, are often followed by a rise in demand for the products recommended on the course.

Unfortunately, individual social accident insurance institutions have different methods for collecting their data. As a consequence, it is difficult to obtain an accurate overall picture. The possibility of introducing a standard recording system should therefore be considered. This would allow a clearer idea of the real demand for I & C products to be obtained. This, in turn, may provide a sounder basis for justifying the resources invested. There are almost no records of the number of telephone calls and e-mails asking questions about prevention. The few data that do exist suggest that these are very important information channels. Once again, the possibility of collecting this type of data in the future should be considered. Telephone and e-mail enquiries are especially useful for showing how urgently information is required by the insured parties.

The evaluations of individual products provided by the social accident insurance institutions revealed that the quality of the I & C products considered is generally high. For example, the respondents described them as comprehensible, attractive and useful. The survey results also confirm that it is important to provide different products for different target groups. For example, small business owners require in the first instance brief information that can be rapidly digested. This allows them to seek more detailed information if necessary. Meanwhile, safety experts and health and safety officers need more detailed information. The survey results also show how important it is to combine information material with other prevention services such as consulting, in order to ensure that the information is actually noticed at all. In the case of the introductory publication provided by the Berufsgenossenschaft for health and welfare services (BGW, a brochure that provides introductory information for BGW member companies, with references to more in-depth information) the survey results were differentiated for two groups: People who knew less about health and safety before they read the brochure thought that they were more likely to change their behaviour and attitudes than those people who knew more about the subject. It is however also true that people who know less about health and safety are less likely to read this type of brochure in the first place. So, these people are ready to change their attitude but will probably not take a brochure and read it. It is thus important for information material to be combined with other prevention services such as consulting, so that the material can be handed out directly.
The social accident insurance institutions were questioned about any previous evaluation studies of I & C products. This should give some information about the extent to which the insurance institutions already analyse the quality of their products, and to complement the findings of the literature review with previously unpublished results. Up to now, products and campaigns are evaluated only sporadically. Further evaluation studies would be useful to help identify both the good products and the not-so-good products. The better products could then be used as a model for new product development.

Regarding the future, the most important advice may be to discuss the goals of a product in-depth before its production. It seems that “effectiveness” is often implicitly equated with changes in behaviour or reductions in the number of accidents. In other words, we ask how much safer people’s behaviour is once they studied the information. But I & C products will rarely if ever prevent an accident or change people’s behaviour in the long term. Their goal is actually to present the facts in a comprehensible, appealing and clearly structured manner, and to spread information about health and safety, thereby considering the target group. How this can be achieved best, should be clarified at the beginning, i.e. when we start to develop a new I & C product.
Introduction
One of the means favoured by INRS for diffusing the results of its studies and research encompasses making a wide range of communication and information products available to enterprises. These different products also recommend the respect of safety instructions, and are sometimes proposed to assist in the development of other communication products more specific to the context of the enterprise. Intended for a very broad public, it follows that their intrinsic qualities are not always sufficient to guarantee their efficiency in extremely varied and increasingly fluctuating working environments. Moreover, a previous study highlighted in particular the conviction held by most users that optimizing the impact of these communication and information tools in prevention requires the combined use of several products and adequate management of the preventive initiative accompanying them.

Objectives, Methodology
To get a clearer view of the actual use of these products in enterprises, a survey was conducted among 300 safety managers of French enterprises with workforces ranging from 10 to over 500 employees belonging to 10 different sectors of activity. Each interview, taking the form of a telephone conversation, lasted between 25 and 65 minutes. The results allowed the establishment of a list of efficiency indicators for the different communication and information products made available to enterprises according to their effective use, the aim being to optimize the diffusion channels of the results of prevention research and the concrete applications in enterprises stemming from them.

Results
The context of the enterprise: considerable heterogeneity
- Each sector of activity has its own requirements linked to its intrinsic mode of operation; communication product designers therefore cannot integrate every eventuality.
- The person in charge of safety in the enterprise also represents a highly heterogeneous category: while being clearly designated in over 9 out of 10 enterprises, only 54% of them hold the title of safety manager (18% with this exclusive title, the others having been assigned it in addition to other joint responsibilities such as environment, quality, etc.). Moreover, while the average time set aside for safety by those designated is 50%; full-time occupation is observed in only 23% of the enterprises questioned. This how-ever is clearly a discriminating factor for the introduction of prevention initiatives and the use of prevention products.
- In addition, only in certain enterprises (less than a quarter of our sample) can...
these managers rely on a communication department for back-up, mainly for logistics and diffusion and more rarely for the design of documents.

The prevention communication tools used by enterprises

The general term “tools” employed in relation to communicating and informing about different elements of prevention in fact encompasses two broad categories that must be very clearly distinguished: “physical products or supports” that the enterprise procures from prevention organisations like INRS or creates itself in order to approach the specific problems of the enterprise; prevention actions and initiatives that the enterprise decides to implement that will both integrate and sustain the aforementioned physical supports, sometimes in a very specific manner.

While in the case of “physical” products an a priori intrinsic evaluation is often conducted by the issuing organizations, thus ensuring their validity (evaluation possible at several levels: media experts used, prevention experts, sample of users), the same does not apply to the prevention initiatives taken in enterprises. In general, their evaluation is almost always carried out ex post facto, inside the enterprise itself, and is mainly limited in scope to an overall appraisal of the results obtained without always entering into an in-depth analysis of the factors of success or failure.

- The products: these are not all on an equal footing, notably as regards their objective: awareness raising, information, reminder, regulations, etc., even if they all aim for a longer or shorter term change of attitude and even behaviour. Moreover, they may be intended for an entire enterprise or merely part of it; besides, each product requires

a different investment in terms of financial, human and temporal resources. The lawful safety panels, of the compliant type, was found in 95% of the enterprises questioned and, along with safety instructions, workstation safety data sheets and practical safety guides (90%), constitute the bedrock of the presence of information products concerning safety. Safety posters are in use in 86% of the enterprises questioned despite criticism of their incongruity in relation to the specific activity of the enterprises and their sometimes old-fashioned appearance. Specialised journals and periodicals, brochures and technical documents, as is the case with the INRS internet site, are used by two thirds of the managers within the context of active preparation to extract relevant elements and thus simplify presentations intended for employees (intermediate product). Less than half the enterprises use videos, due to a lack of projection equipment, insufficient budget for its acquisition, impossibility for managers to view content before acquisition or viewing time constraints on the part of employees. Intranet sites dedicated to safety generally host all the regulatory documents, safety guides, instructions, simplified information, reports, accident analyses, and anomaly feedback follow-up files. They are sometimes backed up by a safety section in the in-house magazine. Communication on safety by different objects in conjunction with prevention (t-shirts, first-aid kits, safety waistcoat, …) is encountered more particularly in large enterprises, sometimes as a means to “reward” their employees. Few managers have had the occasion to use theatrical events, deemed too expensive, though certain have at least done...
role plays or situation simulations. Generally speaking, the absence of a person designated to safety is felt in the existence of information products in the enterprise, and the more time this person puts in, the more he or she uses information products (85% of the enterprises not using posters have no person appointed for safety!).

- The actions: among the actions and initiatives taken, training courses are mostly used (89%). Information sessions (68%) and direct communication (67%) follow, often used together. Safety campaigns (45%) need more time and logistics and, as a result, are to be found more in large enterprises. Followed by audits (45%) and safety animations (30%), often used in combination.

- The choice of approach and products is of course dependent on the objectives set by managers. In this respect, to change the behaviour of the employees, they prefer training courses, direct communication or meetings with audiovisual back-up; to teach employees new things, training, again backed up by audiovisual facilities, is favoured. On the other hand, to remind staff of things already known, they rely on posters and direct reinforcement communication. The meeting would appear more suited to improving safety results, in this case reducing the information products to a congruous portion: encouraging employee participation would require further direct communication, the products then serving as triggers or supports for dialogue and exchange. However, it is interesting to note that to achieve prevention objectives, it is not the information products themselves that are emphasized by the managers questioned, but more the initiative or action:

**Conclusion**

The aim of this telephone survey-based analysis was to place the question of the use of information products in the context and the environment of the enterprise. Safety and prevention in these enterprises are, to say the least, subjects of specific concern, and sometimes even form part of the culture of the enterprise. Means of prevention contribute to creating a favourable climate, advancing the enterprise and evolving prevention. They help reduce occupational accidents or health problems, and behavioural changes have been observed during targeted actions.

For the majority of those questioned, dialogue is vital to ensure that employees are more directly involved in their own safety. Participative management and the unreserved willingness of the directors would therefore appear to be necessary conditions, as are the continuity and the follow-up of the policy implemented.
**Improvement of the Quality of OSH Information and Communication**

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**Introduction**
The internet is a valuable tool for collecting and evaluating good quality OSH data and provides the mechanism by which information for employers and workers, researchers or policy-makers can be prepared and delivered. The flexibility of the internet means that the information may be statistical data sets, practical tools, research reports or description of good practices. This presentation focuses on the collection of information; selecting, processing and using it in different kinds of documents and on possibilities to assure the quality. It shows by means of two examples the challenges, difficulties and benefits of using information from the internet. Good practice is defined and illuminated with examples to achieve a common understanding on it in order to use the information in an effective and useful way.

**Information collection**
Through publication in the internet, OSH research can enter into the public domain quickly, reducing the delay before data have an impact, and allowing rapid comparison, analysis, and evaluation of the research. Together with existing practical examples (case studies), the OSH research forms the basis of information for workers and employers. This stage is challenging as it requires the translation of expert knowledge into a form that meets the needs of the identified target audience. The needs of a worker may differ from that of an employer or an OSH professional acting in the workplace. The parallel use of scientific data (research results) and practical data (case studies) is the core of OSH communication.

The main areas for the use of OSH information are the development of expert reports, the development of OSH information at workplace level, the preparation of OSH campaigns and the development of an EU-wide OSH information data base. The main work is based on collection and evaluation of online information. The work may be challenging because not all EU member states have published their OSH information on the web. In such cases a good network of partners and information sources is crucial. To achieve these benefits, there are several challenges that have to be overcome, particularly when working at European or global level. Working at EU level means trying to get information from as many EU member states as possible: in the best case from all EU member states. The work also includes facilitating the development of a common European approach in the practical implementation of legislation in the workplace, sharing of knowledge between information providers to achieve a consensus, provision of knowledge to policy makers to facilitate decision-making and comparison of information and the identification of both differing approaches and common success factors.
Definition of “good practice”
Good practice is difficult to define; though there are several features which should be met. Good practices are practical innovative solutions or procedures, successful in the long term and with the overall view of all issues which makes them sustainable. They are innovative solutions used in the everyday working life and transportable (as a whole or partly) to other companies and operational procedures horizontally and vertically (multiplying effect). Possibly existing (industrial) standards should be met or even exceeded. Good practice is not always best practice, as it is often difficult to define the very best solution and in many cases different solutions can collocate. Additionally good practice is in constant development; “best practice” can become very quickly the norm and may remain static. Bringing these general features to the OSH area, “good practice information should provide persons who have a role in occupational safety and health with knowledge to allow them to improve working (and in some situations, living) conditions to reduce the health and safety risks to workers at workplace/enterprise level.”

According to the EU OSHA guideline “the definition of good practice varies between the Member States due to the different occupational safety and health systems and legislation, culture, language, and different experiences. In addition, different groups with different interests and levels of knowledge have different points of view related to good practice at workplace level.”

These paragraphs already show how difficult it is to search for “real” good practice information on the internet; not every piece of information called good practice is covered by the definition given and can be used as such. Preparing good practice information for different target groups requires a clear and reproducible definition of good practice.

Analysing and presenting OSH information to support OSH communication
High-quality and up-to-date information is necessary to establish effective OSH communication between stakeholders and to make progress in combating safety and health problems in Europe. To reach different target groups (policy makers, workers’ representatives, workers, OSH-experts) information has to be prepared and presented aligned to the correspondent audience. Case studies, policies or overall prevention reports are tools/instruments to support this aim. Policy reports promote the understanding of existing OSH communication strategies and campaigns. Case study reports support the exchange of good practice solutions (experiences) with other companies (among companies and) to improve working conditions within their companies and prevent occupational hazards all over Europe.

Two different kinds of reports were selected to illustrate the benefits (possibilities) and challenges (problems) of preparing good practice information for special needs.

Prevention report cleaning workers: An example of the challenges and benefits of preparing good practice information and the role of communication
Following identification in the European

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Community Strategy that some worker categories are still overexposed to occupational risks, a report on the prevention of harm to cleaning work was commissioned with the primary target group of OSH professionals and policy makers. This report had to consider the complex interaction between workplace risks (e.g. dangerous substances), work organisation (subcontracting), labour policy (illegal labour), and a particular workplace demographic (typically female and often immigrant). To achieve a broad overview about actions taken in the EU member states to prevent harm to cleaners it was necessary to gather information from as many EU member states as possible, from different approaches as well as identifying the success factors. Questions that have to be analysed and presented are amongst others: the aim of the project or campaign, the scope, the success factors and the transferability.

Policy report on occupational exposure limits (OELs): Dealing with rapidly changing and politically relevant data

Many enterprises, workers and OSH specialists are looking for practical information, background information and instruments to handle dangerous substances. OELs are one of the major control instruments. The aim of this report was to prepare a policy overview. To reach this mission ideally all member states had to be covered in country reports. Relevant information that had to be collected and evaluated was: legal basis, scientific basis, detailed regulations concerning OELs, guidelines and recommendations how to apply the values, accompanying initiatives or programmes to support the use of the lists critical and political statements and the evaluation of the implementation. A network beyond the internet was needed for data collection and to ensure the timeliness of the information.

Solutions/Recommendations

OSH workplace level information has to be prepared with very detailed background information, considering the experiences and positions of social partners (workers and employers), and academics. This requires a good network of informants and experts. The core of OSH communication is bringing together the scientific data and the practical experience (good practice). The dialogue with the social partners is crucial for the implementation of outcomes. Working at EU level means trying to get information from as many EU member states as possible: in the best case from all EU member states. Selecting and preparing case studies at enterprise level often requires the original language to get in contact with workers, employers or safety representatives. Often only general information is published in English and does not allow a quality assessment. In depth information for case studies can only be retrieved by personal contacts (to people involved in the good practice solution) and knowledge of the language in question. This also applies to policies like campaigns: they are mostly carried out in the national language. General information has to be searched via the internet. The selection and determination of high quality information is crucial and requires exact investigations as well as a broad knowledge about the European (or even worldwide) situation and legislation and clear criteria for the selection of the material. The OSH information provision is also unbalanced in some areas on the internet and the nature of the internet in general is unregulated. Information has to be put in the right context/scope. Specific information has to be acquired from experts. This requires a functioning network. There is a need of
appropriate tools to prepare and evaluate the information. Legislation and regulations are permanently developing. For that reason it is crucial to look for up-to-date information. Sometimes regulations are in the process of changing and have to be updated while a report is prepared.
Measuring the Effectiveness of Prevention Campaigns

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1. Introduction
Prevention campaigns of the statutory accident insurance in Germany have the goal to protect employers, supervisors and employees against accidents, diseases and/or work-related health hazards through raising their awareness and educating them. Upon completion of the nationwide healthy-skin prevention campaign a new prevention campaign with the title “Fight the risk” is being prepared for 2010/2011 focusing the main measures in three fields of activity: workplace-related accidents in transport and traffic, pupil accidents in road traffic, and work, service route and commuting accidents on public roads. Accordingly, the verification of the effectiveness of this campaign requires a complex evaluation concept which we have organised on eight different levels.

2. Campaigns in prevention
Apart from the classical prevention measures the statutory accident insurance institutions have increasingly applied campaigns for the prevention of accidents and diseases in the past few years. The prevention services’ campaigns are performed in a coordinated way as a set of combined activities using different media and a specific schedule-based plan, in order to address the target group and to reach the desired effect with a defined effort. According to Rogers and Storey (1987, from McGrath) social-communi-
of the measures also play a role. Evaluation criterion is the effort of all campaign partners. We assume that the campaign will not achieve its goals, if the activities are not perceived by the target groups. In order to enhance the scope and presence of the campaign, the activities and measures will be documented and categorized by all partners with the help of a developed excel-sheet.

### 3.2 Media response

On the second level we perform a media response analysis to see which campaign activities were taken up by the media. It gives information, when where and how which information was accessible to the target groups. The messages from print and online media, television and radio transmissions will be documented and analysed on a monthly basis with regard to both frequency and content. The frequency analysis shows the occurrence of messages in different media. The content analysis however refers to a subjective evaluation of the messages in line with certain criteria of the campaign. In the collection of the data we made a distinction between two sources:

- The press echo which comprises all messages found in the media of the press.
- The own media which comprise all messages found in the media of the campaign partners.

The messages of the different media were entered into an excel-sheet on the basis of a developed scheme.

### 3.3 Perception level

On this level the target group of all campaign activities moves into the field of efficacy for the first time. Here we ask whether the target groups have perceived the campaign, what they remember after a period of time and what they associate with the theme. We will measure this level with an online-questionnaire for occupational safety specialists in a pre-post evaluation design.

### 3.4 Behavioural/Change level

The examination on the fourth level, whether and to which extent a program caused real changes in the desired direction, presupposes a specification and operational definition of program goals and success criteria. Thus a program is considered effective only if it causes a change in the direction of the goals set. We will measure this level with the help of the following parameters: increase of knowledge, attitude change, change of image, change of behaviour. Again the chosen evaluation method is an online-questionnaire for occupational safety specialists. In addition, on this level we have built so-called “institutional partnerships”. That means we evaluate the change within the target groups together with different partners of the campaign, who have direct access to the companies by means of paper-and-pencil questionnaires.

### 3.5 Impact on companies

The fifth level describes the economic success of a campaign. The usual criteria on this level are the number of accidents, cost savings and increase in sales. But in case of this campaign it is impossible to take the number of accidents as a criterion especially because of methodical problems. We explained that in a special position paper. For the time being we discuss the measurement of this level through a model calculation or a cost-benefit-calculation.

### 3.6 Quality of the structure and processes of the campaign

The process evaluation on the sixth level aims at optimizing our own structure
and processes in order to learn for future campaigns. We will measure this level with an online-questionnaire to be answered by all organizing groups of the campaign. Relevant topics are the design and the theme of the campaign, the services of project management, the communication and cooperation process, the planning of activities and learnings for the next campaign. In addition we will perform interviews with decision-making persons.

3.7 Recommendations and advice to the institutions for statutory accident insurance
The structure of the campaign comprises an umbrella campaign and various individual insurers’ campaigns. On the seventh level of the evaluation concept we give recommendation and advice to all carriers of the campaign how to evaluate a carrier-specific campaign. Every carrier-specific evaluation concept will be an individual solution because they follow slightly different aims and activities within their own campaigns. Therefore we offer courses, workshops, individual consultation, and a lot of documents and check lists. The individual consultation includes the evaluation concept, the methods and instruments, the execution of the evaluation and the reporting.

3.8 Feedback of the evaluation
In regular intervals and during a continuous process we will feed back the results of the evaluation on the eighth level. They are interesting for decision makers, partners or carriers of the campaign and for the target groups.

4. Workgroup evaluation
To develop the eight levels of the evaluation and to discuss all working steps in detail we established a “workgroup evaluation”. In this group there are representatives from the institutions for statutory accident insurance and prevention and the German Road Safety Council (DVR e.V.) as well as other independent scientists with expertise in workplace-related transport and traffic accidents, pupil accidents in road traffic, and work, service route and commuting accidents on public roads as well as in evaluation methods and campaign design.
European occupational safety and health legislation places general legal duties on employers and workers. For example, the “framework” directive requires employers to “ensure the safety and health of workers in every aspect related to work” and workers to cooperate with the employer “for as long as may be necessary to enable the employer to ensure that the working environment and working conditions are safe…” (Council Directive 89/391/EEC). Such a goal-setting approach leads duty holders to ask not WHAT they need to do, but HOW they should go about achieving these goals.

The European Agency for Safety and Health at Work (EU-OSHA), set up in 1996 on the legal basis of Council Regulations to contribute to the improvement of working life in the European Union, is the main EU reference point for safety and health at work.

In its founding regulations, EU-OSHA is required to “play a leading role in the collection and dissemination of information on good practice” (Council Regulation 1112/2005). Recognising that the range of stakeholders require differing approaches, EU-OSHA publishes many types of materials, from risk assessment tools to detailed reports, from simple fact sheets to E-facts describing more technical approaches to specific issues.

“Case studies” is the term used to describe examples of “real life” situations where a change has been made resulting in the elimination or reduction of risks to workers.

The case studies are used in conjunction with other materials, such as risk assessment tools to provide a range of practical materials so that not only the steps that are required in theory would be described, but they can then be illustrated in a practical situation.

For the purposes of EU-OSHA, a case study is a structured examination of an actual (not theoretical) situation in which there are specified interventions and identified outcomes. In examining the actions, the study tries to identify what worked – the success factors – allowing a meta-analysis of these success factors to draw up strong common approaches for preventing harm to workers.

Case studies are published to illustrate that action can be taken and that solutions do exist to many occupational safety and health challenges and that these solutions may be transferable to other workplaces.

EU-OSHA has established criteria for assessing the suitability of case studies and a simple structure for publication. These criteria include that the intervention...
should be clearly identifiable as the action to cause the elimination or reduction of risk, by achieving an identifiable and permanent benefit, and at least meeting the relevant legal requirements.

Examination of the case studies’ “success factors” has also led to the identification of essential components for a successful workplace intervention. These components include the application of a methodical approach to workplace safety and health issues, a participatory approach to problem solving, the use of multidisciplinary teams, and the sponsorship and support of management.

Since 2000, EU-OSHA has sought to make available case studies through both the collection of material by expert institutions and through European competition. Accessibility of the material has been greatly enhanced since 2008 when EU-OSHA created a database on its website (osha.europa.eu) of the approximately 600 cases it has published.

The case studies are presented in a common format. There is an abstract containing the title, name of enterprise or organisation, date, and three text sections entitled “the issue”, “the action”, and “the results”. The abstract has metadata attached to facilitate searching by sector, keyword, and Member State.

The case study normally comes with a PDF file of the relevant section of the Agency report where the study was originally published or with a link to otherwise unpublished documentation relating to the case study in greater detail. The abstracts are of a length to facilitate translation (currently all material is in English only) but it is hoped that translation of the abstracts will make the resource as accessible as possible across Europe.

The cases published have been on subject matter as varied as young workers, the construction sector, and noise at work. In addition to publishing these case studies, EU-OSHA has created a searchable online database to ensure accessibility of the material available. They are viewed as an effective format for communicating information on solutions for occupational safety and health challenges to workplaces.

**Case studies for intermediaries**

EU-OSHA provides case studies not only for those operating in enterprises, but also examples of approaches for intermediary organisations. A challenge facing the occupational safety and health stakeholders is how to cascade information into workplaces at a time when small- and medium enterprises (SMEs), and micro-enterprises are identified as being at particular risk (European Commission 2007). Some case studies published by the Agency describe actions by intermediaries in communicating knowledge to the workplace, whether the action is campaigning, training or a mixture of approaches.

**Limitations to the case studies approach**

Limitations to the use of case studies should be noted both in the collection of data and the application of the published studies.

EU-OSHA looks for cases that reflect the modern work environment. A balance is needed between maintaining a structured and analytical approach while maintaining currency and relevance in the workplace. The case studies are not considered scientific literature. Although they are analysed their intention is to illustrate
and guide, rather than present formal academic results. The limitations of case study usage should also be noted. While the conceptual approach and techniques used may be employed, the solutions illustrated cannot be copied directly from one workplace to another. They have to be fitted into the context of the workplace’s hazards, risks, and preventive and work culture. There is a danger of presenting solutions that implementers may not follow a risk-assessment-based approach. For example, if a case study illustrates the use of personal protective equipment (PPE), there is the danger of the reader of that study implementing a PPE-based solution rather than trying to eliminate or substitute the danger in the first place.

**Bibliography**


Good evening ladies and gentlemen

I would like to deeply thank the organizers for inviting a trade unionist to participate in a conference pitched at prevention officers. Our organization, the Confédération des Cadres en France, represents French executives. The invitation is an honour for us, and we even consider it symbolic.

Isn’t it indeed significant that we decided to make prevention one of our priority fields of activity? It is a fact that this topic has given rise to some alarm and needs to be seen against the backdrop of rising stress levels at work.

My talk is a challenge too. I have been an occupational physician for thirty years. As you well know I have been practicing preventive medicine. However, as I was going along during the first ten years of my profession, I realised that there were missing links to be addressed. The true challenge of this talk is to let you understand that I have found these links through my experience as a trade unionist.

As a union officer in the French and in the European Confederation of Executives and Managerial Staff, I would like to outline this shared approach. My work as a trade unionist in various organisations and many years of experience gathered in training sessions granted me insights I was unable to gain in my work as a company doctor.

In addition, our Confederation, as an organization, initiated workshops to thoroughly discuss issues and exchange, share and modify related documents to an extent a company doctor can only dream of. Finally, having these discussions in organisations which are able to make an impact by way of communication and publication, will strengthen the mission of safety in the workplace.

When I majored in social psychology in Nice, I had already been deeply impressed by the experiments conducted by Kurt Levin on group climates and leadership which can be authoritarian, democratic or laissez-faire in style. The leadership style determines whether or not positive behavioural change will be quick, real and of lasting effect. Levin showed that changing behaviour is not dependent on the money invested in publicity or training seminars but on workers making a deliberate choice (after group discussions with their peers).

This is what I would like to share with you.

The focus of the work is on the stress experienced by executives and service sector employees. France has not exactly been a trail-blazer in this respect, and ILO gave us a great deal of support with their studies and research conducted in other countries. What is important is the approach: once an organisation has un-
understood the importance of prevention, all stakeholders – and not just preventive officers – are invited to participate.

**The situation**

France disposes of a system of recognition of occupational diseases which is very democratic at first glance but in reality is difficult to access not least due to the business leaders who have no interest in a greater number of claims granted as this would increase their social contributions.

The recognition of the worker’s claims might indeed be the job for a lifetime as we have seen in the cases of lead, asbestos and silica-related diseases. Homeric battles were fought to have these diseases recognized as work-related. Recognition is the first but not the least obstacle. Everybody, even those who are interested in such topics, fail to see the reality of work other than physical tasks. If a person does not move loads, his or her work will always be considered easy and effortless. This, for example, is a difficulty in the evaluation of static work which would nevertheless be tiresome and pose constraints.

Work is never purely physical or intellectual; there is always some intellectual work involved in any job just like in any human activity. The lion’s share of management work is marked by cognitive, emotional and psychological activities; unfortunately we have no means of measuring the effort involved. The work is so to speak invisible or lacks activity – which is not any better. Currently, we can just rely on the narrative about the workers’ personal experiences during and after work and recovery. There is no dearth of testimonies provided by my colleagues from the trade union. This anecdotal data cannot be ignored even if it is not scientifically sound. There are some biological indicators such as salivary cortisol, urinary catecholamines, electroencephalography, the brain scans or the measurement of cutaneous resistivity. But they are rough and indirect measurements, and the lack of counterarguments is the reason for the idea that non-physical work should be effortless. “And yet, it does ache,” could have said Galileo.

The lack of understanding the stress involved in non-physical work makes it difficult to improve conditions. It is up to those who do see need for improvement (i.e. company doctors and trade unionists) to speak up and minimise stress levels not least in discussions with the government.

**The project**

This situation is anything but new. Since 1993 ILO has published epidemiological studies and solutions introduced by the Scandinavian and Anglo-Saxon countries. The complaints expressed by company doctors and trade unionists refer to the same phenomena even if they are difficult to be communicated and almost invisible in society to non-experts. France seems to be lagging behind in Europe when it comes to a social dialogue to discuss the findings of recent studies.

As a result of this situation a working group has been set up by the Confederation with the objective to change attitudes as regards the burden of non-physical work.

We have to do away with preconceived ideas and must convince people that it is intolerable for employees to become ill due to work-related stress (which hasn’t got anything to do with destiny or personal weakness).

To challenge public opinion and in particular the media, journalists, public opinion leaders etc. it is necessary to
speak their language and understand how they work. This is a sine qua non to bring about changes in the workplace and in corporate management in order to eliminate negative effects on the health of a company’s workforce and its business success.

The action
Before embarking upon an operation costly in human and monetary resources we addressed our 250,000 members directly by way of a written communication. The response to our questions as regards work-related stress was overwhelming. As a result, we established working groups to design a questionnaire on the basis of the feedback given. This questionnaire after validation was tested in our own organisation. Then it was transmitted to a polling institute which revised it according to professional standards. The results corroborated what the working groups had highlighted, from which point onwards we started to inform the civil society. Every six months we hold a press conference during which we update the public and publish testimonials given by executives and employees in the service sector. Last time we presented three comic books relating the situation of executives in a big French organisation. The 100,000 copies were used up very quickly but the comics can still be found on the Confederation’s website. Our organisation has certainly taken note of the topic and is committed to reduce work-related stress levels. Our efforts have galvanised various stakeholders into action. What is required now is the development of studies and training courses and negotiations with decision makers. I hope I have been able to show how the trade union’s communication efforts have made everybody more receptive for the issues and consequences of work-related stress in non-physical activities.
Research on the effectiveness of prevention measures at the workplace

Hear no evil: Encouraging Construction Workers to Reduce their Noise Exposure

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Abstract
In construction, noise has traditionally been identified as a difficult hazard to address. However, the many associated costs have made noise exposure reduction an area of concern for companies. Ninety-eight workers from a large construction organisation were interviewed about their knowledge and beliefs about noise reduction activities. Workers’ participation in these activities and their attitudes to noise were examined in relation to constructs of the Health Belief Model. Opportunities to improve and encourage workers’ motivation and participation are discussed.

Introduction to Noise Exposure – Costs and Consequences
The direct cost of noise induced hearing loss (NIHL) as defined by compensation claims has been found to be considerable. In 2006/2007, in NSW Australia, hearing loss claims accounted for 56.1% of all occupational disease claims within the construction industry, equating to a direct cost of $AUS 7.6m (WorkCover, 2008). In reality, the actual cost of NIHL (including costs of ongoing rehabilitation, and indirect costs such as reduced work capacity and burden of disease costs incurred by individuals, families, and the community) is difficult to quantify. For this reason, the construction industry recognises noise as a serious workplace hazard.

However, reducing noise exposure in construction has been acknowledged as a difficult goal to achieve (Berglund & Lindvall, 1995; Nietzel et al, 1999; EASHW, 2005; Colvin & Luxon, 2007). Worksites are generally expected to be an area of high noise and noise is often viewed as one of the lower level hazards on site. Thus workplaces need to carefully consider a range of about factors influencing workers’ attitudes to noise reduction in order to improve their participation.

Method
Ninety-eight male participants were sampled opportunistically during visits to four very large construction sites in NSW, Australia. The sites all belonged to an international construction company identified as having a strong safety culture. Workers were aged between 17 - 65 years (M = 35.4, SD = 12.5), and had varying experience working in construction from just a few weeks to 43 years (M= 13 years). Participants were a combination of company employees, contractors, and sub-contractors, and included a variety of positions and fields (e.g. electricians, concreters, bricklayers, foremen, and carpenters).

Structured interviews were undertaken to ask workers about their knowledge, attitudes, and thoughts regarding workplace noise exposure reduction techniques (see Gilliver & Williams, 2009). Results were
analysed in relation to the main constructs of the Health Belief Model (HBM; Rosenstock, 1974), to identify areas associated with motivation that may be used to assist in improving participation.

**Results and Discussion**

Workers showed a relatively high level of interest and compliance towards noise exposure reduction compared to that of workers in other recognized noisy industries (SafeWork SA, 2008). Workers were found to have received and retained a high level of theoretical information about the risks of noise exposure – the result of the company’s strong safety culture. However this knowledge did not translate directly into correspondingly high levels of participation. Thus, education alone appears insufficient to bring about widespread change. A discussion of other factors that may impact on workers’ motivation and behaviour is provided below.

**Perceived Severity & Susceptibility**

Workers showed reasonable awareness of the consequences of noise, and expressed a desire to avoid NIHL. However, workers’ responses suggested that conceptualization of hearing loss remains relatively abstract (e.g. “things will be quieter”) and that its potential severity may be poorly understood.

Many workers were aware of their personal susceptibility to hearing loss, and reported early experiences of NIHL symptoms. Workers also acknowledged their general susceptibility to NIHL from their workplace, accurately identifying major sound sources, and commenting that “construction is noisy”. The expectation and acceptance of noise in the workplace, however, carries some potentially negative consequences. In a noisy environment it is easy to become ‘acclima-
tised’ to high noise levels and, as a result, workers may underestimate moderate activities downplaying their potential risk. Providing more detailed information about the nature of difficulties associated with hearing loss, personalizing the potential impacts, and providing workers with accurate information about their individual noise exposure in all situations may improve motivation and participation.

**Perceived Benefits and Barriers**

Workers showed a strong understanding of the benefits of reducing noise exposure and knowledge of the “facts” of hearing loss. These results are encouraging, but remain open to improvement. Motivation for reducing noise exposure continues to be lower than that for other on-site safety behaviours, with a lack of consistency in the way opportunities for noise exposure reduction are sought out and implemented.

Noise threats on site will always be viewed with less concern than more immediate physical hazards, however it is important that this does not result in low expectations for worker participation. Rather, an overall strong safety culture should be used to improve rather than detract from activities aimed at noise reduction behaviour.

**Self Efficacy**

Employers have a number of controls at their disposal in order to reduce noise exposure on-site including “buying quiet”, providing engineering controls, implementing administrative measures, and providing appropriate personal protective equipment (PPE) and training. Each of these levels were associated with different levels of worker self efficacy. The majority of workers were knowledgeable and confident with PPE use. In contrast, many of
the higher level controls were viewed as “management responsibility” and workers were less confident to initiate or participate in their implementation.

While higher level controls do, of course, require approval/support from management, organizations need to create a safety culture where employees feel their input is valued at all levels. It is important, therefore, to continue to support personal noise exposure reduction techniques (e.g. PPE use) while also encouraging workers to comment on and participate in activities that reduce noise through other means, thereby increasing feelings of self efficacy across the board.

**Conclusion**

Traditional education about noise and its consequences is an important tool in reducing workers’ noise exposure. However, this is insufficient to achieve widespread change. Personalizing hearing campaigns to acknowledge additional factors associated with workers’ motivation may assist to improve participation.

**References**


SESSION 7
Incentive systems
Research on the effectiveness of prevention measures at the workplace

Exchange of Economic Incentives Good Practice at European Level

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Introduction
The European Commission’s Community Strategy on Health and Safety at Work for the period 2007-2012 has the ambitious aim of reducing the European Union’s occupational incident rate by 25%. To achieve this, it is not enough for EU Member States to simply transpose and implement EU health and safety regulations into national legislation. Enforcement is essential, especially in small and medium-sized enterprises (SMEs), to bring about behavioural change that will lead to improvements in workers’ health and safety. Besides taking direct measures to ensure compliance with legislation, such as inspection and the issuing of penalties, occupational safety and health (OSH) policies can be promoted through economic incentives that reward organisations which develop and maintain safe and healthy working environments.

This European Agency project gives an overview, analysis and evaluation of existing systems providing economic incentives for OSH in Europe. It examines how enterprises and employers can be influenced and motivated to improve OSH. The report offers best practice information in the form of case studies to help companies and other organisations in the development and provision of economic incentive schemes.

Literature review on economic incentives
Overall, there was a strong argument for the benefits of economic incentives arising from sources outside a company to improve occupational health and safety. This finding is tempered by methodological difficulties in evaluating the effectiveness of various incentive schemes, and it was suggested that further research is required to clarify ambiguous results in the research literature.

Insurance-related economic incentives were an effective way to motivate organisations to invest in OSH. Evidence suggests that economic incentives alter employees’ behaviour or incident rates in organisations. There has been a reasonable amount of research regarding experience rating in worker’s compensation, which usually consists of a bonus-malus system for insurance premiums based on the individual accident rates of a company. The literature review analysed several research papers about the effectiveness of experience rating and found at least moderate evidence that it reduces the number of insurance claims.

Policy overview on economic incentives
Regarding the basic criteria of social insurance systems and worker’s compensation approaches there are not very many differences in Europe. Most countries designed their social security system in the Bismarckian tradition and the acci-
dent insurance institutions are based on a state-run monopoly. There is a significant group of countries with a competitive market in a Beveridgean system and two smaller groups of countries with mixed forms. So the variety of different accident insurance and social insurance systems is fairly limited regarding basic criteria, even though there are probably many more differences in detail. These differences between countries and economic incentive schemes naturally have an influence on the potential transferability of incentive models in OSH. Subsidy systems, tax incentives and non-financial incentives should be theoretically possible in all EU countries. Experience-rating approaches can be found in both competitive and monopolistic markets. However, there are differences when it comes to the funding of future-oriented prevention efforts, such as training or OSH investments. This should be no problem for monopolistic approaches, because the insurance company can be sure it will benefit from the positive effect that investments will have on the claims rate. In a competitive market, however, the insurance company runs the risk that enterprises could change their insurance provider at short notice and therefore investments in prevention efforts could benefit its competitors rather than the original insurer. A possible solution for competitive markets could be the introduction of long-term contracts over several years or the creation of a common prevention fund which is financed equally by all insurers. Nearly all larger EU Member States are rather active in offering economic incentives. Germany, France, Italy and Poland all offer various incentives through their public insurance system, often not only insurance premium variations, but subsidy programmes for specific investments in OSH as well. In Spain insurance incentives are planned in the national OSH strategy and a great variety of OSH subsidy programmes is offered on a national as well as regional level. Of the smaller Member States Belgium, Finland and The Netherlands are the most active, showing that economic incentives are also possible in private accident insurance systems. All in all the overview shows that economic incentives can be offered in all Member States, regardless of their social security system traditions or whether the accident insurance system is private or public.

Case studies
The collection of case studies shows that economic incentives can be effective in a great variety of settings in order to promote OSH. All incentive schemes presented have been managed efficiently and undergone some kind of evaluation. In six case studies we even have quantitative indicators for positive effects on the working conditions for the participating companies:

- In the German butchery sector participating enterprises have seen an over 25% drop in notifiable accidents since the introduction of the incentive scheme in 2001.
- In the Finnish agricultural sector the accident rate dropped by more than 10%.
- Of the Polish enterprises that introduced a funded OSH management system, 70% had fewer accidents and lower insurance premiums, while 50% reported fewer workers working in hazardous conditions.
- The Italian Workers’ Compensation authority subsidises bank credits to stimulate OSH investments in SMEs; participating companies had 13–25% fewer accidents than comparable en-
In a German health insurance incentive scheme sick pay and absenteeism decreased significantly when enterprises introduced a modern health management system.

The Dutch subsidy programme for investments in new OSH-friendly machinery and equipment led to better working conditions in 76% of the enterprises (40% of the employers said that the new equipment was highly beneficial, 36% that it was reasonably beneficial).

Success factors for economic incentives

Summarising the three parts of the report the following success factors could be identified:

1. The incentive scheme should not only reward past results of good OSH management, i.e. past accident rates, but should also reward specific prevention efforts which aim to reduce future accidents and ill-health.

2. The incentive scheme should be open to all sizes of enterprises and pay particular attention to the special needs of SMEs.

3. The incentive should be high enough to motivate employers to participate.

4. There should be a clear and prompt relation between the desired prevention activity of the enterprise and the reward.

5. The incentive system should have clear awarding criteria and should be designed to be as easy to use as possible, in order to keep the administrative burden low for both participating enterprises and incentive-offering organisations.

6. If the incentive needs to target a large number of enterprises, insurance or tax-based incentives with precisely defined criteria are most effective (closed system).

7. If the desire is to promote innovative solutions for specific areas, subsidy schemes are most effective (open system).

For more information

This report is planned to be published in spring 2010, meanwhile you can find a wealth of information on economic aspects of OSH under: http://osha.europa.eu/en/topics/business
Use of Health and Safety Awards for External Marketing

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Background
The use of awards schemes to improve company performance and motivate the workforce has proliferated in recent times and there are a wide range of externally organised health and safety award schemes in the United Kingdom (EASHW, 2002). The work presented here considers how awards are used by winning organisations for external marketing.

Method
Data were collected by questionnaire to organisations that may enter health and safety awards. A convenience sample was taken and the questionnaire was distributed to 85 health and safety professionals attending health and safety training courses at Loughborough University. 31 responses (36%) were obtained. The questionnaire was piloted via personal communication with 3 past students. The questionnaire was designed to cover a number of issues including details of awards entered, the perceived reasons and benefits of entering awards and any disadvantages. A questionnaire was also sent to three Health and Safety Organisations that run health and safety award schemes. The questions included why offer awards, changes in awards types and changes in entry numbers over time.

Results
Organisations participating in awards
The participants represented a range of sectors – service (9) utilities (8) construction (8) and manufacturing (7). 6 were small and medium sized enterprises (less than 250 employees) whilst the remainder were large organisations. Of the 31 responses 12 organisations do not presently enter any health and safety awards, although 3 plan to do so in the future. Awards entered, as categorised by Tait and Walker, (2000), are presented in table 1. A number of organisations entered several awards.

Table 1: Summary of award categories entered

<table>
<thead>
<tr>
<th>Award Organiser category</th>
<th>No. of organisations entering</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and Safety Organisation</td>
<td>24</td>
</tr>
<tr>
<td>Professional/Trade Association</td>
<td>7</td>
</tr>
<tr>
<td>Trade/National Press</td>
<td>7</td>
</tr>
<tr>
<td>Suppliers of products and services</td>
<td>1</td>
</tr>
</tbody>
</table>
Participants were asked to outline reasons for entering awards and their perceptions of benefits from achieving awards, the results are summarised in table 2.

Table 2: Summary of reasons for entering and benefits from winning an award

<table>
<thead>
<tr>
<th>Theme</th>
<th>Reasons – No. of mentions</th>
<th>Benefits – No. of mentions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstration of achievement to external stakeholders</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Demonstration of achievement to internal stakeholders</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Continuous improvement</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Tendering</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Benchmarking/comparison</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Requirement of clients/audits</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Part of CSR</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Evidence of contribution made by H&amp;S specialists</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Credibility of achieving award from recognised body</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Internal stakeholders focused particularly on motivation of employees but influencing senior management was also identified if the external commercial benefits of awards were demonstrated. The external stakeholders identified included members of the public, clients, suppliers, investors, shareholders, enforcing authorities, trade associations and insurance companies. Participants were also asked to outline any disadvantages and limitations of participating in award schemes. Twelve participants identified the resources required, this includes preparation of submission, the entry fee and attendance at an award ceremony. There was a suggestion that the entry fee ‘buys’ the award. A number of participants (7) expressed concern that awards may not truly reflect outstanding health and safety performance and as such can divert valuable resource. ‘It might be that the good bits are advertised and latent problems are hidden.’

Award Organisers
The Organisers were asked to outline the reasons for running awards. Reasons included recognition and reward for best practice in winning organisations. This may be at the corporate level or for the contribution of individuals. Awards are a means of improving standards of health and safety performance and the winners may act as role models to motivate other organisations. They provide an opportunity to engage with members/professionals. Offering awards also provides a source of revenue to the Organisers. The Organisers were asked to summarise how their awards had changed over the years. Changes include standards required have increased, the judging processes have become more rigorous and additional sector and activity categories have been introduced. These categories...
Research on the effectiveness of prevention measures at the workplace

may be run in association with sponsor organisations.
All Organisers have seen an increase in participation in awards over recent years. The sectors that attract most participation are high risk sectors and include construction and manufacturing. But there are also good levels of entry from engineering, healthcare, transportation, facilities and utilities. The sectors that attract least entries include banking, retail, agriculture and research and development.

Discussion
Anecdotal evidence suggests that prevalence and participation in awards and recognition schemes are increasing across the workplace in a range of business areas. The 3 Organisers contacted for this research have all introduced more awards over recent years and are experiencing increasing numbers of participants, especially in sectors such as construction and manufacturing. Although it is noted that not all organisations in the sample participate in awards. Previous research, (Tait and Walker, 2000), demonstrated that health and safety awards were mainly used by organisations to motivate employees but also to influence external stakeholders. The results from this small scale research reinforces this, but suggests a more wide ranging use of awards in an external marketing capacity. Awards may be used to raise the overall profile of an organisation and to exemplify commitment to corporate social responsibility. For example awards are used as part of the competitive tendering process, in discussion with insurance companies and visits from the enforcing authorities. Significantly a number external assessment agencies now include a number of specific awards in their assessment criteria (Ainsworth, 2009) and awards may be a requirement of clients.

There are a range of types of awards which are based, for example, on overall health and safety performance, individual performance, innovations, occupational health promotion etc. The methods of assessment are documented on Organisers websites and are outlined by the Hopkinson and Gervais, (2006). The more rigorous awards may be based on extensive audits and attainment of a management standard. Indeed the UK Health and Safety Executive have expressed support for specific awards suggesting that they demonstrate achievement of high standards and are strong motivators for health and safety (HSE, 2009).
The majority of awards entered by organisations in this small sample, are offered by Health and Safety Organisations. Reasons for entering such awards may be based on the credibility of achieving an award from a recognised body, which could be important for external communication. Overall, the use of awards for external marketing appears to be most common in the large, high-risk organisations, particularly, construction where many of the participants entered a range of awards in addition to those organised by Health and Safety Organisations e.g. trade magazines and trade associations. In some instances the management of awards is carried out by communications/marketing departments, rather than the health and safety department.
With the wide range of awards some participants in this study expressed concern about the validity of awards in truly reflecting health and safety performance. It is perhaps relevant that continuous improvement and benchmarking were not mentioned by participants as frequently as demonstration of achievement to stakeholders as reasons or benefits, although Organisers of awards considered this as a key driver and have made efforts
to make their awards more stringent. Wilford, (2007) has demonstrated that awards for quality management indicate the ability of some organisations to fulfil the criteria set by the awards studied. As such, awards should not be seen as a panacea for organisational excellence, but may be used to demonstrate organisational commitment to health and safety.

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Research on the effectiveness of prevention measures at the workplace

Cost Benefit Analysis of an Economic Incentive Model

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Fleischerei-BG (“Institution for Statutory Accident Insurance and Prevention in the Meat-Processing Industry”), Germany

Introduction

In Germany, the statutory insurance institutions must have a bonus or malus system by law which reflects the number and/or costs of accidents which insured companies had the year before. Especially for SMEs, only one accident can lead to a malus or loss of a bonus, even though the company may do a lot for prevention. Therefore, the system was to reward the entrepreneur’s effort without taking into account the accident situation which is dealt with separately by the bonus or malus system. Road accidents can not be included in the bonus-malus system, but since these accidents are rather costly, the aim was to help prevent them through the incentive system. As an example, premiums are given on driver’s training, using public transport rather than the own car is rewarded and regular medical check-up appreciated. Occupational diseases are not included in the bonus-malus system either, and in order to help prevent these, issues like skin protection, protection against cold and noise are tackled within the system. The scheme is flexible, i.e. the questions can be modified every year if necessary to take e.g. into consideration national campaigns like skin protection in 2008 or the implementation of new regulations like the need to have a system of reintegration of long-term patients, which became law in Germany in 2004, and was introduced in the catalogue one year later. As in 2008 no less than 46% of all member companies insured by the FBG participated in the incentive programme, a good insight on which preventive measures are implemented in the meat industry in general is possible.

Preventive measures that offer premiums

The following table gives an overview on the topics of the FBG incentive system. Some are very specific for the meat sector, like the protection against knife accidents, others like traffic safety, reintegration, protection at VDU work and others could be applied to any industry sector. 39 different prevention measures can be dealt with, either by filling in a paper form or via Extranet. 4 questions are answered by the FBG through in-house data. Some are double-checked to be sure that they were answered correctly. Besides, the premiums granted are compared with the accident rate and costs of the year before as well as the average of the last 5 years to see whether the respective company can have achieved the premiums they got. The FBG inspectors furthermore check at the customer’s whether the list was filled in correctly, either before these are sent to the FBG or afterwards. So far, it can be stated that the FBG member companies handle the system carefully.
Costs of introducing and maintaining the system
Before the introduction of the incentive system, the catalogue of prevention measures was tested in companies of all sizes to make sure that they would be sufficiently relevant and applicable. Once this test was finalized, the primary costs were printing the form sheets and sending them to the roughly 20,000 member companies in the meat sector. The returned sheets are scanned or read in the FBG IT system electronically, in case they are filled in by extranet. This needs to be programmed beforehand.

Benefits from the system
The following graph shows that the degree of target fulfilment could be improved in all prevention fields that have been suggested since 2002. Comparing the 7-year participants with all participants in 2008, one can state,
that the long term participants achieve even better results in all preventive measures, particularly in safety of machines, skin protection, protection against cold and ergonomics.

The focus of the current Swedish EU presidency with regard to OHS is on the reintegration of injured or ill workers. The incentive system seems to work here as well, however, the current degree of participation of about 15% leaves room for improvement, especially when considering that reintegration is compulsory.

In 2008, the FBG started giving premiums for OHS systems that were introduced and audited by the FBG. The number of participants climbed as a consequence. Companies that introduced OHS systems a couple of years ago were able to get a higher reimbursement of their insurance fee due to less (costly) accidents, as can be seen in the following chart.

In microeconomics the expression of price elasticity is known, which describes what quantity of goods is bought when the price is modified. Regarding the FBG incentive system there seems to be more involvement when more premium points can be achieved or not, at least for some of the prevention measures suggested.

Cost benefit balance
Participants in the FBG incentive scheme have a lower accident rate than non-participants. Therefore, the system theoretically prevents a considerable amount of accident costs as is shown in the following graph.

Conclusion
As a summary it can be stated that the incentive system provides an additional motivation for prevention, which has a positive effect on OHS indicators and ensures that expenditures are overcom-
Research on the effectiveness of prevention measures at the workplace

Regular participants continuously improve their performance and the quantity of data collected allow for a benchmark between the companies.
Research into the Feasibility of Using Economic Instruments to Internalise the Costs of Health and Safety

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An externality is an impact that affects the welfare of society and which is not reflected in market prices and hence, not taken into account when individuals and organisations make economic decisions. Externalities, which can be positive (a benefit to society) or negative (a cost), create economic inefficiency – not enough of some goods and services are produced and too many of others, compared to what would be optimal for society. One solution is to “internalise” the cost or benefit – ensuring that it is wholly or partly reflected in relevant market prices and therefore influences economic decisions.

In the past, the UK Health and Safety Executive (HSE) has tended to use command-and-control style regulation to set mandatory standards which lead to improvements in the health and safety outcomes of the individuals affected by their activities. However, HSE has recently begun exploring the possibility of using various kinds of incentives in order to achieve the same aim.

One of the areas that are currently being explored is the use of economic instruments ¹. The main advantage these present over traditional regulation is that economic instruments incentivise agents to take health and safety concerns into account, leading to the possibility that they may even go above and beyond what could be prescribed through command and control regulation. It can also be argued that such incentives have the potential to encourage flexibility and innovation, are better at dealing with emerging risks, and could potentially require less enforcement effort.

Economic instruments are widely used in health and safety spheres by other European countries, but have had comparatively limited application in the UK. Insurance companies do link premiums charged to companies for Employers Liability Insurance to individual health and safety management, but this is done only in the case of larger companies. For small and medium enterprises (SMEs), there are indications that premiums depend mostly on industry and size, rather than their individual health and safety management. Additionally, premium linkage is not done in a standardised way. Rather, each insurance company (all of which are private) uses its own models and methods to decide on what premiums to offer to each client. HSE has developed two self-assessment tools ² to try to encourage further linkages, but take-up has been

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¹ Another is the use of behavioural economics insights, a study on which is being presented in this Colloquium by Anna Richardson-Owen, also from HSE.
limited. Another example of economic incentives used by HSE has been our Ladder Exchange Programme 3, which allows companies to exchange unsafe ladders for new ones at reduced prices.

HSE intends to further explore the possibility of making more and better use of economic instruments, and the first stage in that process has been the commissioning of research looking into the feasibility of doing so. This research has been taken on by Risk and Policy Analysts Ltd. (RPA) 4, and the final report is due in November. The project will cover the use of economic instruments in the areas of both workplace health and safety and land use planning around major hazard sites. We will discuss only the first strand of the research in this paper.

As implied by the title, the research’s focus is on the practicalities of implementing different kinds of economic instruments, although theoretical considerations are also contemplated.

The methodology RPA proposed started out by identifying a variety of different possible instruments to be analysed. These were five: reform of insurance schemes, health and safety taxes, subsidies, tradeable permits and so-called “name-and-shame” schemes (which rely on public perception of the company providing the link between its health and safety performance and its profits).

The analysis of each of these relied on a set of criteria determined at the outset, which included a mix of theoretical and practical considerations. Twelve criteria were identified, among which we consider five to be the most important: 1) Effectiveness (which includes both whether the instrument would be effective in changing behaviour and whether this behavioural change would result in health and safety improvements); 2) Information requirements to implement it (this criterion would interact with others; the fewer information requirements, the more likely the instrument would be more effective and the smaller the resource implications in designing and operating it); 3) Distributional impacts; 4) Institutional support (how stakeholders and the wider society would perceive the instrument); and 5) The potential for perverse incentives (this criterion has the scope for making use of some behavioural economics insights).

The rest of the criteria were: cost, flexibility, uncertainty/stability, revenue-raising potential, competitiveness and competition, compatibility with existing regulations and potential for other positive incentives.

Once the criteria were identified, they were then applied. The first stage of this analysis consisted on desk-based research, with analysts considering the implications of the instruments identified initially in light of each criterion.

The result of this analysis was that only three of the instruments looked at were deemed to be feasible enough to be carried through to the next stage of the process. These were insurance reform, health and safety taxes and subsidies.

With tradeable permits, one of the main issues that led to its rejection was institutional support. It was thought, in line with a European Foundation for the Improvement of Living and Working Conditions report (1999) 5, that it would be morally unacceptable to the public for a company to be able to buy from another the right to produce injuries or ill-health.

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3 See: http://www.hse.gov.uk/falls/ladderexchange.htm
4 http://www.rpaltd.co.uk
There were also problems with its effectiveness in practice, due to considerations relating to allocation of permits and information requirements. As for name and shame schemes, there were doubts about their effectiveness, and it was thought that the costs and uncertainty about outcomes generated concerns. The three instruments still in the running will be further analysed in workshops in which the relevant stakeholders will participate. We expect their contributions to prove especially valuable with regards to the practicalities that would be involved in implementing such instruments. These workshops will unfortunately take place after the closing date for receipt of this paper, but we plan to share their results in our presentation at the Colloquium. At this stage, we would like to highlight that from the beginning, there were some potentially problematic general concerns that we hoped this research would provide insights into, and possibly find ways to get around. The first is the fact that instruments could have differing effectiveness in ill health and accident prevention. With ill health, there are some particular issues that need to be contemplated, such as their complex causation (with certain conditions, it can be unclear whether they were caused by work activities, lifestyle or a combination of both, so a full link between outcome and a company’s profits would not be justified) and time lags (if the outcome will only develop a long period after exposure, it makes linking incentives to outcomes much harder). Secondly, linking incentives to outcomes is relatively straightforward in larger companies, but with SMEs the link between outcomes and management’s actions is not as strong (in the UK, the average SMEs will have an accident every several years). Finally, there is the potential for perverse incentives in most of the instruments we are analysing: they could incentivise companies to underreport accidents, or to discriminate against particular groups when recruiting. These issues will be further explored in the workshops. Further work emerging from this research will obviously depend on what its results turn out to be, especially what comes out of the workshops. If the conclusions are positive about any of the instruments, further work would involve working with our policy colleagues and key stakeholders to develop a working plan to use the instrument in question.
Please imagine the following: You manage a facility or company and, in decisions and investments, you concentrate on the health of your employees; health-supporting measures and projects are no isolated solutions but are integrated in your structures and processes. The employees participate in decisions and processes of change. You are satisfied as the working climate is excellent and the rate of absences due to illness is continuously decreasing.

You are a realist and think this is utopian – especially in times of economic crisis. Far from it! They really exist – the companies which are aiming to achieve this utopia with their policy. Our task is to detect them, to support them and to make them a role model for others.

The BGW Health Prize represents an incentive for facilities which are involved in occupational medicine and health protection for their employees beyond the standard required by law. Over the years, it has outgrown its original purpose and has become an incentive instrument. Besides the financial support, the award offers well-established facilities the opportunity to publicise their facility’s health management thus becoming a reference facility or to exchange information and compare themselves with other facilities. The Institution for Statutory Accident Insurance and Prevention in the Health and Welfare Services announces their Health Prize biennially under the motto “profit by getting involved”. The Institution for Statutory Accident Insurance and Prevention in the Health and Welfare Services (BGW) is the legal accident insurance for non-governmental facilities in health and welfare services.

BGW is one of the current 21 institutions for statutory accident insurance and prevention (there were 35 before the fusions in May 2005); the organization is responsible for over six million insured persons in more than 565,000 companies and thus German’s second largest institution for statutory accident insurance and prevention. As an institution of this size and range, BGW is predestined to reach a large target group with their Health Prize. As part of the broad obligation to prevent risks to health, the Institution for Statutory Accident Insurance and Prevention does not only have to take care of classical safety at work but also of the prevention of work-related health risks. As regards the latter, aims have changed: instead of analysing the reasons for occupational diseases at work, the approach is to prevent work-related health risks with a focus on analysing and strengthening resources and supporting possible ways of keeping the employees healthy.

Apart from their prevention services (such as lectures for prevention of work-related health risks, advice for organiza-
tional development and documents about topics of occupational health management), BGW has now undertaken to single out for praise and support member facilities with exemplary achievements in the area.

It is for the sixth time since 2000 that the BGW Health Prize, which is awarded to specific sectors, has been announced. It used to be limited to institutions like hospitals, rehabilitation clinics, facilities of inpatient geriatric care, outpatient social care services and workshops for the handicapped.

The prize is now worth €45,000 which can either be awarded to only one facility or split between several winners. It is to support further health-supporting projects and schemes in these facilities. In this context, the BGW Health Prize represents an incentive for companies to systematically manage the health of their employees in the long-term.

Beyond the financial support, the award primarily constitutes an image improvement for the companies.

Companies benefit in many ways from participating in the BGW Health Prize: Firstly, the employees of a competing facility have already benefited from a functioning occupational health management. Secondly, the winners are awarded the prize for their excellent commitment in keeping their employees healthy. Thirdly, participation offers the opportunity to publicise their own examples of good practice and to become a role model for others. Fourthly, every participant is able to determine the status of their occupational and health safety through the participation in subsequent benchmarking against other participants.

As part of the benchmarking, every participant receives the score of their facility in comparison with the score of the facility with the highest points and the average score of all participants (such data being rendered anonymous).

It is not only the prize winners that benefit from their participation in the BGW Health Prize; all the participants receive an invitation to the BGW Forum. As part of the Forum and besides the BGW Health Prize award ceremony, target-group specific workshops, lectures and other events take place. In the forum, prize winners present their award-winning best practice projects so that there is an additional possibility to exchange knowledge and experience of occupational health management. The presentation either takes place in the form of workshops or with booths providing information. Moreover, as part of the award, a short film about the winner facility is presented which shows the award-relevant structures and processes of the facility.

The participants of the BGW Health Prize 2005 greatly benefited from the Day of Innovation which was organised by BGW as a follow-up event for the participants. A results-orientated platform for a moderated exchange of experience about the topics of occupational health support was offered. The two-day event was pitched at managers and experts familiar with the topic of occupational health support in their facilities. Among other things, the participants tested the principle of effect chains in a workshop. This method allows to evaluate processes regarding their benefit for the facility without to much of an extra effort – not only for occupational health support. Moreover, the participants were able to exchange information about their planned measures and projects for occupational health support.
support and to prompt new related BGW products. Possibilities were also discussed about how BGW can support their projects in a more targeted manner in the future.

The application form for the BGW Health Prize is based on the regulations of the European Network for Occupational Health Support; this is a cooperation project of the World Health Organization (WHO). The participants’ form guarantees comprehensive approach to quality management with the EFQM Model for Excellence.

The form is deliberately designed to be highly comprehensive so that the participants can describe their commitment in various ways. It contains questions on the following aspects:

- Importance of the employees’ health in the facility’s OSH policies, HR strategies and organisation of work
- Planning of measures and activities of health support
- Personnel and financial resources
- Employee orientation in occupational health management
- Maintaining outcomes and sustainability

The PDCA cycle with graded answer categories is available for the participants to provide information on the level of quality and maturity of concepts, occupational health management projects and related activities.

Firstly, all applications are evaluated according to this procedure. BGW evaluates the participation forms. An external social research institution supports the procedure of evaluation and guarantees neutrality and scientific accuracy. All measures of health-supporting activities are included in the evaluation. These measures go beyond legal requirements for occupational and health safety. A functioning occupational organization is the precondition. It should be recognizable for the jury to what extent specific measures, projects and activities are implemented in practice and embedded in a concept of occupational and health safety.

The jury, which is composed of two representatives of the employer and two representatives of the insured persons of the self-administration of BGW, will determine winners from short-listed candidates chosen in accordance with the evaluation criteria.

Subsequently the jury will visit the nominated facilities and evaluate their OSH activities and achievements with the help of audits, whereafter the final decision will be made as regards the prize winner.

The award takes place as part of the BGW Forum.

In this time of rapid change and adaptations to modified requirements, the product “BGW Health Prize” is as flexible as the occupational health management for which the prize is announced and awarded. Moreover, the BGW Health Prize is subject to a continuous process of improvement. In the near future, it is planned to put competing facilities in contact with one another with BGW acting as a kind of facilitator. In this way, not only the participating facilities will benefit from an exchange of information but also BGW, which can respond more specifically to the requirements of their customers by keeping their finger on the pulse of developments.
There has been much discussion as to why only facilities with a well-established OSH system should benefit from the BGW Health Prize. In fact the questionnaire is very demanding which is why only excellent facilities feel addressed. The primary aim of the BGW is to investigate examples of good practice by announcing their Health Prize, to publicise them and to make them a role model for others. For this reason, the BGW has decided to set the bar high. The prize winners are meant to serve as “lighthouses” for good quality in occupational and health safety. As there have been many announcements in this area, it is a top priority for BGW to see to top quality in the matter.

Every BGW Health Prize is finally evaluated according to the following aspects:
- Types of facilities
- Size of facility
- Selected measures
- Procedures for reducing workloads
- Steering committees
- Measures for preventing work-related health risks
- Maintenance and strengthening of occupational abilities of the employees

In the future, it is planned to evaluate all announced health prizes, in order to continuously improve the quality and to emphasize the benefit for the facilities even more clearly. The focus will be a review as to whether occupational health management is still a topic in the facilities after the award or to what extent the health of the employees could be optimised.
Health and safety failures in the workplace can be thought of as the negative effects of providing labour to the market (i.e. negative externalities). The most recent estimates put the cost of these failures to society at between £20bn and £32bn \(^1\). Given that employers bear only a small portion of these costs, there is an argument for government intervention to re-dress the failures. In the UK this intervention is delivered through the Health and Safety Executive (HSE) and traditionally through a command and control approach to control health and safety risks i.e. regulation underpinned by the Health and Safety at Work Act 1974.

However, an alternative to regulation is to use incentives. The feasibility of any incentive system relies to some extent on human behaviour. This paper therefore discusses the findings from research commissioned by HSE into how insights from Behavioural Economics could impact upon health and safety compliance. \(^2\)

Broadly speaking, Behavioural Economics may be defined as the application of behavioural analysis (typically from psychology) to micro-economics decision making (Sapsford et al, 2009). Standard economic theory assumes that agents (individuals) are perfectly rational and seek to optimise their utility when making decisions. Behavioural Economics challenges the principle of rationality implied in standard economic theory and instead suggests that people are not rational decision making agents. In fact, the irrationality displayed is often predictable and people show biases in their decisions. Examples of such biases include limits to will power, making choices that greatly favour the present over the future and having a preference for fairness. The theory suggests that it is possible to correct this irrationality by nudging people’s behaviour in a more optimal direction than would otherwise occur.

The research commissioned by HSE had three main objectives: to provide a detailed review of the current and emerging literature on the use of behavioural economics; to provide initial proposals relating to the sort of policies that could be feasible and effective in changing behaviour; and to offer recommendations on priorities for further research. In the context of this report, behavioural economics

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\(^1\) Interim update of the Costs to Britain of Workplace Accidents and Work-Related Ill Health (2001/02) Available at: http://www.hse.gov.uk/statistics/pdf/costs.pdf

is broadly defined to include experimental and psychological economics.

Four main themes of behavioural economics were identified around which the literature review was structured and articles combined into common areas of applicability. In conjunction with HSE, six areas within these themes were identified for which further research might produce useful insights for HSE policy making.

**THEME 1: Costs of processing information and risk and uncertainty**

I. Long tailed perception of risk (problem of understanding low risk-high cost)

It is suggested that individuals have a skewed perception of risk and that this is reinforced on a daily basis if risk-taking results in small and regular rewards. This encouragement of risk taking and the inaccurate assessment of the expected cost of a catastrophe helps to explain how catastrophic failures can and do still occur. This was evidenced before seatbelts became compulsory in motor vehicles, and many people saw the small effort saving gains of not putting on their seatbelt as outweighing the high cost of a motor accident (death or disabling injury). Only when the wearing of seatbelts became law did people develop the habit of wearing them.

Sapsford et al (2009) recommend that future research by HSE could involve a gambling game, where a sample of people are asked to rate their perception of risk of a particularly hazardous event using a scale of probabilities with more commonly known reference points (such as the even odds when a coin is tossed down to the chances of winning the jackpot on the lottery). The results could be used to quantify in monetary terms the expected lifetime costs perceived by the person and then these results compared to the actual risks and associated costs of the hazard. Such quantification of the skewed risk perception could then help inform HSE educational materials.

II. Costs of processing information (Information overload)

Stigler’s Nobel Prize winning work in 1961 on the ‘costs’ of information, overturned the previous economic assumption that more choice is better than less. Stigler demonstrated that information is accompanied by a cost of processing and a point is reached whereby any additional information creates a negative utility.

HSE relies on the provision of information to influence health and safety outcomes. Sapsford et al (2009) suggest further research into the best way to focus information and the optimal channels of delivery. One suggestion by Sapsford et al (2009) is that HSE information could be conglomerated into a single directory or compendium source perhaps with a search questionnaire or flow chart at the front (as with tax returns). It is also suggested that a study could be designed to assess and quantify the magnitude of any effect brought about by variations in the rate of informational flow. A focus group

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3 The expected cost is a function of the probability of the catastrophe happening (fairly low) and the costs associated with the catastrophe (extremely high) and so altogether the expected cost is much higher than people calculate.

4 It is acknowledged that HSE are already aware, to some extent, of the problems associated with too much information, exacerbated by the ever increasing use of internet communications.
of non-health and safety experts could be formed, and the subjects of the study provided with a specification for a hypothetical business. One group of subjects would be given access to all health and safety literature and the others to a more limited amount. Each group could then be asked to provide a list of health and safety issues they would address and this list compared to a similar list completed by health and safety experts. Scores could then be analysed for significant deviation between the alternative information delivery strategies.

THEME 2:
Influence of prior bias and cultural factors on motivation and choice

I. Self identity, discrepancy and cognitive dissonance (committing and vesting to standards)
Cognitive dissonance arises when a person is forced to hold two contrasting ideas or beliefs. To avoid such cognitive dissonance, people will behave in a way that avoids any discrepancy with prior beliefs they hold about themselves. The evidence suggests therefore that commitment exerts a superior power over coercion as a means of influencing behaviour.

Based on this theory, if compliance with health and safety regulations is seen as alien to cultural beliefs then it is unlikely that compliance can be increased through disciplinary measures. Alternatively if businesses can be persuaded to commit publicly to comply with health and safety then this may be more effective than coercive techniques.

As part of the ‘Revitalising Health and Safety’ strategy in 2000, the top 350 companies were encouraged to report health and safety performance as part of the Corporate Social Responsibility Statement in their annual accounts. More recently, the current strategy ‘The Health and Safety of Great Britain: Be part of the solution’, encourages business leaders to sign up to ‘a pledge’ to demonstrate their commitment to keeping workplaces safe. Sapsford et al (2009) suggest that such initiatives could be built upon by asking companies to commit to health and safety targets. A pilot could be run, with a certification brand being awarded to companies committing to health and safety compliance, and their health and safety performance compared to a control group that makes no commitment.

THEME 3:
Strategic behaviour including learning

I. Self efficacy and efficacy of choice (stakeholder involvement)
Sapsford et al (2009) highlight research which shows that an individual’s belief in his/her ability to influence outcomes, to make decisions and the expected efficacy of these actions/decisions in effecting the outcome, significantly affects their actual behaviour and their decision making. While the evidence would suggest that the act of empowering an individual to be part of the decision making process will encourage greater compliance, the converse is also true. The act of being rendered a subject and being told what to do effectively demotivates the agent from compliance. In fact, how satisfied

5 ‘Revitalising health and safety’ strategy available at: http://www.hse.gov.uk/revitalising/
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an individual is with an outcome actually depends on the process of involvement. The evidence even suggests that the utility gained from participation in the creation of regulations may improve compliance over and above that which would be expected with financial incentives.

HSE could therefore conduct experiments to investigate whether actual levels of stakeholder involvement affect compliance. Analysis of correlations between beliefs of efficacy and high compliance and between non-efficacy and non-compliance would provide further evidence regarding the strength of the ‘stakeholder’ effect. Further research could then be performed into whether improving beliefs in self-efficacy influences compliance.

II. Dynamic Modelling and static equilibrium (gaming)

A dynamic equilibrium is when individuals make utility maximising decisions in successive time periods and where attempts by others to influence the equilibrium outcome are incorporated into the maximising game. Sapsford et al (2009) quote a couple of examples of where this is evident, notably a system of fines introduced to an Israeli nursery for late collection of children. It was found that the fines served to increase the number of late collections. The fines were set at such a level as to create a price for being late and this price had a lower utility cost than the previous cost of the shame of being an irresponsible or uncaring parent.

Applying this to health and safety, it is possible that the level of fines in place are actually creating a market for non-compliance, with the disutility associated with fines being less than the costs of actually complying with regulations. An economic analysis could be used to compare the costs of compliance with the expected cost of not complying (being a function of the risk of being caught and the likely fine). The presence of serial offenders might provide evidence that the expected value of the fine is insufficient, either because the monetary value is too low or the perceived probability of detection is low. Eventually, such research could lead to the estimation of a financial ‘tipping point’ for fines and sanctions, i.e. the point at which the fines become sufficient to encourage compliance.

THEME 4: Human interactive choices

I. Inequity aversion

(the theory of equity and fairness)

Economic theory says that decision making in the labour market is an optimum utility maximising choice between work and leisure. Equity theory recognises that employees compare their own reward/investment ratio with that of their peers. If they assess that there is a lack of equity then there will be a reaction in terms of the aggrieved worker’s effort in the future. This may not just be effort related to the work task. The employees may disregard certain procedures to save effort or sabotage procedures for disruptive purposes. There is less empirical evidence on the latter of these two actions.

It might be possible for HSE to gather information from self-reported indicators from questionnaires relating to perceptions of satisfaction, equity and fairness and apply these to the utility maximising decisions of the individual. These indicators would then be compared with indicators concerning behavioural practices of compliance with H&S factors in the workplace. Any significant correlation
between the two would suggest the impact of fairness and inequity aversion on H&S compliance.

**Conclusion**

The research conducted would suggest that behavioural insights have potential to offer useful inputs to the design of economic incentives to improve health and safety outcomes. The decision is yet to be taken as to what further research will be taken in this area, but with an ever increasing requirement to reduce regulatory burdens on business, it is arguable that incentives should become more prominent in HSE strategies in the future.
INQA – Making Good Prevention Visible to Customers – Two Approaches in the Construction and Healthcare Sector

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Construction sector
INQA-bauen and its internet platform www.Gute-Bauunternehmen.de – making good occupational health and safety, good organisation and good prevention visible to customers

The German construction industry shall become again a figurehead of Germany as the business location. To achieve this, we need more quality in construction and construction services instead of the current ruinous price-competition. Those are the goals to which the initiative “New Quality of Construction” – INQA-Bauen – is devoted.

INQA-Bauen is defined as a national platform for the German construction industry. The members of the initiative develop criteria for a new quality of construction and support a high quality-orientation in supply as well as demand. To accomplish a new quality in construction, the entire lifecycle of a building – planning, construction, usage, maintenance, reconstruction and demolition – has to be included.

The initiative supports the implementation of change for as many construction businesses as possible towards innovative companies, which offer new services as well as new technologies, working methods and building products with a high level of quality. To achieve this high level of quality, the members of the initiative regard the promotion of employee satisfaction, motivation and productivity as well as the guarantee of a safe and healthy construction process as a necessary prerequisite. Taking those aspects into account can literally lead to a construction process which is “worth the money”. Furthermore, German companies can differentiate themselves from their competition and secure their own competitiveness in the long run.

The members of the New Quality of Work Initiative INQA-Bauen developed a joint strategy with 3 elements for success:

- Joint instruments of reference as a standard for the construction industry as well as access to the products and services of the partners.
- The joint implementation of the instruments of reference in regional networks.

www.Gute-Bauunternehmen.de was developed in cooperation with corporate associations, consumer associations and institutes of occupational health and safety. The internet platform is a combined presentation of all relevant seals of quality and certifications for the construction industry. The prerequisite for corporations to be listed as a high quality construction company, is the self-evaluation with CASA-bauen.
A reliable quality has the same basis or sources as good occupational health and safety: Planning, communication, cooperation, qualification and motivation. To communicate these principles to the building owners and to provide them with the necessary tools doesn’t only improve the quality, but also health and safety at work. The broad marketing instrument www.Gute-Bauunternehmen.de makes a high quality of occupational health and safety as well as a good work organisation visible and transparent for customers.

www.casa-bauen.de
www.gute-bauunternehmen.de
www.inqa-bauen.de

**Healthcare sector**

Contest: “Beste Arbeitgeber im Gesundheitswesen” – Germany’s Best Workplaces in the Healthcare Sector: A hallmark of excellence for the corporate culture

The contest “Beste Arbeitgeber im Gesundheitswesen” makes good employers and a good corporate culture visible for customers and healthcare staff. In consideration of demographic developments in Germany, the healthcare industry will soon be faced with a new challenge – a lack of personnel. Due to the diminishing labour force potential, successfully finding qualified and motivated personnel will become a complex task for every nursing and care institution.

The New Quality of Work Initiative (INQA) has the goal to support the development of more and better workplaces for nurses – to provide attractive workplaces, to increase the quality of care and to facilitate the competitiveness of healthcare facilities. INQA-Pflege is partner of the yearly contest “Beste Arbeitgeber im Gesundheitswesen” of the Great Place to Work® Institute Germany.

The contest provides the possibility for healthcare facilities to look carefully at their level of trust, pride, and camaraderie at the workplace. It also offers the possibility to develop the attractiveness of each participating facility, to present themselves as a great employer to work for in the healthcare sector.

The basis of the contest is the evaluation of the corporate culture based on the Great Place to Work® Trust Index® and Culture Audit®, an employee survey and open-ended questions, addressing various aspects of the corporate culture.

Besides having a benchmark with other healthcare facilities, one major incentive for the winners of the contest is great publicity, which results among others in more new applications, regarding different positions, from physicians to nurses.

Manfred Maaß, CEO of the Pflegezentrum Steinheim “Mainterasse”:

We did not only want to determine our ranking but also find the improvement potential on the way to our own employer’s brand. We are better known after our successful participation in the contest. This type of Excellence Marketing automatically attracts customers; we don’t have to go looking for them. The same is true for personnel marketing: Our ranking is primarily based on employee assessment; the winner’s logo is a confidence building measure in our advertising on vacancies.

The results of the contest show that it is possible to create a workplace in the healthcare sector, were employees are proud to work. Workplaces can be created where employees interact respectfully with each other, have common values and believes and – maybe most
important – where employees are proud of the quality of care they can provide to the patients they take care of.
The New Quality of Work Initiative supports as a partner of the contest the development of more and better workplaces in the healthcare sector by:

- Publishing easy-to-understand information material for a new quality of work, including the publication “Memorandum for a new quality of work in healthcare” presenting nine core activities for more health and safety in nursing.
- Presenting examples of “Best Practice”
  - Good solutions in nursing and care, download free of charge at http://www.inqa.de/Inqa/Navigation/root,did=126766.html
  - Contest: Beste Arbeitgeber im Gesundheitswesen (Great Place to Work in Healthcare), http://www.greatplacetowork.de

The Award “Work – Safety – Health”: An Open Marketplace for New Ideas

Holger Imhoff
Steinbruchs-BG (“Institution for Statutory Accident Insurance and Prevention in the Quarrying Industry”), Germany

Rescuing injured workers from confined areas such as silos is a critical task. But the retrieval of an unconscious person through the so-called manhole – a narrow opening to exit a silo, typically 600 mm in diameter or even less – is even harder than first aid. Severe injuries of neck and spine can be the terrible consequence of pulling an immobilized person through the manhole, often when you are pressed for time.

Some employees started to analyze the situation and possible solutions. In the end they designed a rescue slide to be attached to the manhole flange. With a winch and a rescue cable, the injured worker can be pulled out of the container on this slide while lying on his back, the curved shape of the device safely preventing any back injuries.

The rescue slide is now available on the market and will help to save many workers from suffering severe injuries as the result of a rescue process – a simple, but ingenious, and most efficient product … and a contribution to the Award Work – Safety – Health of StBG and BBG.

In 1997, StBG and BBG (institutions for statutory accident insurance and prevention in the quarrying industry and the mining industry) started a new approach to improve occupational safety and health at work. The intention for this move was not any recently passed legal regulation but rather the broad interpretation of the BGs’ mission to prevent work accidents, occupational illnesses and work related health hazards using all the suitable means available.

The intention was to create a market place of opportunities that unifies the following three central ideas:

1. Many companies already adhere to a programme of good and innovative safety measures. Intelligent individual solutions are often available to deal with the problems that are often similar in nature. Unfortunately, these solutions have not been published to the degree that is usually required. The sponsorship award is intended to make such ideas accessible to other companies so that they can be implemented by the entire industry.

2. Many people have good ideas on how to solve technical safety problems or promote good health habits. Many times these initiatives fell short before they could be implemented. This is where the sponsorship award is to provide the necessary incentives and more impetus.

3. By including peoples’ input in the member companies, the topic of occupational safety is to be revived in
all plants. Only when people are made aware of safe and health-conscious work practices will it be possible to prevent accidents and occupational illness on a large scale.

The goal of the Award Work – Safety – Health is to look for new ideas and concepts that will make work more human, safer and healthier. In line with this goal, the Award searches for contributions from the following areas:

- Innovative, safety-oriented solutions for existing problems.
- Successful measures for the improvement of health and safety at work.
- The successful introduction of new management concepts.
- Efficient plant activities for the promotion of safety and health.
- Measures for improving road and transport safety.
- Activities creating more human working places.
- Awareness raising measures.
- Operational solutions geared towards SMEs.

The competition is open to all those who – on an individual basis or within a team – have new ideas and proposals to improve our working environment:

- Entrepreneurs and employees, managers, specialists in occupational safety and factory physicians, safety representatives and members of works councils – in brief: all those working in the mineral-extracting industries
- Representatives of the supply-industry, engineering companies, universities and other academic institutions as well as their students.
- Young people and apprentices.

The rules are very simple to avoid any barriers: The contribution should be given on paper (max. of 3 pages), indicating origin, content, evolution and success of the measure. The participant may add specific documentation (like engineering sketches, videos, photos, prototypes) in order to further illustrate the project. Of course the project can be also submitted by e-mail (foerderpreis@stbg.de or foerderpreis@bergbau-bg.de).

Prizes – totalling 100,000 Euros every year – are awarded primarily for projects, concepts and actions developed by enterprises, as well as for scientific studies geared towards practice in the mineral-extracting industries.

When the award started, nobody imagined that the resonance would be so great. The hopes of giving new momentum to the cause of safety and health protection at the workplace with the sponsorship award have been fulfilled: Every year, incoming contributions surprise with their creativity and practical benefit. The number of entries has constantly grown over the years – and the award has become a respected institution, also in neighbouring countries. In the 13 years of the Award Work – Safety – Health, more than 7,700 participants sent in 3,700 ideas and solutions for the daily problems of work. They include the optimisation of working processes, precautionary measures, increased safety at work, prevention of accidents and reduction of occupational illness – and each of these ideas could be worth its weight in gold for other companies!

The collection of ideas and expertise is assembled on the website “www.arbeitssicherheit-gesundheit.de”. This database is an unprecedented fund of information for the mineral extracting industry – and also provides the opportunity to contact the originators directly.

Many of the ideas have been adopted by the industry and can be ordered at retailers today. As such they are useful, for many people … like the rescue slide.
SESSION 8

The economic benefit of prevention
I. Aim of the study
Companies spend money on prevention work with regard to occupational safety and health in order to follow legal and social requirements. These expenses also represent investments, since the companies benefit economically from the effects of prevention measures. Therefore, it is of interest whether spending for prevention work delivers a monetary return, and if so, to what extent a “return on prevention” comes up. To answer these questions, it is necessary to account for prevention work. The difference between single-economic costs and monetary benefits processed in a prevention balance sheet shows the prevention profit or loss. The return on prevention, defined as cost-benefit ratio, illustrates the economic potential of investments in prevention work.

Most of the already existing theoretical analyses and empirical studies relating to the economy of prevention work do not explicitly consider the return on investment in occupational safety and health. Classical approaches examine the costs of occupational accidents and diseases for the economy as a whole (Neubauer 1993; Baum/Schulz 1997, 50; Thiehoff 1997, 12) or the particular companies (Krüger 1995, 95; Kohstall/Lüdeke 2003, 10900; Rikhardsson 2004). Others analyse the different types of costs (Gut/Steffens 1983; Andreoni 1986; Larsson/Betts 1996, 148; Health and Safety Executive 1999) as well as the contribution of occupational safety and health to the company’s success (Langhoff 2002, 78, 131; Packebusch/Herzog/Laumen 2003, 35) including meta-analyses (Kreis/Bödeker 2003; Kramer/Bödeker 2008). However, a concept for prevention accounting and comparing costs and benefits of prevention work in monetary format as well as an evaluation of the return on prevention are still missing.

II. Theoretical concept
Traditional accounting does not disclose the costs and monetary benefits of prevention work. Instead, it is oriented towards the external capital market or the internal decision-making processes. A complementary, social and ecological perspective goes along with social and ecological accounting. Externalities represent advantages and disadvantages of third parties quantifiable by means of social and ecological valuation. Prevention accounting considers the costs and benefits of prevention work. While the costs of prevention lead directly and in the short-term to expenses, the revenues of the benefits of prevention emerge only indirectly and in the long term. Costs and benefits affect the companies carrying out prevention measures. Regarding the morphology of accounting schemes, it is helpful to perceive prevention accounting as an extended investment appraisal or a specific form of cost-benefit analysis. The return on prevention consists directly of
Research on the effectiveness of prevention measures at the workplace

The prevention of occupational accidents, diseases and health risks and indirectly of secondary effects generating economic advantages for the company.

The prevention profit or loss is the difference between the costs and the benefits of the prevention work in companies. It is possible to draw a distinction between the following categories of prevention costs: costs of personal protective equipment, costs of company medical support and guidance on safety technology, payroll costs of company safety officer/s (excluding company medical support and guidance on safety technology), costs of specific prevention training measures, costs of preventive medical check-ups, organisational costs, investment costs, start-up costs. It seems appropriate to distinguish between the following categories of prevention benefits: cost savings through prevention of disruptions of operations, cost savings through prevention of wastage and reduction of time spent catching up after disruptions of operations, added value generated by increased employee motivation and satisfaction, added value generated by sustained focus on quality and better quality products, added value generated by product innovations, added value generated by better corporate image. Prevention accounting refers to single branches or cross-sector to several or all branches. It can also be of interest to analyse the trend of prevention costs and benefits over several years.

In principle, it is possible to account for prevention profit or loss for specific types of prevention measures (e.g. consulting, inspection, training). Because of interrelations of the effects of prevention measures and the complexity of the whole study, it seems to be reasonable to account for the prevention work of the company “as a whole”. It is possible to measure the profit or loss of prevention work non-monetarily in point values or in monetary value. The prevention balance sheet formats typically in monetary values the prevention costs and benefits in the style of prevention statements. The key indicator “return on prevention” demonstrates the ratio between the monetary value of the benefits and the costs of prevention work.

III. Methodological approach

To collect empirical data regarding prevention costs and benefits, 39 companies of different branches, sizes and legal forms were surveyed during the years 2007 and 2008. The selected companies showed interest in occupational safety and health and declared themselves willing to cooperate. Insofar, the collected data is based upon a cross-survey and positive selection. The survey in the form of standardized interviews was addressed abstractly to the companies. For practical reasons, members respectively experts (e.g. controller, employer, member of the workers’ council, safety officer) of the companies were interviewed, either personally visited or contacted by telephone or email. Ideally, the interviewed persons expressed themselves as group and delivered a common answer. While it was relatively easy to determine the prevention costs with the help of controlling and especially cost accounting, problems arose by measuring and evaluating prevention benefits. For their assessment, the use of methods of social accounting or empirical social research was recommended.

At first, the interviewees were asked to estimate the values of the particular categories of prevention benefit of their companies. However, most of them had problems with directly indicating values.
Therefore, an indirect approach following the willingness to pay-method seemed to be more appropriate. The interviewees were then requested to visualize the prevention balance sheet as a pair of scales with two scales, one on each side. Due to their experience, they should estimate whether the prevention costs and the prevention benefits of the company balanced each other or whether the costs or the benefits outweighed. In the latter case, proportionality factors beginning with 1.0 in steps of 0.2 were suggested. The interviewees decided for the just acceptable proportionality factor. Afterwards, it was possible to calculate the total monetary prevention benefit for the company.

In the next step, it was important to allocate the total monetary prevention benefit to the particular categories of prevention benefit. For this, the interviewees were asked to answer the following corresponding questions referring to the effects of occupational safety and health with “yes” or “no”:

- Do you see any cost savings through prevention of disruptions of operations for your company?
- Do you see any cost savings through prevention of wastage and reduction of time spent catching up after disruptions of operations for your company?
- Do you see any added value generated by increased employee motivation and satisfaction in your company?
- Do you see any added value generated by sustained focus on quality and better quality products for your company?
- Do you see any added value generated by product innovations for your company?
- Do you see any added value generated by better corporate image for your company?

The number of positive answers for each category of prevention benefit in relation to the total amount of positive answers of all companies led to the generation of the following system for the allocation of the total prevention benefits on particular categories:

- Cost savings through prevention of disruptions of operations: 20%
- Cost savings through prevention of wastage and reduction of time spent catching up after disruptions of operations: 8%
- Added value generated by increased employee motivation and satisfaction: 25%
- Added value generated by sustained focus on quality and better quality products: 17%
- Added value generated by product innovations: 8%
- Added value generated by better corporate image: 22%

It was assumed that this system is valid for every company included in the survey. In the case of companies not appointing all categories of prevention benefit, the allocation system had to be adapted by extrapolating the values of the categories.

Prevention accounting is an economic model that is based upon assumptions. For example, it does not consider the effects of technical and social progress on the occupational risks regarding safety and health. It is not possible to isolate singular effects because prevention work interconnects almost everything in the working world. For the same reason, it is not possible to isolate prevention costs (e.g. technical safety standards) included in prices of goods. Although prevention accounting as well as the prevention profit or loss formatted in a prevention balance sheet give an impression of the
economic potential of occupational safety and health.

**IV. Empirical results**

The prevention balance sheet below summarizes the empirical results of the study (for details see Bräunig/Kohstall/Mehnert 2009 and Bräunig/Mehnert 2008). The prevention costs and benefits are structured by categories. The difference between both sides expresses the prevention profit or loss. In this study, the values were calculated on an average basis. It also would have been possible to account for median values without structural consequences for values and results. The empirical results are based on a survey of companies that are interested in occupational safety and health. This positive selection goes along with the risk of answers that are too positive. Since the actual answers were predominantly located in a narrow corridor, the risk did not prove true. Otherwise, companies that are less interested in occupational safety and health should even have higher benefits of prevention work. To increase the significance of the prevention balance sheet, it is useful to calculate the prevention benefit and cost ratio, which expresses the return on prevention. For the companies included in the survey, the Return

### Prevention Balance Sheet (n=39, basis: average values)

<table>
<thead>
<tr>
<th>Prevention costs (of companies)</th>
<th>Value in € per employee and year</th>
<th>Prevention benefit (of companies)</th>
<th>Value in € per employee and year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs of personal protective equipment</td>
<td>166,80</td>
<td>Cost savings through prevention of disruptions of operations</td>
<td>304,80</td>
</tr>
<tr>
<td>Costs of company medical support and guidance on safety technology</td>
<td>114,40</td>
<td>Cost savings through prevention of wastage and reduction of time spent catching up after disruptions of operations</td>
<td>98,60</td>
</tr>
<tr>
<td>Payroll costs of company safety officer/s (excluding company medical support and guidance on safety technology)</td>
<td>199,70</td>
<td>Added value generated by increased employee motivation and satisfaction</td>
<td>375,70</td>
</tr>
<tr>
<td>Costs of specific prevention training measures</td>
<td>95,00</td>
<td>Added value generated by sustained focus on quality and better quality products</td>
<td>150,00</td>
</tr>
<tr>
<td>Costs of preventive medical check-ups</td>
<td>22,50</td>
<td>Added value generated by product innovations</td>
<td>62,00</td>
</tr>
<tr>
<td>Organisational costs</td>
<td>91,20</td>
<td>Added value generated by better corporate image</td>
<td>285,50</td>
</tr>
<tr>
<td>Investment costs</td>
<td>68,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start-up costs</td>
<td>82,90</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>840,50</strong></td>
<td><strong>Total</strong></td>
<td><strong>1276,60</strong></td>
</tr>
</tbody>
</table>

*(Monetary net) prevention profit: 436,10 € per employee and year*

Fig.: Bräunig/Kohstall/Mehnert 2009, p. 27, Bräunig/Mehnert 2008, p. 48
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on Prevention (ROP) is 1.6. The return on prevention does not describe a financial relation, but an abstract economic potential. This illustrates that expenses in prevention work improve the economic performance of the companies.

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*)
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Using Financial Metrics such as ROHSEI to Make HSE Decisions

Norman Tan
ORC Asia Pacific, Singapore

ORC stands for Organization Resources Counsellors. For the past 37 years, ORC Worldwide has been providing high-value occupational HSE professional networking services to the world’s leading corporations. We provide these services to its member companies through 9 specialized networks of Regional Corporate Health, Safety and Environment Leaders. We have presently more than 150 major Corporations in many industry sectors who are members of ORC’s HSE networks.

Our ORC’s HSE networks focus on couple of value-added services such as:
- Important technical HSE topics, strategic business issues & regulatory and compliance issue
- HSE management systems, performance metrics, risk reduction strategies, business integration
- Benchmarking and sharing best practices, information & data
- Providing ORC members with access to outside experts and government officials
- Providing rapid responses to member requests for assistance via phone, email, surveys, bulletin board and other tools

Genesis of ROHSEI
A Taskforce of members of ORC Safety and Health Group (representing 15 Fortune 300 companies) sponsored and participated in the development of a process and supporting tool set to answer important questions such as:
- What HSE&E investments should we make?
- How do we know we are doing the “right things” in the “right way”?
- Which HSE&E investments create the greatest value to the organization?
- How can we demonstrate the value of our investment decisions?
- To which projects should we allocate our human resources?

The Four Steps in the ROHSEI Process
Step 1. Understand the Opportunity or Challenge
Step 2. Identify & Explore Alternative Solutions
Step 3. Gather Data and Conduct Analysis
Step 4. Make a Recommendation

Step 1. Understand the Opportunity or Challenge
Purpose of Investments: to increase revenues, to decrease costs, to improve productivity, to reduce injuries, etc.
Developing a business case, whether brainstorming alternatives, gathering data, making assumptions, formulating recommendations, or making decisions,
is to have a solid understanding of the objectives, requirements and constraints of the investment opportunity. ROHSEI’s Business Case Summary is used to document the specific definition of the investment opportunity.

Step 2. Identify & Explore Alternative Solutions
Alternatives are documented in this step. Brainstorm beyond these initial ideas to ensure that all reasonable alternatives are reviewed. May also spark innovative ideas about alternatives that push the edges of current approaches.

ROHSEI’s Causal Loop Diagram is used to explore those other solutions. Prioritizes alternatives to evaluate, based on the ability of each alternative to address the objectives, requirements, and constraints of the opportunity. Once a reasonable set of alternative investment scenarios is developed, each is described in Step 2 of the Business Case Summary tool.

Step 3. Gather Data and Conduct Analysis
Explore a comprehensive view of how HS&E investments impact business performance. Specifically, the process facilitates the consideration of the direct and hidden benefits, as well as costs of each investment alternative.

Direct impacts are defined as those impacts that are easily quantified and clearly observable, such as HSE personnel time, production downtime, loss of raw materials, and HSE capital. Analysis of these impacts results in metrics such as Net Present Value, Return on Investment, Internal Rate of Return and Discounted Payback Period.

Hidden impacts are defined as those HS&E impacts on business performance that are hard to observe and to quantify. Examples include worker productivity, product quality and customer satisfaction. Analysis of these key business metrics results in semi-quantitative rankings that can be used for business decision making.

At the completion of the analysis of the direct and hidden impacts, decision makers will have both quantified financial and business metrics, as well as semi-quantitative rankings of key business impacts to evaluate and to compare each of the alternatives.

Step 4. Make a Recommendation
Evaluate the degree to which each investment alternative meets the requirements and constraints that were identified during the analysis. The learning and metrics that have developed through use of the ROHSEI process and its tools should contribute to an investment decision that considers additional criteria.

Investments, however, should also support the company’s HS&E strategy, the company’s business strategy and the business case reviewer’s priorities. Furthermore, an explicit discussion about how the company and business unit manage HS&E risk should take place to ensure that investment decisions do not arbitrarily assume a “risk neutral” position.

Example of ROHSEI Projects
1. Sprinkler Protection
2. Onsite Primary Healthcare
3. Disability Management
4. Recycling
5. Soil Remediation
6. Behaviour Based Safety Programs
7. PPE vs. Engineering Controls
8. Ergonomics Programs (Lower back)
9. Ergonomics Programs (Work Station)
10. Fleet Safety Programs
11. Electronic Data Sheet Systems
Conclusion

- Using only traditional lagging metrics such as incident frequency & severity rate will not be enough to justify HSE investments

- Integrating HSE decisions into financial metrics that are aligned with business goals and processes are necessary to drive HSE investment acceptance

- ORC’s ROHSEI tool has proven successful in evaluating and justifying HSE investments in financial terms
The Costs of Work-Related Diseases for Economies and Companies – A Rational for Investment

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Initiative Health & Work (iga) of German Health and Accident Insurance, Federal Association of Company Health Insurance Funds (BKK Bundesverband), Germany

In modern societies, work is the source of most individual, corporate, and community wealth. At the same time, the world of work comprises risk factors for the health of employees. Work-related diseases can lead to temporary absence, reduced productivity, long-term disability or even to premature death. Occupational Health and Safety (OSH) has traditionally been focused on occupational accidents and occupational diseases. However, there is increasing approval that employee’s health is also endangered by new risks and by social inequalities. This widened scope brings OSH closer to the concept of workplace health promotion (WHP). WHP has pointed effects on the improvement of the health of employees as well as on the economic position of enterprises. As a scientific consensus it can be stated that WHP leads to a reduction of risk factors and diseases and has a positive return on investment (ROI).

In order to demonstrate the economic impact of work-related diseases two different lines could be followed. First, intervention studies provide evidence on the effectiveness of work related prevention activities by making use of (randomized) controlled designs and allow for return on investment calculations. Against this advantage the evidence is restricted to specific interventions only. Furthermore, interventions are often facilitated as WHP because there can be no control group for OSH activities where legal frameworks are in effect. Risk studies – building the second line – on contrast analyse the relations between risk factors and relevant outcomes. Attributable risks may be derived which allow for calculation of attributable costs. Although risks studies can be deployed rather generally for methodological reasons it can not be concluded that estimated costs can actually be saved by prevention.

In this paper both lines of reasoning will be highlighted. First, based on risk studies costs of work-related morbidity and early retirement in Germany will be presented. Second, the evidence from international research on the effectiveness of workplace health promotion is summarized and it is discussed how this evidence can be used for the calculation of the prospective return on investment for German companies.

Cost of work-related morbidity and early retirement
The costs of work-related illness are an indicator for the importance of occupational safety and health measures. Knowledge about these costs can be used to plan the most efficient deployment of prevention services given the limited resources. Consequently, in recent years studies were conducted by several national and European institutions. One fundamental difficulty is determining the proportion of the costs attributable to the working conditions. However, as a
standard approach in epidemiology, the proportion of diseases which are caused by certain factors can be calculated by the so-called attributable risks. With respect to working conditions, attributable risks indicate what proportion of the illnesses could be avoided if a workload factor was eliminated or reduced by preventive action. To calculate attributable risks it is necessary to first determine the significance of the association between the occurrence of a factor and a disease (the so-called relative risk). Provided that it is also known what proportion of the working population is exposed to the workload factor (the so-called prevalence), the attributable risk can be calculated.

Direct costs, taken as the utilisation of medical resources, were calculated from statistics of the German health insurance system. The indirect costs were calculated on the basis of the human capital approach, meaning the loss of productivity resulting from sickness absence and early retirement. Direct and indirect costs multiplied by the population attributable risk yield the desired work-related costs.

In Germany the annual costs of work-related diseases are estimated at 43.9 billion Euro (Table 1) summing up from app. 33 billion Euro for temporary sickness and 11 billion Euro for early retirement. The most important exposures are heavy work (lifting) and low job control. It is estimated that a moderate increase in job control could save up to 3 billion Euro annually.

### Evidence for the economic benefit of WHP from international studies

Rising health care costs, productivity losses due to absenteeism and presenteeism, and an aging workforce evoke an increase of WHP activities. Current literature on the impacts of WHP programmes brought up new evidence about the savings associated with such interventions. Sick leave was used as outcome in 25 of 56 studies. The average percent change in absenteeism is specified with -26.8%. Health cost analyses occurred in 28 studies and show an average percent change in health costs of -26.1%. A total of ten reviews deal with the economic benefit of WHP programmes. They all conclude that enterprises financially profit from the implementation of such interventions in the long term. The most frequently used factors to visualize the savings are absenteeism and medical costs. The reviews included report a return on investment between 1:2.5 and 1:10.1 for absenteeism, as well as a ROI between 1:2.3 and 1:5.9 for medical costs. For every $1 spent on WHP programmes enterprises can save a minimum of $2.50 due to reduced absenteeism and a minimum of another $2.30 due to reduced medical costs.

Often enterprises have to justify their in-

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Table 1: Annual costs of work-related diseases in Germany

<table>
<thead>
<tr>
<th>Health outcome</th>
<th>Cost category</th>
<th>Billion EURO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work-related temporary morbidity</td>
<td>Direct costs</td>
<td>17.7</td>
</tr>
<tr>
<td></td>
<td>Indirect costs</td>
<td>15.6</td>
</tr>
<tr>
<td>Work-related early retirement</td>
<td>Direct costs</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>Indirect costs</td>
<td>9.6</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>43.9</td>
</tr>
</tbody>
</table>
vestment decisions in WHP programmes. Despite the fact that these programmes improve employee health, the decision-makers are primarily concerned about economic terms. Executives want to know what savings and possible financial return on investment they could expect from an investment in health promotion programmes. They are interested in a key data model that presents the possible savings due to WHP.

A promising approach to show the economic potential of WHP interventions is the so-called prospective return on investment. It is a specific cost-benefit-analysis that estimates the prospective cost-benefit in the run-up to the programme implementation. The prospective ROI analyses the cost-effectiveness and evaluates the efficiency of an investment or compares the efficiency of different interventions. The key figure can be used as an instrument to convince management of workplace health promotion. Furthermore it can be used by external consultants and health insurance companies as an argument for a rational allocation.

Over the past years scientists, mostly in the US, developed some models to calculate the prospective ROI. In 2007 iga initialized a project to this topic with a main focus on the identification, analysis and description of such models. The results are summarized in a report 5 that includes a detailed description of four models for different risk factors and diseases as well as some supplemental studies. Based on the results of this project the Initiative Health & Work (iga) set up a follow-up project aimed at the development of a special calculation for Germany. The analysis of the tools and studies made clear that there are different influencing variables used for calculating a return on investment in the US compared to Germany. This is caused by the different health insurance systems: a pluralistic health care financing system in the US versus a more centralized payment system in Germany.

**Literature**


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An Economic Evaluation Methods Initiative for Occupational Health and Safety

Emile Tompa *)

Introduction
After completing a systematic literature review of workplace OHS interventions with economic evaluations (full report reference Tompa et al., 2007; published as Tompa et al., 2006; 2008a, 2009, and submitted) we became aware of how little evidence there is available on the topic. Through the review we also found the quality of application of economic methods in this literature to be rather weak. Other reviews of the OHS literature have come to similar conclusions (DeRango and Franzini, 2003; Goossens et al., 1999; Niven, 2002). Indeed, a common complaint in the assessments of the research literature on the economic evaluation of workplace interventions is that ‘well-designed and conducted evaluations of programme costs and benefits were nearly impossible to find’ (Niven, 2002).

Undertaking economic evaluations of workplace OHS interventions can be a challenging task, yet there is little focussed guidance available on how to tackle the challenge. Most methods text referred to by researchers in the OHS field are designed for use in the health care sector. But this sector is very different, so the framing of issues, measures, and methods are difficult to adapt to workplace context. An advisory committee involved with developing our systematic review and stakeholders attending presentations of

the completed review emphasized the critical need for information on the resource implications of health and safety interventions, and the need for methods, guidance, and tools. In response to the dearth of evidence, the Institute for Work & Health has been spearheading a methods initiative that has taken two tracks. First, we have developed a methods text for good practices in the economic evaluation of OHS interventions (Tompa et al., 2008b). Second, we are developing jurisdiction and sector specific economic evaluation software for use by workplace parties.

Other researchers working in the field have also noted the critical need for method and tools development. Specifically, the United States National Institute for Occupational Safety and Health and the World Health Organization sponsored a conference in 2004 entitled ‘Economic Evaluation of Occupational Health and Safety Interventions at the Company Level’ (Eijkemans and Fingerhut, 2005; Biddle et al., 2005) where researchers discussed the need to advance methods and presented existing tools (Amador-Redezno, 2005; Bergström, 2005; Lahiri et al., 2005; Oxenburgh and Marlow, 2005).

Overview of the Methods Text
The methods text (Tompa et al., 2008b) is meant to serve researchers, practitioners, policymakers, and course instructors familiar with the nature of initiatives
undertaken to improve OHS performance, and the evaluation of the effectiveness of such initiatives. We have assumed that readers may come from various fields concerned with OHS, including ergonomics, engineering, occupational health, health promotion, workplace studies research, and applied economics. We have also attempted to make the book broadly applicable in jurisdictions having different institutional and regulatory approaches to OHS, disability policy, and health care provision.

There are three clusters of topics in the book – scene setting and context chapters; specific topic chapters, and a concluding chapter with suggestions for a ‘reference case’. The scene setting and context chapters provide a wealth of background material ranging from a presentation of the broad conceptualization of work and health to suggestions for strategies in confronting the data dearth often experienced by OHS researchers. Lessons are also drawn from other literatures, primarily the health technology assessment literature and research on valuing reductions in physical risk. A discussion of the value of health and safety and a critical review of the OHS literature provide a platform for developing insight and guidance on how to take the application of economic evaluation methods further in future studies.

The specific topic chapters delve into the principles and application of economic evaluation methods with focus on issues most salient to OHS. Study design, type of analysis, costs, consequences, uncertainty and equity feature in the roster of topics that provide guidance on analytical and decision making challenges. Each specific topic chapter ends with a concise list of recommendations. In the final chapter, we synthesize the summaries, conclusions, challenges and recommendations from across the book in the development and presentation of a ‘reference case’. This is intended to serve as a minimal set of criteria for which we judge there to be a professional scientific consensus. One benefit of standardization, beyond encouraging good practice, is that it makes results from different studies more readily comparable in future evaluations. As the application of economic evaluation in the OHS arena matures, the agreed upon reference case will likely evolve as the distilling becomes more refined.

Overview of the Software Developed for Workplace Parties

The software is being developed for use by workplace parties, and is designed to be sector- and jurisdiction-specific. The three primary goals of the software are: 1) to improve workplace parties’ understanding of economic evaluation methods for OHS interventions; 2) to enable workplaces to undertake accurate analyses of the costs and consequences of OHS interventions; and 3) to increase the use of economic evaluations in OHS resource decision making.

Currently, we are developing software for three sectors in two jurisdictions. For Ontario, Canada we are developing software for the service and manufacturing sectors. For British Columbia, we are developing software for the health care sector. All versions are being developed over a one-year time period in conjunction with health and safety partners in each of the two jurisdictions and from each of the three sectors. The process began with an environmental scan of existing tools, followed by the development of a prototype that was evaluated by stakeholders at focus groups. An advanced version of the software will be field tested at workplaces over the fall of 2009 before final
release. The software will be available free of charge from the Institute for Work & Health and from our health and safety partners.

The working title of the software is the “Health and Safety Smart Planner”. The software has three principal paths that the user can take upon opening it. They are: 1) a user support section entitled “About the Workbook”; 2) a template for documenting and storing information on injuries/illnesses and their costs called the “Incident Cost Calculator”; and 3) an economic evaluation path entitled “Do Your Own Analysis”.

The user support section provides assistance to users with varying levels of economics knowledge, definitions and explanations of key terms and constructs, and examples of economic evaluations that are sector specific. The incident cost calculator provides a template for users to document the financial burden of injuries and illnesses, and to store the incidents in a database that can be retrieved for future reference. In particular, the database is drawn upon by the user to undertake an economic evaluation. The analysis section has three options that reflect different study designs: 1) Before and After Analysis; 2) Analysis of Concurrent Groups; and 3) Analysis of a Potential Intervention. These correspond to an uncontrolled study, a controlled study, and a prospective analysis, respectively. Each of the analysis options provides a template with multiple steps to document the costs and consequences of the intervention being evaluated. Analyses are also saved to a database for future reference. Summary reports of incidents and analyses can be printed for meetings and presentations.

Summary and Future Directions
Complete information on the costs and consequences of interventions is an invaluable input into OHS decision making. By advancing methods used by researchers and developing user-friendly software for workplaces, we hope to make reliable
information about the resource implications of interventions readily available to workplace decision makers. Planned future directions of the initiative include: 1) developing the software for other sectors and jurisdictions in North America; 2) developing economic evaluation training workshops for workplaces; and 3) developing research methods workshops for OHS researchers.

References


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Strategic Steering of Occupational Safety and Health (OSH) – Examples on Different Organisational Levels

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Introduction

Many European countries have developed from industry-based to service or even knowledge-based economies during the last decades. Globalisation, increased innovation pressure and growing competition for talented workers have given organisations added incentives to review their employee relation strategies in order to attract, motivate, qualify and retain the workforce that will help them to be successful (Zivnuska, Ketchen & Snow, 2001).

Since employees are the basic precondition and resource in terms of future business success there is an intense discussion of how to recruit and develop personnel and sustain their capabilities and well-being.

Investments in Occupational Safety and Health (OSH) as part of Human Resource Management can thus generate added value for a company. This value should be measured and reported to management by means of strategically aligned measures and controlling approaches. This is relevant because in many companies OSH improvement seems not to be a trigger for managers to invest in OSH, and the benefits of many investments in OSH are much more difficult to assess than the costs (Zwetsloot & Van Schepingen 2007). As a result OSH is all too often seen as a cost factor and not as an asset. Already in the 1960s first attempts were made to account for the human factor. In the 1970s concepts were developed that focus on human-orientated research and work organisation in order to foster and develop human resources. Models which arose specifically during the 1990s emphasise the holistic idea of work structures and tasks in conjunction with the worker’s health.

Employees are increasingly considered an intangible asset thereby going beyond such assets as branding, patents, or customer relations. They are supposed to be crucial for future competitiveness (Schubert et al. 2009). The fundamental idea behind applying business cases on human resources (HR) including health is that it is both necessary and possible to organise work without compromising on working conditions or on long-term economic efficiency. Hence positive associations between human-related resources and organisational performance are being presumed (Becker, 1997; Glaser, 2007).

The lack of a common standard to measure success, however, probably aggravates the reluctance of management and CEOs to take OSH issues into strategic account.

In this contribution the business perspective on OSH and its economic impacts are discussed. We address the major question raised by CEOs, Management, and HR Management in terms of OSH: What controlling instruments are available and eligible for different stakeholder groups
Methods of OSH evaluation and controlling
To date, neither binding standards nor regulations exist for internal or external reporting of human capital or OSH in organisations. There are certainly interesting examples, but they hardly play a role in capital market communication (Rimmel & Nielsen 2007). Indeed there is no generally accepted standard in theory, models or business cases. However, there is an enormous need for knowledge as to the effects of human-related measures and appropriate steering methods in real-life settings. In production as well as in the service industries, the focus is set on cost reduction and value creation. Therefore, investments of all kinds – also human-related investments – have to be economically justified.

The likely relationship of HR issues and organisational performance are pictured by Becker (1997) as follows:

OSH-controlling measures are a means for steering health, human resources or – in a broader – sense human capital. They picture the (potential) value of OSH seen from a business perspective. Their objective is to obtain management commitment and approval for investment in OSH through transparent arguments for the investment and more OSH interventions at the company level. However, not only HR Management or the CEOs are in charge of OSH issues.

Many members of a company are responsible for ensuring that its HR management is efficient: the company’s management, HR managers, its HR department, health & safety officers, the company doctor and social services (Pennig & Vogt, 2006). All these actors, being decision-makers or (joint) organisers of HR work, are potential recipients of information on the impact and benefits of HR measures, even if their focal interests and information requirements differ:

HR management experts emphasise the importance of the quality of HR measures; their appropriateness, acceptance and usefulness will certainly determine the employees’ satisfaction with such measures. Accordingly, cost-benefit analyses or evaluations should prove that these measures are worthwhile for the company as a result of their expert quality, high acceptance, scope or specified use and appropriateness. If this is not the case or only applies to a limited extent, the specialists in question will be inter-

Fig. 1: Heuristic chain/relation of human resources and shareholder value (modified from Becker et al., 1997)
Research on the effectiveness of prevention measures at the workplace

Wished in having a profile of the measures’ strengths and weaknesses so that they can optimise them in the future. Since HR departments are generally run as cost centres, the measurement and assessment of use of resources by HR measures is also important for this group of addressees. Consequently, an economic evaluation on this level should provide information in terms of health as well as on performance indicators. The measures have to fulfil a steering and reporting function (see step 3 of fig. 1).

The second group of addressees is the company’s operational management, e.g. foremen or team leaders. They are responsible for ensuring that the HR measures provide the skills, attitude, motivation, teamwork and working conditions needed to perform the tasks in their respective domains (see step 2 of fig. 1). Thus, any profitability assessment should provide actors with operational responsibilities with the information they need to enable them to select, organise and assess HR measures affecting the employees’ performance of their tasks. From the perspective of this group of addressees, the purpose of an economic evaluation is therefore to demonstrate the effects of HR measures on the competence, behaviour and performance of employees and the profitability of the investment in relation to these criteria.

The managers responsible for larger domains, such as divisional managers, principal heads of department or departmental heads, constitute the third group of addressees. Unlike operational managers, they manage managers rather than employees. They will ensure their sector’s ability to perform well less through direct, personnel management than through the implementation of structural measures, agreeing on goals and controlling by means of key indicators. From their perspective, HR measures need to ensure that the performance systems and business processes in their domain are working properly. The information needs of those who are responsible for and steer structures and processes are also different from those of operational managers managing individual employees as regards the assessment of HR measures. Accordingly, the goal of an economic evaluation for this group of recipients is to show the impact of HR measures on the quality and efficiency of the system and processes that determine performance. In this case HR measures must be planned and implemented in close connection with structural and procedural measures, since both need to complement each other’s effectiveness. Correspondingly the economic evaluation should also take up and clarify the links between staff factors (e.g. employees’ qualifications) and structural factors (such as responsibilities).

The fourth group of recipients comprises a company’s senior executives, i.e. the members of its board and the executives running the business. They are particularly important addressees of the results of evaluations, since they often tend to consider HR as an administrative unit and cost item. In the eyes of senior managers, measures taken in areas such as human resources or OSH are rarely worth the expense. A professional profitability evaluation may be able to change this philosophy and secure support for attractive investment. The directors are responsible for the company’s ability to survive and the achievement of strategic corporate objectives. Thus, seen through a top manager’s eyes, the aim of performing a profitability assessment is to be able to assess strategic areas of HR management from an economic viewpoint in order to derive from it the right “HR line of
Research on the effectiveness of prevention measures at the workplace

In addition to determining actual staff costs, the prime objective is to highlight usefulness, i.e. link HR investments to the company’s competitiveness. Hence from the CEO’s perspective HR/OSH have to contribute to the overall strategy and therefore have to be derived from this strategy (See especially steps 1, 5 and 6 of fig. 1). A company’s competitiveness is often expressed in the form of strategic Key Performance Indicators KPIs. These should be included in the economic evaluation for this group of addressees.

Table 1 summarises some examples of available evaluation or controlling approaches with the potential of addressing different problems and supporting different stakeholder groups (Pennig et al. 2006).

The broader approaches cover the effectiveness and efficiency of intervention bundles (see step 2 in fig. 1) or even the entire range of a company’s OSH or HR activities (see the whole chain in fig. 1). Meta-studies regarding the effectiveness of OSH interventions conclude that

Table 1: OSH controlling methods categorised in terms of stakeholder groups. Modified from Pennig et al., 2006, S. 22.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Level at issue</th>
<th>Interest</th>
<th>Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shareholder</td>
<td>Capital allocation</td>
<td>Capital steering</td>
<td>Best Employer Studies (Glaser et al., 2007, Joo et al., 2006)</td>
</tr>
<tr>
<td>Company board/top management</td>
<td>Organization on the whole</td>
<td>Strategic management</td>
<td>Balanced Scorecard (Kaplan &amp; Norton 1996)</td>
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<td></td>
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<td></td>
<td>Skandia Navigator (Edvinsson, 1997)</td>
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<td>Human Capital Scoreboard (Fitzenz 2003)</td>
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<td>Workonomics™ (Strack, Franke &amp; Dertnig 2000)</td>
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<td>Saarbrücker Formel (Scholz et al. 2004)</td>
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<td>Humanpotenzialindex (Schubert et al. 2009)</td>
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<td></td>
<td></td>
<td></td>
<td>Sozialkapital (Badura et al., 2008)</td>
</tr>
<tr>
<td>Management of the organisation’s different departments</td>
<td>Processes</td>
<td>Process management</td>
<td>Customer Perceived Value Accounting CPVA (Schröder &amp; Wall 2004)</td>
</tr>
<tr>
<td>Lower management</td>
<td>Tasks</td>
<td>Steering of behaviour and performance</td>
<td>4-level-model (Kirkpatrick 1994)</td>
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<td></td>
<td>5-level-model (Phillips 1996)</td>
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<td></td>
<td>Utility analysis (Boudreau, 1991)</td>
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<td></td>
<td>Multi attribute utility analysis (Roth &amp; Bobko 1997)</td>
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<td></td>
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<td></td>
<td>Cost-benefit analysis (e.g. Zange-meister &amp; Nolting 1997)</td>
</tr>
<tr>
<td>HR Management</td>
<td>Personnel department</td>
<td>Management of HR-activities</td>
<td>Ahonen, G (2007)</td>
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<tr>
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<td></td>
<td></td>
<td>Potential model</td>
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<td></td>
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<td></td>
<td>HR Scorecard (Becker, Huselid &amp; Ulrich 2001)</td>
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<tr>
<td></td>
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<td></td>
<td>Health Scorecard (Möller et al. 2008)</td>
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<td></td>
<td></td>
<td></td>
<td>Personalcontrolling mit Kennzahlen (Schulte 2002)</td>
</tr>
</tbody>
</table>
combined OSH measures are more effective than single interventions (Kreis & Bödeker, 2003). Thus evaluation or business case approaches should also consider that a bundle of OSH interventions has synergetic rather than merely additional effects. As ever in the field of evaluation there is no “one fits all” method. Whether an approach is eligible or not has to be decided based on the objectives of the system in which the intervention in question is to be evaluated such as enterprise, social assurance, health sector of a national economy etc.

During the last years the demands of companies as to OSH or HR controlling measures have mainly been influenced by the need of attracting and maintaining highly qualified personnel. Hence the above mentioned stakeholder groups have special interests in terms of human capital, human resources or OSH information. Though there are many approaches available which meet these needs, structured and systematic evaluation and controlling of HR and OSH are scarcely found within organisations. Apart from research in terms of new instruments a major challenge lies in attracting enterprises’ decision makers to apply these methods.

References


SESSION 8

Research on the effectiveness of prevention measures at the workplace

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Introduction
Cardiovascular diseases (CVD) are still a major contributor to early morbidity and mortality among working-age populations in industrialised countries. They cause significant economic burdens for these societies. Numerous risk factors are known, most of which are lifestyle-associated and therefore potentially preventable. For decades, CVD prevention programmes at worksites and in communities have been targeting these risk factors following behaviour and/or condition-oriented approaches with or without risk stratification. Though generally feasible, acceptance is highly dependent on socioeconomic status, and overall benefit and cost-effectiveness remain controversial. Worksite-based programmes might have advantages thanks to better access to specific risk groups and a better integration of behaviour- and condition-oriented strategies. The aim of this study was to summarize cost-benefit ratios for worksite and community-based CVD programmes separately and compare return-on-investment (ROI) between both settings to identify the most cost-effective option. So far no systematic review has been published looking at the setting as an influencing variable.

Methods
For this systematic review a comprehensive literature search was performed in electronic databases (PubMed, EconLit, NHS Economic Evaluation Database), followed by hand searching and reference tracking limited to articles published 1978-2008 in English, French, German, Italian, Spanish or Portuguese. Two independent reviewers selected the studies using predefined inclusion and exclusion criteria that were applied on titles, abstracts and full texts accordingly. Retrieved papers underwent a methodological quality assessment with critical appraisal instruments from the Scottish Intercollegiate Guidelines Network (SIGN) before data were extracted in evidence tables and analysed. The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) were adhered to.

Results
From 3,420 studies identified, after screening 101 full texts were assessed for eligibility and 12 were finally included in the systematic review (fig. 1). Nine studies reported worksite based CVD prevention programmes and three described such programmes in com-
Six studies were of good, three of very good and three of poorer methodological quality. Study size, target-ed risk factors and applied interventions differed considerably as did follow-up and other key characteristics like economic perspectives. All CVD prevention programmes showed positive cost-benefit ratios with ROI ranges of 1.1-15.6 per 1 US$ in occupational settings and 1.9-7.8 per 1 US$ in community settings respectively (fig. 2). Direct comparisons of individual programmes were not possible.

Discussion

Only few studies of mixed methodologi-cal quality could be included. Heteroge-neous design, economic perspective and selection of risk factors and interven-tions did not allow pooled data analyses. Cost effectiveness was positive, albeit marginal to at best moderate in both settings. Studies of weaker quality tended to find higher cost-benefit ratios. Based on the available evidence, an advantage of work-based over community-based programmes or vice versa cannot be concluded. CVD prevention programmes are complex interventions, highly context dependent and difficult to standardise. This makes a generalizability of study results highly questionable. Further studies in specific systems and settings are therefore required involving experts from public health, medicine and health economics. Focused research questions, rigorous methodological standards (e.g. randomisation) and a societal economic perspective with uniform discounting should be applied to make results better comparable.

This study did not receive any external funding and the authors declare that there are no conflicts of interest.

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(9) Ozminkowski RJ, Dunn RL, Goetzel RZ, Cantor RI, Murnane J, Harrison M. A return on investment evaluation of the Citibank, N.A., health management

Fig. 1: Study flow diagram following PRISMA

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SESSION 8
Fig. 2: Return on Investment (ROI) in US$ ranges of included studies 3-14 according to methodological quality group (-/+/++) and setting (worksite/community)

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Preventing the Manual Handling Risk for Healthcare Workers: A Cost-Benefit Analysis

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The European study NEXT ¹ shows that of the five causes lying behind the desire of care staff to leave their jobs, the physically demanding nature of the work, and in particular having to lift and move patients manually, is the main one. The statistics at the two hospitals chosen for that study show the same findings, and they have resulted in programmes being set up for preventing the manual handling risk. Alongside the investment in handling assistance equipment (patient lifts, stand-up lifts, and slide sheets) and in training at the two hospitals, a cost-benefit assessment was conducted in order to determine the cost-effectiveness of investment in prevention. For the first hospital, the assessment shows that, with the assumption of a 60% reduction of injuries (estimate based on the literature and on consultation with experts), prevention investment pays for itself in 3.3 years. For the second hospital, the availability of statistical data made it possible to establish a 42% reduction in occupational accidents related to the patient handling risk. The investment made does not pay for itself within the set period of 10 years, but the study shows that, at the end of that period, the expected benefits will offset 80% of the cost of the prevention. The two studies highlight the advantage, when investing in prevention, of using cost-benefit assessment. Such an approach makes it possible to change the image of prevention, which is perceived as being merely a cost, by fitting it into the more positive vision of investment that can be partially or fully offset by financial savings in terms of accident reduction. In addition to those savings, we should include less tangible benefits such as improvement in productivity, improvement in quality of working life, and improvement in the image of the hospital. Furthermore, given that prevention follows a law of diminishing returns, the economic argument is even more of an incentive if the establishment has not yet invested very much in prevention, and is therefore likely to have a very short payback time.

¹ NEXT: Nurses’ Early Exit Study
Reduction of Sickness Presenteeism: The Neglected Source of Productivity Increase?

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1. Introduction
Two headlines coincided this summer in the German press about the economic crisis and the lowest employee sickness absenteeism rate since 1970. The impact of employees’ health on productivity and economic success is widely recognised and some studies confirmed that sickness absenteeism rates decline in times of high unemployment (cf. Fahr/Frick 2007; Clark et al. 2008). This could indicate that either employees are healthier or employees skip work less often due to a perceived higher risk of being dismissed than in times of low unemployment. However, it is likely that this hypothesis of an increased individual cost of skipping work (i.e. a higher risk of future unemployment) is not the one and only explanation for declining sickness absenteeism rates. Instead, the low absence rate can also be achieved by employees who are indeed sick but do not dare to stay at home for several reasons, the fear of losing their job being only one reason in addition to work pressure, tight deadlines, solidarity with colleagues, commitment and – very relevant for the so-called knowledge society – being the only person with the relevant qualification or knowledge. Under the label of “sickness presenteeism” this phenomenon of going to work while being sick has shifted into the focus of economic and health research because in most of these cases presenteeism has a negative impact on productivity and on health alike.

2. How does presenteeism influence productivity?
The relationship between presenteeism and absenteeism is very complex. Presenteeism can occur as absence-independent event and in connection with absenteeism, i.e. before or after health-related absences (Brouwer et al. 2002). Absenteeism can be substituted by presenteeism, especially during periods of restructuring (Caverley et al. 2007, MacGregor et al. 2008). Although presenteeism decreases immediate absenteeism rates, presenteeism also causes absenteeism in the long-term (Kivimäki et al. 2005, Hansen/Andersen 2009).

Appropriately addressing sickness presenteeism provides a broad scope for increasing productivity. This is not only due to the extent to which this behaviour is practised in companies. Several European studies (cf. Zok 2004, de Vroome 2006, Bödeker/Hüsing 2007, Hansen/Andersen 2008) showed that 60 to 80 per cent of all employees go to work when sick at least once a year; but the costs to companies, the social insurance system and the tax system are also enormous.

Presenteeism has an important impact on workplace productivity (through decreased quantity and quality of production or higher scrap rates) and causes other indirect costs for companies (interrupted supply chains, colleagues who take...
Research on the effectiveness of prevention measures at the workplace

over part of the work but cannot do their own or others’ work, staff turnover, bad intra-company communication, penalty fees for not keeping deadlines etc.). When the sick person is present, it is more difficult for supervisors to redistribute work and arrange for a substitute and the reduction in productivity is not as obvious as during a period of sickness absence. The productivity loss caused by presenteeism can even exceed the productivity losses of sickness absence. A study by Goetzel et al. (2004) showed that the productivity loss caused by presenteeism actually exceeds the productivity loss induced by absenteeism: Depending on the methodology 18 to 61 per cent of all health-related costs to employers in the US were caused by presenteeism. In particular chronic health conditions with a high prevalence (e.g. migraine, diabetes, depression, heart disease, musculoskeletal diseases, arthritis or allergies) are causing very high direct and indirect presenteeism costs (Goetzel et al. 2004, Lofland et al. 2004).

3. How can addressing presenteeism increase productivity?

Several factors have been identified to influence the level of presenteeism. Firstly, there are individual factors such as the employees’ health status, their private financial situation, family life but also personal attitudes, e.g. over-commitment (Siegrist 1996) or individual boundarylessness (Aronsson/Gustafsson 2005).

Secondly, work-related and organisational factors play an important role in promoting health and shaping behaviour in cases of illness. Hansen/Andersen (2008) found evidence that work-related factors have a higher influence on the levels of sickness presence than individual dispositions or attitudes. Time pressure, low control over work tasks, general employment conditions but also the working culture and the relationships with colleagues have a proven influence on the presenteeism levels (cf. Musich et al. 2006, Caverley et al. 2007, Hansen/Andersen 2008). These structural and organisational factors are within management’s reach and can be addressed more directly and should therefore be of high interest to the companies’ management. Most if not all of these measures do not only help reduce health-related productivity losses but they are likely to improve the general health and resilience of employees. Among these measures are

- the provision of sufficient resources,
- the structuring and distribution of work and workplaces in a way that the work will not be left undone in cases of absence,
- the provision of supportive measures (workplace furniture, part-time arrangements etc.) at the workplace to offer working conditions conducive to the healing process,
- other provisions in order to avoid conflicting demands from employees, and
- the provision of greater flexibility in relation to the kind and pace of work.

One recommendation to reduce productivity losses caused by presenteeism is to encourage people to stay at home when sick. However, presenteeism may also lead to a long-term positive productivity development, especially in those cases for which the evidence-based medicine recommends to stay at the workplace under adjusted conditions, as is often the case for musculoskeletal diseases and certain mental health conditions (Bödeker/Hüsing 2008). The employees concerned are at the workplace while ill. Although their productivity will certainly be reduced, their presenteeism will not be harmful to the employee’s health (if acute symptoms...
have been excluded); instead, the work skills and social relations to colleagues and clients will be maintained. Thus, encouraging presenteeism can increase productivity in the long-term when combined with supportive measures to ensure that an employee’s specific health status is duly accounted for.

Since health and productivity issues are very complex, absenteeism and presenteeism would have to be assessed together in order to provide a complete view on health-related productivity losses. This also means that it is not sufficient to aim solely at decreasing absenteeism rates or presenteeism rates. For this purpose, it is a basic prerequisite to collect not only absence data but also data on the prevalence and extent of presenteeism in the workplace. In combination with absenteeism data, this provides a better basis for assessing the development of the employee health status and to identify the most relevant areas for intervention in order to improve workplace productivity. The employees’ health only improves when both absenteeism and presenteeism rates are falling. A variety of tools to measure the impact of presenteeism has been developed but a lack of a generally accepted and applied methodology (Lofland et al. 2004, Chapman 2005, Mattke et al. 2007) continues to complicate comparisons.

4. Conclusion
In conclusion, reducing either sickness presenteeism or sickness absenteeism alone will not necessarily increase productivity. Instead, productivity can be increased by improving the overall health status of the workforce. In order to improve health-related productivity and employee health alike, it is necessary
- to measure health-related productivity losses in the workplace and identify tangible areas;
- to raise employee and supervisory awareness for the health and productivity impact of sickness presenteeism; and
- to implement organisational and structural measures at company level in order to remove barriers for taking legitimate sick leave and to improve the overall employee health.

Because of its high impact on productivity and on employee health alike, the implementation of appropriate measures to address presenteeism and absenteeism will potentially entail a high return on investment of the measures taken.

5. Bibliography


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Special Sector Construction Industry – Integrative Approaches and Activities for Effective OSH in the Construction Industry

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The construction industry is one of the main fields of activity for BAuA. Due to the construction industry’s structure in Germany (i.e. the high number of small and medium-sized construction companies) and the many risks involved in construction work it is necessary to present good solutions and to develop practicable instruments for effective OSH in construction.

The instruments are addressed to small and medium-sized construction companies and also to clients, designers, planners and managers of building projects to bring about improved conditions for health and safety in construction. It is crucial to show the added value of health and safety measures with a view to the success and competitiveness of the company, if we want the instruments we offer to small and medium-sized companies to develop their full utility.

There are three different levels of addressing the construction industry:
- Our strengths: research and development, providing information and publications, information events, colloquia
- Better results through cooperation programmes: cooperation with health and safety specialists and sector organisations
- INQA-Bauen: presenting building processes which ensure quality, efficiency and OSH

Planning, organisation, communication, cooperation and co-ordination are the basis for reliable quality, schedule efficiency and cost control as well as effective OSH in construction – this is the common basis for the INQA-Bauen-Partners. INQA-Bauen is a national network of the main construction industry organisations.

INQA-Bauen developed a memorandum and instruments which describe good, efficient and safe working in construction. The instruments serve as reference instruments for the instruments of the INQA-Bauen-partners.

A synopsis of the instruments is published in the form of a brochure; the full version is available online: www.casa-bauen.de; www.komko-bauen.de; www.check-bauen.de.
Occupational Health and Safety in Nursing and Care – Presenting “Best Practice Examples” for Healthier Workplaces for Nurses

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Under time pressure at work? This is something that many nurses experience every day. The idea of nursing oriented towards patients and residents has been wishful thinking for a long time. Too few personnel and too much “paperwork”, i.e. documentation, are often reasons quoted for the limited time available. In consideration of demographic developments in Germany, the nursing industry will soon be faced with yet another challenge – a lack of personnel. Due to the diminishing labour force potential, successfully finding qualified and motivated personnel will become a complex task for every nursing institution.

The Federal Institute for Occupational Health and Safety (BAuA) in Germany supports the development of more and better workplaces for nurses. To achieve this, the BAuA pursues different activities, such as:

- Producing information material regarding possible improvements for the work design, such as reports and brochures on working-time, reducing time pressure or red tape.
- Founding regional networks for the information exchange between healthcare institutes
- Funding projects, e.g. showing the relationship between good working conditions, high quality care and the economic situation of geriatric care homes (3Q-Study)
- Distributing free information material at trade fairs and conferences

Our strategy is to produce and distribute easy-to-understand information material for a new quality of work in nursing and to present examples of “good practice”. Every year, the best places to work for in the healthcare sector are awarded in the contest – Beste Arbeitgeber im Gesundheitswesen (Great Place to Work in Healthcare) in cooperation with the Great Place to Work Institute Germany.

Examples of our products, which we distribute free of charge, are our memorandum for a new quality of work in healthcare, presenting nine core activities for more health and safety in nursing, and brochures such as “Good management in nursing”, “Dementia: Recognising the other world” and “Less red tape in nursing”.
Prevention Services for the Construction Industry Provided by the Berufsgenossenschaft

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Construction site operations differ very much from stationary operations in industry. The conditions for building and construction work are subject to frequent change due to work being required in various sections of the construction site and due to the different requirements during the various stages of the construction. For this reason adjusted and detailed operations’ scheduling would have a particularly effective influence on occupational safety and health on site. The Berufsgenossenschaft [BG – The Institution for Statutory Accident Insurance and Prevention] is a service provider to support companies in preventing accidents. BG offers support to companies during the acquisition phase or when a company asks BG for consultation. After the order has been confirmed the service commences by supporting the company in developing a detailed risk assessment based on the specifics for the building project (consultations, checklists, guidelines for risk assessment...). This evaluation is included in the safety concept for the construction site. Regular inspection tours on-site indicate whether or not the safety concept has to be optimized according to the progress of the construction work. This contribution is an example for the cooperation between companies and BG in the different stages of construction sites. It should motivate companies to ask BG for assistance already in the planning stage. This can help complete a project successfully and without any accidents.
Although metalworking fluids have been widely used in industry for decades, occupational exposures to metalworking fluid aerosols have not been well characterized. A variety of organisms have been identified which are associated with fluids, including bacteria, fungi and mycobacteria. Endotoxins have also been identified. The aim of this study was to assess airborne exposures to metalworking fluids (MWFs) as a potential source of harmful biological agents. Sampling was conducted in 11 engineering industry plants in Umbria (Central Italy) during two different seasons (spring and fall). The sampling was performed with passive (air microbial index – IMA Standard) and active (SAS surface air system – microbial sampler) microbiological assessment methods. Endotoxin values were also measured. The results showed the increase of air microbial contamination during the use of MWFs. Ranges of medium value, obtained by active method, of psychrophilic bacteria during workshift were 16-394 CFU/m$^3$(Colony Formant Unity/m$^3$), of fungi were 19-197 CFU/m$^3$. The absolute values of the bacteria and fungi contamination obtained by passive determination were lower, but showed the same microbiological situation. The predominant genera of molds were Alternaria, Aspergillus and Cladosporium.

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EUROSHNET – Supporting the Transfer of Research Results into Practice

Rüdiger Reitz, Jocelyne Jolly, Eero Korhonen and Sonja Miesner *

EUROSHNET is a cooperation network between European OSH professionals active in standardization, testing, certification, and/or related research. It is supported by a Steering Committee and a Working Group with members from Finland, France, Germany, Poland and Spain. Nearly 500 experts from 20 European countries are registered for the network.

The essential aims of EUROSHNET are as follows:
- To facilitate contact between individual OSH experts
- To promote the discussion of issues of common interest
- To disseminate information of interest to occupational safety and health
- To forge and maintain contacts with other networks

The network’s activities are closely linked to research activities:
On the one hand, the development of high-quality standards requires scientifically robust knowledge as an objective basis for negotiations between interested parties. On the other hand, standardisation can enhance the practical use of OSH research or study results thus promoting innovation and competitiveness.

EUROSHNET can also be used to
- improve mutual awareness and integration between the research and standardisation communities by assisting researchers in taking standardisation into account when planning their research programmes and assessing their results on the basis of standards.
- to promote the carrying out of common research projects on priority topics, and to stimulate and facilitate collaboration and the creation of research consortia.

The poster will focus on the activities of EUROSHNET and how it could be of help for the transfer of research into practice.

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Assessment of Chemical Protective Coveralls with Regards to Permeation Tests

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Introduction
Chemical protective coveralls are often the last barrier between the user and adverse substances. In order to allow the selection of the appropriate coverall, user instructions have to specify the results of permeation tests undertaken by the manufacturer. Protective coverall are usually tested against basic substances such as acids, bases or solvents, according to EN 14605 specifications. In practice, however, these protective clothing are often used to protect against complex mixtures of chemicals (such as pesticides in agriculture, paints in the automotive and building sectors) which have not been specifically tested.

Study
A previous study, conducted at the University of Bordeaux, suggested that coverall protection was inadequate against mixtures used during agricultural activities. To address this issue, the French Ministry of Labour entrusted Afsset to conduct objective investigations on chemical protective coveralls placed on the market with regards to permeation. These investigations only deal with protective coveralls against liquid chemicals, i.e. coveralls of types 3 (liquid-tight connections) and 4 (spray tight connections), as defined in standard EN 14605.

The study was conducted using two steps:
- First, permeation tests were performed to check the conformity of the coveralls: the substances which were mentioned by the manufacturers in the user instructions were tested.
- Then permeation tests were performed with certain chemicals actually used by workers in certain business sectors (agriculture, paints...).

Tests were conducted by a notified body according to harmonised standards EN 14605, EN 14325, EN 374-3.

Results
These investigations are expected to highlight the relevance of the current testing and labelling practices. They should provide a contribution to the discussion of whether the current harmonised standards should be revised in order to improve the health and safety conditions in workplaces.
Use of PIMEX for Risk Assessment and for Motivating Both Workers and Employers

Mario Dobernowsky and Klaus Kuhl
Kooperationsstelle Hamburg, Germany

The poster will explain the Pimex method and how it is used to motivate workers to apply preventive measures.

The Pimex Method (Picture Mixed Exposure) uses a simultaneous recording of several aspects of workplace conditions, presented visually in real time and in format which is easy to follow and understand.

The flow of work is filmed with a video camera. At the same time, the exposure data (noise, air pollutants, etc) are recorded using direct-reading measuring instruments. We insert these exposure data into the video film as bars or as columns on the screen, so that instant access to the data is provided. The data can also be used for further assessment and for immediate changes of the work procedure (e.g. positioning of exhaust systems, movement of tools, use of different tools, etc.).

Workers become highly motivated as they can immediately see how they are exposed to dust, noise, etc. and what they can do to prevent or minimize such exposure.
Development of a Prevention Index for a Prospective Assessment of Accident Risks

Dietmar Bratge and Matthias Timm *)

Accident figures and similar criteria refer to the past. Therefore, they are only suitable to a limited extent to assess the current or future accident risk in a company in order to set priorities for effective prevention work. For this reason, the Berufsgenossenschaft Metall Nord Süd is developing a procedure which enables the inspectors to record the state of health and safety at work in a company and to summarize it in a prevention index. It covers information concerning technique, organization and personnel.

The poster introduces the contents of the prevention index, the graphical presentation of the results and initial experience in its application.

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Occupational Safety and Health Risk Control Strategy Through MSE

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Occupational Health and Safety (OHS) risk control has become an important aspect of a business operation. Traditional OHS risk strategy includes elimination, substitution, reduction, engineering control, administrative control and PPE. It is very important to have management support in all aspects of the risk control strategy and hence a holistic approach should be followed. For an effective and comprehensive OHS risk control strategy, management support as an additional control measure to the traditional risk control strategies is to be implemented.

The model highlighted in this paper considers management control as a first level in the hierarchy of risk controls. At any point during the OHS risk evaluation and identifying controls measures, should the management controls are eliminated; there will be an inherent risk to the organization. The other traditional risk controls are re-classified as exposure and system controls to make it more comprehensive. For an overall effective risk control, management control followed by system controls and exposure controls should be adopted.