Survey evaluating what technologies and materials from other industrial sectors can be applicable to the naval ancillary industry.

REPORT N°5:

Good practices for ensuring safety during production.

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Introduction

In the framework of the project AUXNAVALIA PLUS for improving the Atlantic Area maritime safety by increasing the naval ancillary industry innovation capacities, a survey has been led for evaluating what technologies and materials from other industrial sectors can be applicable to the naval ancillary industry. The results are collected in five reports, each covering a different thematic: materials, joining methods, equipment for virtual reality, safety standard procedures for design of an assembly, best practices for safety. The present report is about good practices found in various industrial fields to ensure safety during production, in particular in terms of safety management.

Occupational safety and health at work is an essential concept. Every working situation generates risks for workers. In particular, production activities are a source of serious injuries, from musculoskeletal disorders to more or less severe accidents such as falls, electrocution, motor vehicle collisions, etc. Beyond implications for employees' health, consequences are often penalizing for staff members and their company.

Preventive measures to control workplace risks have been developed for several decades. They gather personal protective equipment (eye, earing, hand protections, etc.), common safety measures (guardrails, fall protections, traffic control, etc.) and implementation of Safety Management Systems (SMS).

Personal protective equipment and common protective measures are described by a number of safety organizations such as ACT (Autoridad para as Condiçôes do Trabalho), EPSC (European Process Safety Center), HSA (Health and Safety Authority), HSE (Health and Safety Executive), IHSA (Infrastructure Health and Safety Association), INRS (Institut National de Recherche et de Sécurité), INSHT (Instituto Nacional de Seguridad e Hygiene en el Trabajo), OSHA (Occupational Safety and Health Administration), etc. They are not presented in this report.

This study focuses on management practices. On the one hand, Safety Management Systems (SMS) are studied: this term refers to a systematic approach for managing safety at workplace, which is part of company management. SMS aim to reduce risks by identifying hazards, implementing effective communications across all levels of a company, setting up processes to correct nonconformities, and implementing a continuous improvement process. Companies are used to setting up their own SMS, according to their objectives, by using and adapting existing standards or reference systems. Main standards and reference systems span across most of industrial fields; they are described here:

- standards for Safety Management Systems;
- Safety Management Systems orientated towards subcontractor industries.

On the other hand, a selection of awarded industrial management practices is presented (OSHA EU, OSHA UK, ROSCA, etc.). These practices have effectively enabled companies to reduce injury hazards and accidents rates, improve workplace organization, improve workers motivation, reduce absenteeism, etc. In this report, two categories of practices are described:

- introduction of safety culture in companies, in particular through implementation of preventive measures, awareness raising initiatives and employees involvement in safety at work;
- development of employees well-being.

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1. Standards for Safety Management Systems

ILO-OSH 2001	International Labour Organization

Description:

ILO-OSH 2001 ("Guidelines on occupational safety and health management systems") is an international standard promoted by the International Labour Organization (ILO). It presents practical approaches and tools for assisting organizations, national institutions, employers and workers in implementing and improving occupational safety and health (OSH) management systems, to reduce risks at work while improving productivity. ILO-OSH stresses on workers involvement in their company and their conciliation with staff representatives.

The main components of the ILO-OHS are :

- *policy*: establishing requirements (resources, management commitment, OSH targets, etc.);
- *organizing*: defining organization structuring, responsibilities (who, where…), etc. ;
- *planning and implementation*: identifying standards/legislation applied to a given company and OSH objectives, implementing hazards assessment and prevention etc. ;
- *evaluation*: defining means for measuring OSH performance, processes for reporting accidents, etc.;
- *action for improvement*: defining means for preventive and corrective management to ensure continuous improvement process.

ILO-OSH 2001 leads to a certification delivered by one of the certification bodies recognized by ILO.

Benefits:

- reduction of workplace injuries;
- motivation and involvement of company staff;
- productivity improvement and costs reduction;
- corporate image.

Maturity and extent :

ILO-OSH 2001 guidelines were first published in 2001 (English) and 2002 (French, Spanish). Several countries in the world have already adopted the ILO-OSH principles for several industrial fields. However, the certification has not gained widespread acceptance among companies. For example, a study (source: CSP FORMATION) showed that 4% of French companies were certified ILO-OSH 2001 in 2009.

However, several leading industries have produced their own SMS, based on ILO-OSH principles. As an example, in aviation the ICAO (International Civil Aviation Organization) safety management manual provides resources to help SMS implementation. AVSSMS (Aviation Safety Safety Management System) was adopted by the FAA (Federal Aviation Administration). On July 2011, the EASA (European Aviation Safety Administration) started the process to implement SMS regulations.

Application fields:	**Actors:**
Most of industrial fields.	• Author: ILO (International Labour Organization). • Certification bodies : AENOR, AFNOR, BSI, BUREAUVERITAS, etc.

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Scientific publications:

- *Management of health, safety and environment in process industry*; NJ Duijm, C Fiévez, M gerbec, U hauptmanns; Safety Science; 46(6): p908-920 (2008);
- *Knowledge management for occupational safety, health, and ergonomics*; B Sherehiy, W Karwowski; Human Factors and Ergonomics in Manufacturing & service Industries; 16(3): p309-319 (2006);
- *Work Improvement and Occupational Safety and Health Management Systems: Common Features and Research Needs*; K Kogi; Industrial health; 40: p121-133 (2002);
- *Guidelines on occupational safety and health management systems (ILO-OSH 2011*); ILO Geneva.

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OHSAS 18001	

Description:

OHSAS 18001 (Occupational Health and Safety Assessment Series) was created by some of worlds' leading national standards bodies, certification bodies and specialist consultancies. It is an international occupational health and safety specification for SMS. It was developed in response to the increasing demand from companies for an internationally recognized standard. OHSAS 18001 is also compatible with management systems ISO9001 (quality) and ISO14001 (environment). It is complementary to OHSAS 18002 that gives the implementation guidelines.

OHSAS 18001 is different from previously presented ILO-OSH. OHSAS 18001 focuses on workers supervision, presents requirements for SMS and leads to a voluntary certification, while ILO-OSH focuses on workers involvement, makes recommendations (which gives more flexibility to companies) and leads to a "mandatory" certification.

Benefits:

- reduction of workplace injuries;
- motivation and involvement of company staff;
- productivity improvement and costs reduction;
- corporate image.

Maturity and extent:

OHSAS 18001 was created in 1999. It was updated in 2007 to fit with ISO9000 and ISO14000 management systems. It is currently seen as the world's most recognized occupational health and safety management system standard. In 2009, more than 50 000 OHSAS certificates had been delivered in 116 countries. For instance, 18.6% of French companies were certified OHSAS 18001 (source: CSP FORMATION).

Application fields:

Most of industrial fields.

Actors:

- Authors: NSAI (National Standards Authority Of Ireland), STANDARDS AUSTRALIA, BSI (British Standards Institution), BUREAU VERITAS, SGS YARSLEY INTERNATIONAL CERTIFICATION SERVICES, ISM (International Safety Management) ORGANIZATION, etc.
- Certification bodies: AFAQ, AFNOR, APAVE CERTIFICATION, BSI, BUREAUVERITAS, DEKRA CERTIFICATION, DNV CERTIFICATION, LQRA, SGS-ICS, etc.
- Consulting firms: ABS CONSULTING, GLOBALO2, IDDES, JW ALLCOCK MANAGEMENT CONSULTANCY, KANTNER & COMPANY, NSC CONSULTING, A QIS, etc.

Scientific publications:

- *Occupational risk management under the OHSAS 18001 standard: analysis of perceptions and attitudes of certified firms;* B Fernandez, JM Montes-Peon, CJ Vazquez-Ordas; Journal of Cleaner Production; 24: p36-47 (2012);
- *ISO 14001 and OHSAS 18001 Certification for Global Drilling Operations;* S Hasan, T Hanson; Asia Pacific Health, Safety, Security and Environment Conference, 4-6 August 2009, Jakarta (2009);
- *Integrated management systems–three different levels of integration*; TH Jørgensen, A Remmen, MD

Mellado; Journal of Cleaner Production; 14(8): p713-722 (2006);
- *Análisis de las normas OHSAS 18000 en la industria naval*; MV Paredes Gonzales; Tesis para optar al título de ingeniero naval con mención en la construcción naval (2005) ;
- *ISO 9001, ISO 14001 and OHSAS 18001 management systems: integration, costs and benefits for construction companies;* LS Pheng, GK Kwang; Architectural Science Review; 48(2) : p145-151 (2005);
- *Safety Mangement System registration in the shipping industry;* KF Pun, RCM Yam, WG Lewis; International Journal of Quality; 20(6): p704-721 (2003);
- *Integration of standardized management systems: searching for a recipe and ingredients*; S Karapetrovic, J Jonker; Total Quality Management and Business Excellence; 14(4) : p451-459 (2003);
- *Integrating ISO 9001 and OHSAS 18001 for construction*; LS Pheng, CY Pong; Journal of Construction Engineering and Management; 129(3): p338-347 (2003).

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1. Safety Management Systems oriented towards subcontractor industries

VCA - SCC	

Description:

VCA (Veiligheid Checklist Annemers) or SCC (Safety Checklist for Contractors) was developed by a consortium of Dutch and Belgian certification bodies (SSVV: Stichting Samenwerken voor Veiligheid). It aims to reduce the number of accidents at work, ensuring greater safety awareness of companies. VCA-SCC is a versatile and comprehensive program for testing and certifying SMS of subcontractor companies. It comprises two different levels of certification, according to the number of employees and the project type.

Certification is made by an accredited body and is valid during three years.

Benefits:

- reduction of workplace injuries;
- better organization and communication;
- motivation and involvement of company staff;
- costs reduction;
- conformity to legislation and credibility benefits.

Maturity and extent:

VCA-SCC certification system was initiated in the 1990s by the SSVV (Stichting Samenwerken voor Veiligheid), to objectively assess safety policies and performance of subcontractors from the petrochemical industry. Since then, VCA-SCC has gained widespread recognition as industrial standard but its use remains restricted to Belgium, the Netherlands, and companies located on the border. VCA-SCC was lastly revised in 2004.

Application fields:

- construction;
- electrical engineering and process control;
- mechanical engineering;
- petrochemical industry;
- other engineering services such as: insulation, scaffold erection, industrial cleaning, painting, transport, inspection, etc.

Actors:

- Authors: SSVV (Stichting Samenwerken voor Veiligheid).
- Certification bodies: ABOMA CERTIFICERING, BSI MANAGEMENT SYSTEMS, BUREAUVERITAS, CEBEC, DEKRA CERTIFICATION, DNV, EBN, EERLAND CERTIFICATION, NCI (Netherland Compliance Institute), SAFEX, etc.

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MASE-UIC / GEHSE / AFIM	

Description:

MASE-UIC is a reference system for SMS, mainly targeting subcontractor SMEs-SMIs that carry out their services on French high-risks industrial sites. Since 2007, MASE-UIC is the outcome of the joint approach of two management systems standards: MASE (Manuel d'Amélioration Sécurité Entreprise) and DT78 from CIU (Chemical Industries Union). MASE-UIC aims to improve safety at work taking into account the working environment and preventing hazardous situations. It hinges on the following five main axis:

- organization management commitment;
- competence and professional skills;
- work organization and planning;
- monitoring;
- continuous improvement.

GEHSE (Guide d'Engagement Hygiène, Sécurité et Environnement) is a variation of MASE-UIC. GEHSE is a reference system for SMS, developed to meet the need of regulating activities of subcontractor companies in the oil & gas field (more precisely, all-sizes hydrocarbon stores or small oil establishments). GEHSE aims to reach « zero accident » in the industry, by continuously improving health at work. It is generally used in parts of the French territory that are not subject to MASE-UIC.

Subcontractor companies meeting MASE-UIC or GEHSE criteria are certified for one to three years, after being audited by a qualified third-party organization. The certification is delivered by MASE or GEHSE organizations.

At the end of 2004, **AFIM** (Association Française des Ingénieurs et responsables de Maintenance) was created. This reference system was developed to enable subcontractor companies to assess their management in terms of health and safety at work. AFIM is the synthesis of other reference systems commonly used (MASE-UIC, GEHSE, OHSAS 18001, VCA). It also takes into account recommendations made by ILO-OSH 2001.

Benefits:

- reduction of workplace injuries;
- better organization and communication;
- motivation and involvement of company staff;
- costs reduction;
- conformity to legislation;
- credibility benefits (in relation to customers, banks, insurances, etc.).

Maturity and extent:

MASE and GEHSE were created in the 2000s by MASE organization (consortium of ordering and subcontractor industries) and GEHSE organization (consortium of oil&gas and oil&gas related companies) respectively. AFIM was created at the end of 2004.

MASE was first reserved to French petrochemical and chemical sectors, but extended to other fields, especially high-risks industrial fields such as nuclear or steel industries. MASE certification is currently popular among French companies that want to be sure of the reliability of the subcontractor companies in relation to safety and their ability to meet with given criteria when they operate on their sites. **GEHSE** certification is not as

widespread as MASE. It is especially recognized by French oil & gas industries.	
Application fields: • all industrial fields, in particular high-risks fields (MASE-UIC); • oil & gas (GEHSE).	**Actors:** • Authors: MASE association, GEHSE association (EDT, ESSO, GEOSTOCK, SHELL, TOTAL, etc.), AFIM (Association Française des Ingénieurs et responsables de Maintenance). • Audit and certification bodies: AC2A, ACTION MANAGEMENT, AEGIDE INTERNATIONAL, AFAQ AFNOR, ANTHEA CONSEILS, APAVE, BUREAU VERITAS, DEKRA, DNV CERTIFICATION, ETSCAF, INERIS, LQRA, PREVACTION, SAFETY RISK SERVICES, SGS – ICS, SOCOTEC, TUV SAARLAND, etc.

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SAFECONTRACTOR	safecontractor

Description:

SafeContractor is a leading UK health and safety pre-qualification assessment scheme. Unlike MASE that is an industrial association, SafeContractor is offered as a service by the company SANTIA CONSULTING LIMITED.

It is firstly directed to subcontractor companies that want to demonstrate their commitment to health and safety at work. SafeContractor scheme is designed to review and audit health and safety policies, procedures and documentation of subcontractors. When accreditation process has been successfully completed, subcontractor companies can use their certificate to demonstrate their level of health and safety compliance to their clients. SafeContractor is also directed to companies that are used to calling in subcontractors and need to ensure that they take health and safety issues into account.

SafeContractor standards cover basic elements (health and safety policies, risk assessment, first aid, etc.) as well as specific requirement relating to the subcontractor activity (asbestos removal, etc.).

Benefits:

- reduction of workplace risks and accidents;
- no longer need for subcontractors to answer multiple pre-qualification questionnaires before providing their services to several companies;
- conformity to legal requirements;
- companies can manage their list of approved contractors more efficiently and cost effectively.

Maturity and extent:

Created in 1999 under the name of SupplyLine, SafeContractor is today one of the fastest growing health and safety accreditation scheme in the UK. With more than 210 major client companies and 19 000 contractor members. It is used by many large organizations in various industrial sectors (KELLOGS, GENERAL MOTORS, HOME RETAIL GROUP, etc.) as a way of obtaining competent contractors.

Application fields:

- automotive;
- banks and insurances;
- construction;
- leisure;
- manufacturing;
- retail;
- transport and distribution;
- etc.

Actors:

- Authors: SANTIA CONSULTING LIMITED.
- Clients: BENTLEY, GENERAL MOTORS, JAGUAR LAND ROVER, KELLOGS, NESTLE UK, NEW LOOK, PROCTER & GAMBLE, SAINT-GOBAIN ISOVER, VINCI CONSTRUCTION, VODAFONE, etc.

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2. Awarded good practices for ensuring safety

INTRODUCTION OF SAFETY CULTURE: RISK PREVENTION MEASURES

Description:

Safety culture in companies reflects attitudes, beliefs, perceptions and values that employees share regarding safety. Introducing a positive safety culture in a company is an effective way to reduce accidents. It especially requires revising risks prevention measures. Preventive measures focus on specific aspects:

- **Occupational health and safety (OHS) standards**: safety standards ensure safety at work, and facilitate cohesion in a company and communication between employees and managers. Standards can affect workplace organization, risk assessment, safety documents and regulations, safety equipment, etc.
- **Increase in safety supervision:** risks prevention can be improved by reinforcing supervision through an increase of human resources (production process supervisors, safety representatives, safety patrols, etc.) and other means such as safety audits, etc.
- **Increase in intervention speed**: safety management is more efficient when decisions are taken more quickly, in response to safety issues. For example, intervention speed can be improved through instant information means (SMS, e-mails, etc.).
- **New means for identifying preventive measures:** new ways for identifying preventive measures include the use of videos to recreate accidents and near-misses, photo case studies, opinion polls, etc.
- **Safety rules out of the company:** in some fields, risk prevention measures must be applied outside the company, at suppliers or contractors levels, to ensure workers safety during the production.

Examples:

voestalpine

VOESTALPINE is an Austrian steel–based technology, capital goods group and a world leader in manufacture and development of steel products. The company has set up a project to create a general OHS standard for tasks and workplaces to be organized. At each of the eight group locations, workplace organization has been revised according to "the 5S's method" (**S**orting, **S**et in order, **S**ystematic cleaning, **S**tandardizing, **S**ustaining), which emphasizes cleanness and tidiness. The company has also introduced OSH guidelines for the purchasing of new machines. Continual improvement process has been implemented to ensure that ideas for safety improvement are applied.

CONSTRUCTION SAFETY PARTNERSHIP

This Irish alliance of employer groups, professional bodies and government departments set up a plan in 2012 to improve health and safety on construction sites. The safety plan concentrated on reaching small enterprises; it could be downloaded by companies. CSP (Construction Safety Partnership) identified that accidents often involved mobile plants at construction sites (cranes, excavators, etc.). It consequently developed online software for tracking the maintenance of lifting equipment.

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Retail group SONAE (Portugal) has developed a computer application on the company's intranet to report accidents, which allows quicker analysis and investigation of their causes. Serious accidents are notified immediately to management seniors by sending a SMS.	PROTON ELECTRONICA is a Spanish electronic firm. In order to create a viable safety system, it has developed its own OSH documents, giving the templates a distinctive bespoke appearance. The company's CEO considers that effective documentation is essential and contributes to internal cohesion and communication. Resulting effects include a zero accident rate and firm's absenteeism close to zero.
WEST OFFALY DAIRY DISCUSSION GROUP is composed of 15 Irish dairy farmers. In 2012, they spent an extra 30 minutes at each of the group meetings to discuss safety issues. Some of their actions include a safety case study using "before and after" photos. The study showed examples of hazards identified by the group and solutions implemented to prevent or remedy them.	CEMEX is a multi-national company in the cement industry. CEMEX Poland have decided to apply the company's OSH rules to contractors. Fines have been introduced for contractors that infringe safety rules. Best contractors have been identified and added to a "qualified suppliers" list, in order to be more likely selected.

Scientific publications:

- *Role typology for health and safety representatives*; LA Harris, KB Olsen, RJ Walker; Employee Relations; 34(5): p481-500 (2012);
- *Safety in construction–a comprehensive description of the characteristics of high safety standards in construction work, from the combined perspective of supervisors and experienced workers;* M Törner, A Pousette; Journal of Safety Research, 40(6) : p399-409 (2009);
- *Factors associated with the activities of safety representatives in Spanish workplace ;* AM García, MJ López-Jacob, I Dudzinski; Journal of Epidemiol Community Health; 61 : p784-790 (2007);
- *Production supervisor impacts on subordinates' safety outcomes: An investigation of leader-member exchange and safety communication*; JH Michael, ZG Guo, JK Wiedenbeck, CD Ray; Journal of Safety Research; 37(5): p469-477 (2006);
- *Implementation of new legislative measures on industrial risks prevention and control in urban areas;* B Cahen; Journal of Hazardous Materials; 130(3): p293-299 (2006);
- *Accident patterns and prevention measures for fatal occupational falls in the construction industry*; CF Chi, TC Chang, HI Ting; Applied Ergonomics; 36(4): p391-400 (2005);
- *Worker productivity, and occupational health and safety issues in selected industries*; AA Shikdar, NM Sawaqed; Computers & Industrial Engineering; 45(4): p563-572 (2003);
- *Management of Safety Rules: the case of railways*; AR Hale, T Heijer, F Koornneef; Safety Science Monitor; 7(1) (2003);
- *Modifying supervisory practices to improve subunit safety: a leadership-based intervention model*; D Zohar; Journal of Applied psychology; 87(1): p156-163 (2002).

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INTRODUCTION OF SAFETY CULTURE: AWARENESS RAISING INITIATIVES AND INVOLVEMENT OF EMPLOYEES

Description:

Poor awareness of safety risks from managers and employees and lack of training often contribute to accidents at work. Companies usually encourage and promote safety awareness by emphasizing workers and managers' involvement in the company's safety. Awareness initiatives are generally carried out following these axes :

- **Information means:** improvements can be made in means used to convey information about safety to new and existing employees. Such means range from booklets containing safety and main life-saving rules or top risks cards to more original solutions such as films, tee-shirts, and mannequins displaying safety messages or interactive theatre.
- **Workers and managers training:** training is essential for workers to perform basic OSH functions and to give managers the keys to organize safety aspects. Training can be compulsory courses, workshops, virtual reality or computer safety games, etc. Some training sessions are often carried out during special safety events gathering managers and workers.
- **Meetings and discussions between workers and managers:** to involve workers in OSH regular meetings, involving management and employees, can be planned. These meetings, which deal with risk assessments or preventive measures, principally aim to show workers that they have a responsibility for good practices within the company, and that their opinion and proposals are taken into account. Safety visits and audits by board members are also another efficient approach to understand workers conditions and discuss safety issues.
- **Individual initiatives:** workers are more aware of good safety practices when they are personally responsible for company OSH aspects. Several companies introduced concepts such as "monthly employee" (worker selected to be a safety example to colleagues), "safety captain" (responsible for noticing breaches of safety) or voluntary site safety representatives.
- **Means for reporting safety issues:** involving employees in company's safety also means allowing them to efficiently report any safety issue and their corresponding comments. Examples include computer applications, internet reporting or hazard report forms. Some companies introduced "safety walks" for workers to observe work practices first-hand and identify unsafe behaviors.
- **Incentives**: to motivate workers to be committed to company OSH, some management boards use incentives such as prizes, money or other rewards for employees' interventions about safety.

Examples:

wehkamp.nl As part of its 2010 safety campaign about forklift trucks risks, the Dutch online warehouse WEHKAMP carried out several awareness initiatives. A website was made to create interest from workers. Cards were sent to forklift truck drivers featuring the top-ten risks. Interactive workshops were also given to workers by an experienced OSH team on forklift truck driving and on behavioral changes needed. Moreover, the company organized training sessions to give tools for middle management to organize safety aspects.

GE Healthcare GE HEALTCARE is a diagnostic agents' manufacturer. At its Norwegian site, it has made safety a priority, implementing a comprehensive OSH system to make employees feel they have a responsibility for good practices. To ensure employees own OHS procedures, they have received extensive training program (including a variety of internal courses and funding for postgraduate research). New employees have also been informed about OHS procedures and how they can contribute to safety in the company. Safety teams (inspection teams, accident investigation teams, etc.) including

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	more than 60% employees have also been set up.
BIERLEIN is one of the leading demolition contractors in the USA. It has set up a global safety program. A safety day is organized every year for employees as a way to reinforce their awareness about safety. Projects are shut down to allow workers to discuss the year's safety performance and outline safety goals for the upcoming year. Some motivational speakers also come to emphasis importance of safety for customers, management and employees. Moreover, BIERLEIN provides a minimum of forty hours training annually. Topics range from fall protection, forklift operator or fire prevention to rigging basics.	For some years, TOFAS (Türk Otomobil Frabricasi Anonim Sirketi), a Turkish car manufacturer, has developed a safety culture in the company. Interactive theatre has been introduced as means for increasing awareness and reducing unsafe behaviors: with the help of a professional theatre group, specific shop-floor cases are dramatized. This initiative has been replicated by other companies in Turkey such as RENAULT or BOSH. Moreover, TOFAS has introduced a "safety captain" initiative: members of a production team are alternately responsible for noticing breaches of safety.
HELLENIC PETROLEUM is the largest oil refining company in Greece. The company undertook a three-year safety program in 2009. Workshops were held for managers and supervisors to give them the tools to motivate workers by supporting and rewarding safe behaviors, and to handle safety violations in a positive way. The company organized weekly "safety visits", undertaken by directors, heads of department or engineers, to every production area. The objective was to observe workplaces and discuss with the workers any unsafe practices and ways to correct them. Moreover, regular discussions between unit operators, maintenance technicians and other employees were introduced. Participants were asked to identify risks, consequences and possible preventing measures. HELLENIC PETROLEUM showcased and rewarded with prizes any successful safety intervention by an employee.	MAHLE is an engine, auto part and filter technology company in Southern Austria. MAHLE FILTERSYSTEM has set up a project to involve management and employees in company's safety. Several mandatory "safety days" for employees have been introduced (protective equipment, footways and vehicle routes, tidiness and cleanness, etc.). Moreover, workers have been encouraged to report safety risks or to make suggestions through the incentive of a 10€ petrol voucher for every suggestion made. Managers have to act on these suggestions and make periodic reports to central management about them.
An innovative initiative has been introduced at SONAE, called 'safety walks', which involves workers from different managerial grades visiting workplaces and observing work practice first hand. The goal is to identify safe and unsafe behaviors, motivate workers, gain their commitment to complying with safety rules, and	TU DELFT has been rewarded for the implementation of safety report on the internet as a method to prevent accidents in experimental research. Employees are asked to fill in a safety report about their own discipline on a special website, answering various questions. Safety reports are prepared each time an experimental unit is built or modified. They are

provide positive or corrective feedback to help changing any unsafe action.	verified by both Area Supervisor and Head of the Section.
US STEEL, a steel producer, has developed a computer based system to allow safety representatives to enter their initiatives or observations (hazardous working conditions, unsafe procedures, ideas to improve OSH, etc.). Entries are followed by a quick manager decision. The safety representative can also check the efficiency of corrective actions. US STEEL encourages the reporting of safety problems by paying quarterly bonuses to employee safety representatives who record safety issues using this computer application.	SKANSKA is a Finnish world leading project development and construction group. A global safety strategy as been developed, initiated by the implementation of a Code of Conduct. Since 2005, the company has been establishing SKANSKA Safety weeks. It is seen as the world's largest workplace safety event organized by a company. It involves employees, subcontractors, suppliers and business partners in activities focused on safety in 18 countries. The week includes numerous activities and training sessions aiming to make aware of safety issues and define how workplace environnement can be improved.

Scientific publications:

- *A system of safety management practices and worker engagement for reducing and preventing accidents: an empirical and theoretical investigation*; JK Wachter, PL Yorio; Accident Analysis & Prevention (2013);
- *Safety leadership: Extending workplace safety climate best practices across health care workforces*; D McCaughey, JRB Halbesleben; Advances in Health Care Management; 14: p189-217 (2013);
- *Using Virtual Environments Simulation to Improve Construction Safety: An Application of 3D Online-Game Based Training;* D Zhao, Y Ye; Future Control and Automation; 172: p269-277 (2012);
- *A systematic review of the effectiveness of occupational health and safety training*; LS Robson, CM Stephenson, PA Schulte; Scandinavian journal of Work Environnement Health; 38(3): p193-208 (2012);
- *Construction safety training via e-Learning: Learning effectiveness and user satisfaction*; CL Ho, RJ Dzeng; Computers & Education; 55(2) : p858-867 (2010);
- *Improving construction site safety through leader-based verbal safety communication*; P Kines, LPS Andersen, S Spangenberg ; Journal of Safety Research; 41(5): p399-406 (2010);
- *Making work safer: Testing a model of social exchange and safety management*; DM DeJoy, LJ Della, RJ Vandenberg; Journal of Safety Research; 41(2): p163-171 (2010);
- *Safety management practices and safety behaviour: Assessing the mediating role of safety knowledge and motivation*; MN Vinodkumar, M Bhasi; Accident Analysis & Prevention; 42(6): p2082-2093 (2010);
- *A review of case studies evaluating economic incentives to promote occupational safety and health* ; D Elsler, D Treutlein, I Rydlewska, L Frusteri; Scandinavian Journal of Work Environment Health; 36(4): p289-298 (2010);
- *Workplace safety: a meta-analysis of the roles of person and situation factors*; MS Christian, JC Bradley, JC Wallace; Journal of Applied Psychology; 95(5): p1103-1127 (2009).

DEVELOPMENT OF WELL-BEING

Description:

Ensuring safety during production also means reducing risks due to musculoskeletal disorders. Bad working conditions can affect mental and physical well-being and are a source of injuries for employees. Several good practices can be found in companies that increase workers well-being and reduce common technology industries problems such as absenteeism.

- **Addressing physical risks:** Good practices for reducing physical risks for workers during production especially include adapting the design and ergonomics of workplaces and the choice of work equipment and production methods.
- **Addressing psychological risks:** Psychological risks are often addressed alleviating monotonous work, introducing healthy programs, allowing balanced work and family commitments, or improving working relationships within companies.

Examples:

ADVANCE FILTRATION SYSTEMS manufactures liquid filters. It received a "Z project award for Innovative Safety and Health Practices". To reduce workers exposition to musculoskeletal disorders (from manually assembling filters in cylindral tubes and inspecting assemblies), the company has introduced robots on the tube setting machine. They move the elements of the assembly from the pallets, rotate the elements, and set them on a conveyor to the tube setting machine. The need for workers to handle product has been reduced as well as the risks associated with musculoskeletal disorders.

ASCOM is a manufacturer of electrical parts for automotive industry. The company has established a multi-disciplinary team (director, medical doctor, safety engineer, project manager, worker representative) that has conducted questionnaire about workplace and lifestyle. Based on the results, a workplace exercise program has been planned and tailored for the specific needs and capabilities of individual workers. The company also encourages workers to exercise during their free-time by organizing activities such as hikes and Nordic walking races.

RODDA'S creamery (UK) has won a Gold Healthy award and a Food Manufacturing Excellence awards, for its health and safety program. In conjunction with UK National Health Trust, the company has introduced in-house campaigns corresponding to nationwide public health campaign topics. Free fruits, smoking cessation programs and health & well-being check-ups for workers have been introduced. Other initiatives such as annual barbecues, personal development training or work interviews have been implemented, leading to improved dedication, motivation and well-being of workers.

The car manufacturer has launched the "Formula Uomo" program, dealing with redesigning working environment, humanizing production lines and enabling individual and team development. Latest ergonomic standards have been applied to modernize buildings (better use of energy, natural light, heating, green materials, etc.) and to reduce workers exposure to solvents. A bar, a learning center, a well-being center, a first-aid station, medical testing labs and a small drugstore have also been introduced to improve social working life. Programs such as language lessons, professional developments, and specific individual interest have also been launched.

This French world specialist in ink chemistry and printing technologies has decided to reduce physical and psychological risks by launching a three - day well-being and communication training program that takes place during working hours. Workers are engaged in role-play as a mean of boosting cohesion, proving the benefits of group-working and reinforcing self-confidence. Moreover redesigned workstations have been developed to reduce employees' lower back pains.	In 2010, a three-year project called the "Good work – longer career" project was launched in more than 50 Finnish companies. It aimed to improve well-being at work. SKF was one of the participants. It implemented anonymous staff surveys to measure employees' well-being. Surveys were followed by discussions to set targets to improve well-being. Surveys were repeated 12 months later. Training was also arranged to improve relationships between supervisors and employees (culture of cooperation, respect, etc.).

Scientific publications:

- *General framework for the manufacturing workstation design optimization: a combined ergonomic and operational approach*; D del Rio Vilas, F Longo, NR Monteil; Simulation; 89(3): p306-329 (2013);
- *Development of a job rotation scheme to reduce musculoskeletal disorders: A case study*; H Fonseca, IF Loureiro, PM Arezes; Occupational Safety and Hygiene (2013);
- *Occupational health psychology*; JM Peiró, L Tetrick; IAAP Handbook of applied psychology; 12 (2011);
- *Workspace design: a case study applying participatory design principles of healthy workplaces in an industrial setting*; O Broberg ; International Journal of Technology Management; 51(1): p39-56 (2010);
- *Systematic review of the role of occupational health and safety interventions in the prevention of upper extremity musculoskeletal symptoms, signs, disorders, injuries*; CA Kennedy, BC Amick III, JT Dennerlein; Journal of Occupational Rehabilitation; 20(2): p127-162 (2010);
- *Leadership development as an intervention in occupational health psychology*; EK Kelloway, J Barling; Work & Stress; 24(3): p260-279 (2010);
- *What's the hard return on employee wellness programs;* LL Berry, AM Mirabito, WB Baun; Harvard Business Review; (2010);
- *Are leaders' well-being, behaviours and style associated with the affective well-being of their employees? A systematic review of three decades of research;* J Skakon, K Nielsen, V Borg, J Guzman; Work & Stress; 24(2): p107-139 (2010);
- *Employee commitment and well-being: A critical review, theoretical framework and research agenda*; JP Meyer, ER Maltin; Journal of Vocational Behavior; 77(2): p323-337 (2010).

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