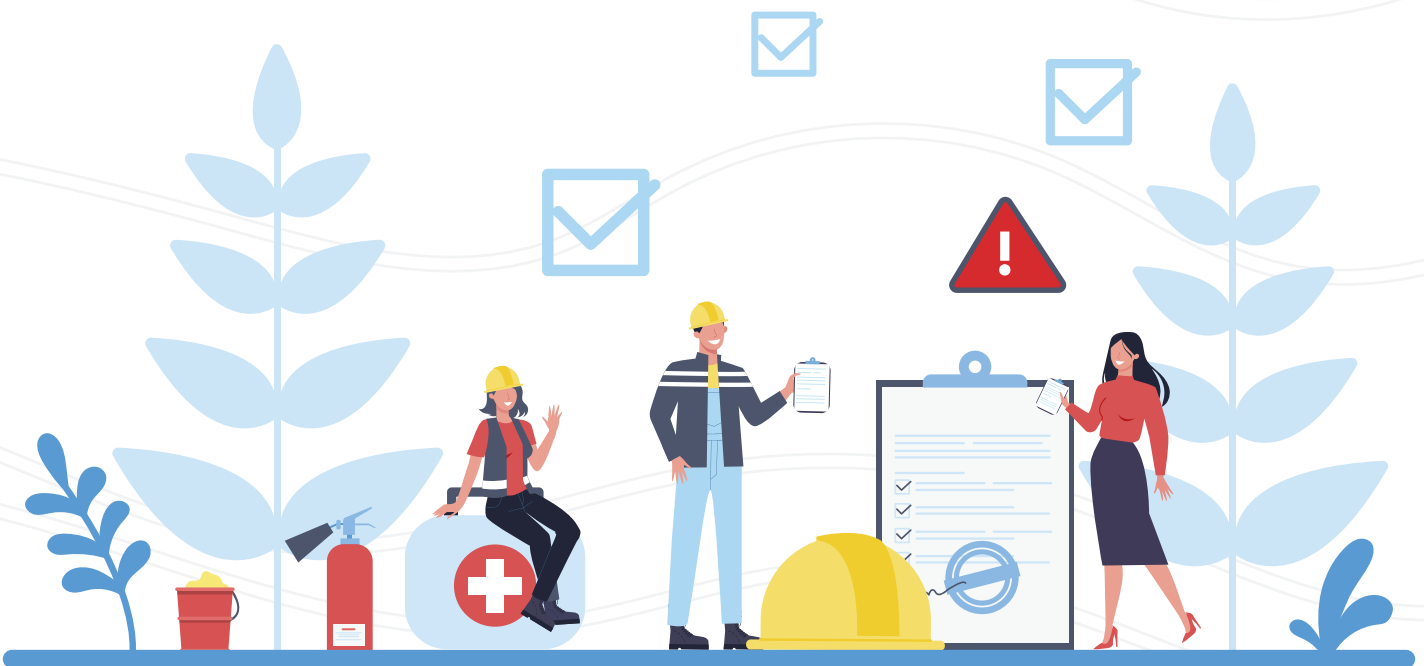


# EMPLOYMENT PROMOTION IN JORDAN



Overview on risk assessment programmes and best proven practices implemented in Europe

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## Executive summary

The “Framework Directive” 89/391/EEC laid the foundations for the legal requirements in the field of occupational safety and health (OSH) and – initially – for the instrument of risk assessment in Europe. Risk assessment (RA) was described as the process of evaluating risks to workers’ safety and health from workplace hazards by systematic examination of all aspects of work that could cause any injury or harm, whether the hazards could be eliminated and, if not, what preventive or protective measures should be taken to control the risks. Although the Framework Directive – along with its additional directives and the CLP and REACH regulation – describes all requirements to conduct a mature risk assessment, it constitutes a very complex system and comprises approximately 40 “core documents” [31]. The complexity is seen as a clear obstacle that hampers the recognition and conduction of a “European risk assessment strategy” so that many European countries transferred and initiated their own OSH standards and programmes, especially regarding risk assessment. The Netherlands, the UK and Germany may have developed and implemented very successful risk assessment strategies when taking into account the very low accidents rates of 0.59, 0.88 and 0.89 respectively. In 2016, incidences per 100,000 workers ranged from 1.0 or less in the UK and the Netherlands [42] and Germany has also relatively low cases.

The Netherlands are regarded as a role model regarding the quick implementation of EU OSH regulation and administrative burden reduction, including reform programmes for inspection and enforcement that strengthen public consultation through the internet. Therefore, their risk assessment programmes can be used as guide.

Important success factors in the Netherlands were:

- simplifying OSH legislation,
- use of online risk assessment software,
- communication and implementation by central support,
- communication through ministries and inspectorates to promote the legislative changes.

Sector-specific RA tools are available via a single, central website, either via a direct link or if the specific tool is not digital one can find at least contact details of the relevant sector organisation from which the paper-based risk assessment tool can be obtained. Most Dutch RA tools are designed to ensure that small and medium sized enterprises (SMEs) comply with the legal obligations to execute a risk assessment and to reduce the administrative and financial burden on them in doing so. SMEs are best targeted through a more personalised approach, combining enforcement and guidance. Creating good, safe working conditions became much more of a customised, workplace-specific process and that the workforce identified more with the requirements and took more responsibility. The Netherlands have a system of five OSH key professionals to support employers regarding environment, health and safety requirements who can call in further experts. This system is very helpful for employers because they do not have to search

for several experts as the key professionals will do that for them. However, internal and external OSH professionals must be qualified to help the employer to take the measures necessary in order to:

- avoid or minimise negative risks for health and safety of workers and the environment
- support the proliferation of health, safety and sustainability at work.

In general risk assessment should contain the following steps:

- Inventarisation of risks factors
  - » Information gathering
  - » Hazard identification
  - » Opportunity identification
- Evaluation of these risks
  - » Probability
  - » Impact
  - » Prioritisation
- Defining objectives
  - » Compliance
  - » Health promotion
  - » Protection
  - » Empowerment
- Planning of risk managing measures (RMM)
  - » Capability planning & project scheduling
- Implementation
  - » Communication RMM
  - » Training of the workers
  - » Evaluation & control
  - » Documentation of RMM
  - » Efficiency of communication RMM
- Regular monitoring of RMM effectivity
- Scheduling provisions of improvement and reassessment

In addition to getting advice, active training and coaching help companies to further improve their risk management and to avoid making mistakes when using risk assessment instruments. Consequently, implementing a good risk assessment and management largely depends on motivated OHS-professionals, management support, and the willingness to invest time and means.

The use of validated tools embedded in a community platform supports companies to organise and structure their risk management in a business-wise manner.

## 1 Introduction

This report is written by **systemkonzept** under the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) programme 'Employment Promotion Programme – Jordan'. The Employment Promotion Programme (EPP) is a cooperation between the Jordanian Ministry of Labour and the German Federal Ministry for Economic Cooperation and Development (BMZ). The EPP focuses on building capacities and strengthening structures for employment promotion with improving worker's employability and their employment situation as one objective. Joining the Ministry of Labour, the EPP will also expand evidence-based policymaking through improved monitoring and evaluation systems and impact assessment. One important tool of monitoring occupational health and safety is the assessment of risks arising from work.

Risk assessment in general can be defined as the combined effort of analysing events that may impact assets, the environment, a community and/or an individual, and estimate the quality of the effects of the considered events. The quality of the effects can be expressed in terms of positive (chances/opportunities) or negative risks (threats/weaknesses). Risk assessment allows experts to investigate a wide range of risks from different angles. It can be conducted focusing on material assets (e.g. financial risks) or living matters. Regarding living matters risk assessment can deal with risks to the environment including animals or to the health and safety of humans. Human health and safety can be further divided by target group: consumers and workers.

This report is aimed at giving recommendations on how to implement and control a risk assessment regime that improves workers' health and safety at the workplace. These recommendations are based on the study of the development of risk assessment in Europe and the experiences made with risk assessment programmes in three European countries, Germany, the United Kingdom and the Netherlands.

## 2 Development of risk assessment requirements & programmes in Europe

In 1976 a severe dioxin disaster in Seveso, Italy, provoked the European Community to issue a directive to all member states known as the Post-Seveso directive. It came into force 1982 and called for certain companies to map risks and to inform their governments about these risks [1]. In 1989 the European Community established a directive 89/391/EEC [2] on the introduction of measures to encourage improving safety and health at the workplace. European directives are legally binding and must be implemented in their national law by all EU member states within a certain period of time. They include minimum requirements and basic principles, set out in obligations to employers and employees. The "Framework Directive" 89/391/EEC laid the foundations for the European legal requirements in the field of occupational safety and health (OSH) and - initially - for the instrument of risk assessment. Risk assessment (RA) was described as the process of evaluating risks to workers' safety and health from workplace hazards by systematic examination of all aspects of work that could cause any injury or harm, whether the hazards could be eliminated and, if not, what

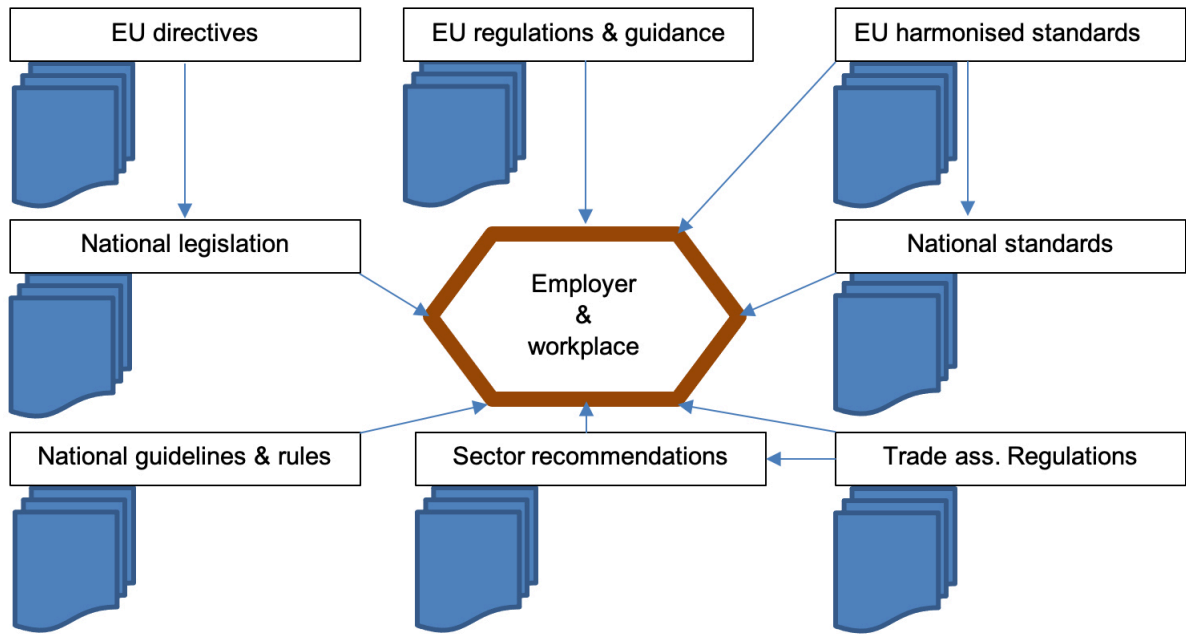
preventive or protective measures are, or should be, taken to control the risks. Seveso might be the reason why the framework directive emphasises chemical hazards without excluding the other aspects. Among others, it explicitly mentions the employer's duty to carry out a RA and ensure that the workers are protected and provided with information, guidance and training on the safe use of chemicals in the workplace, based on information derived from the label and the safety data sheet.

In 1996, the European Commission published a 'Guidance on Risk Assessment at Work' [3]. It describes four major steps of RA and stipulates that the identification of hazards and controlling the risks should be based on the participation and consultation of workers and their representatives. Next to the hazard identification the major steps are hazard characterisation, exposure assessment and risk characterisation.

The European Union (EU) elaborated several additional directives that set out the principles and instruments of the Framework Directive regarding different workplaces with an elevated risk (e.g. temporary work sites, extractive industries, fishing vessels) and specific hazards at work (e.g. exposure to dangerous substances, or physical agents) in relation to single tasks (e.g. manual handling of loads, working with visual display units) or vulnerable workers, such as pregnant women and breastfeeding mothers. Most countries in Europe adopted these and other additional directives (i.e. 19 - 23) in their national legislation including the requirement that employers must perform RA regarding safety and health at work [4,5]. In addition to national legislation there was also an increase in national standards and proprietary certification schemes for OSH systems which companies had to respect. For many companies, the burden of complying with the huge amount of regulation led to further confusion regarding the requirements and consequently made a management system necessary. Recognising this, an international collaboration called the 'Occupational Health and Safety Assessment Series' (OHSAS) - including representatives from occupational safety and health institutions, national standards bodies, accreditation and certification bodies - published the OHSAS 18000 Series in 1999 [6]. OSHAS 18001 provided requirements for an OHS management system, OSHAS 18002 gave implementation guidance [7,8]. The move to include a risk management process into the corporate governance framework has encouraged enterprises to institute and report to shareholders on their risk management and corporate governance processes, e.g. in the UK, the Netherlands and Germany. Further on the International Labour Organisation (ILO) developed and published in 2001 "Guidelines on occupational safety and health management systems", which have been also adopted and transferred into German Guidelines with some specific modifications [9].

In 2000 the Scientific Steering Committee's 'Working Group on Harmonisation of Risk Assessment Procedures in the Scientific Committees advising the European Commission (EC) in the area of human and environmental health' updated and tried to harmonise the risk assessment procedure in Europe by elaborating the four steps in detail [10]. Consequently, in 2004 the EC concluded in a communication [11] that the European legislation had contributed to instilling a culture of prevention throughout the EU as well as to rationalising

and simplifying national legislative systems. But the report highlighted also various flaws in the application of the legislation that were holding back the achievement of its full potential; the complexity was considered as one of them.

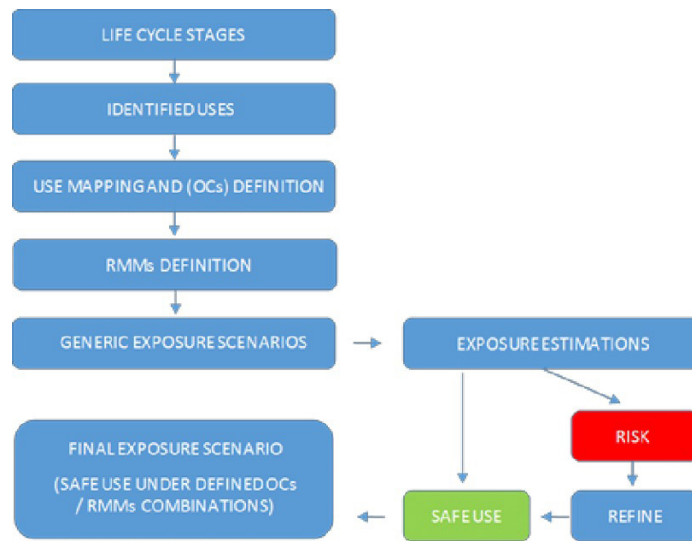


**Figure 1:** Legislation, regulation, guidance and recommendations for the employer regarding workplace health and safety.

Next to documents elaborated by the EU, its agencies or national governments, there are also certain EU standards that were made by experts and approved through consensus by a recognised (standardization) body like the European Committee for Standardization (CEN). If such a standard is created following a request from the European Commission, this so-called harmonised standard can be used to demonstrate that products, services, or processes comply with relevant EU legislation. Figure 1 gives an impression of the context of the OSH legislation in Europe. Next to general requirements there are also several special regulations e.g. for hazardous substances.

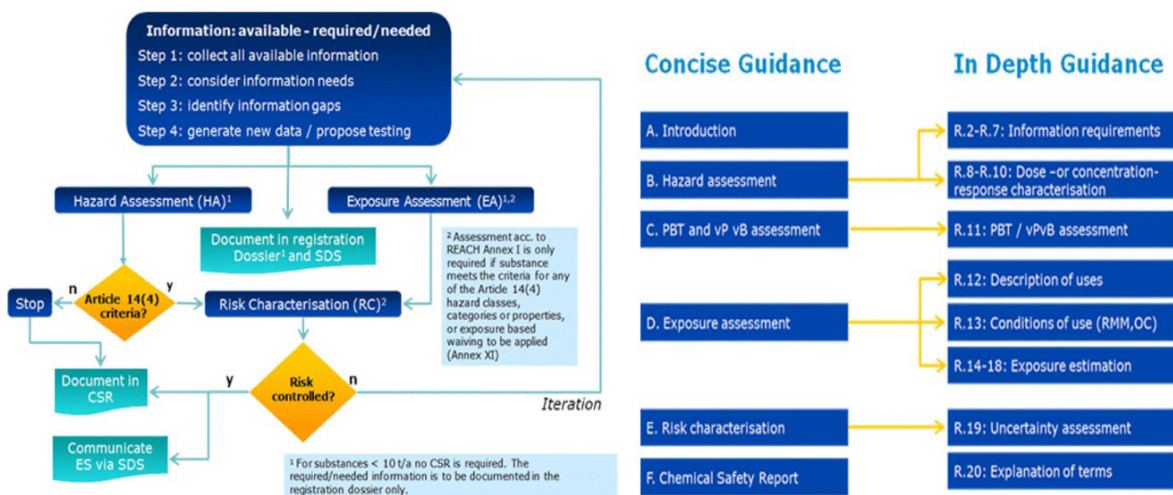
Every year hazardous substances are estimated to cause over half a million deaths of workers worldwide. With the introduction of the regulation EG 1907/2006 (REACH) [12] another important contribution to overall risk assessment in Europe was elaborated. EU regulations are legal acts of the EU which have general validity and are directly effective in each of its member states. REACH set the focus on chemical product safety in Europe with hazardous substances being a major issue, e.g. for the aggregation of chronic diseases. Particularly worthwhile is the generation of exposure scenarios and a corresponding safe use that must be ensured by the manufactures/distributors of certain substances or mixtures via a European centralised reporting system and agency (Figure 2).





**Figure 2:** Step by step approach for the development of Exposure Scenarios and Safe Uses under REACH. From [13] NANoREG framework for the safety assessment of nanomaterials - Scientific figure available: [https://www.researchgate.net/figure/Step-by-step-approach-for-the-development-of-Exposure-Scenarios-under-REACH-OCs\\_fig3\\_316686391](https://www.researchgate.net/figure/Step-by-step-approach-for-the-development-of-Exposure-Scenarios-under-REACH-OCs_fig3_316686391)

Another important regulation that is directly linked to REACH was the Regulation for Classification, Labelling and Packaging of substances and mixtures (CLP) 1272/2008 [14] that offers a harmonised system to identify hazardous chemicals and to inform users about the hazards. REACH as all other risk assessment strategies relies on an adequate information gathering. For the chemical hazard identification all substances placed on the market within the EU shall be labelled and packaged in accordance with the CLP. With CLP and especially with REACH there are a lot of guidelines regarding substance properties, exposure, use and risk management measures. For one aspect, information requirements and chemical safety assessment, the context of guidance is given in Figure 3.



**Figure 3:** Guidance related to information requirements and chemicals safety assessment under REACH and overview of connected REACH Guidance to assist industry in conducting Chemical Safety Assessments and preparing Chemical Safety Reports [15].

Several institutions and expert groups started to develop risk assessment strategies from a specific point of view, e.g. product safety, environment etc. Although it seems necessary to ensure a rapid intervention to recall, withdraw or prohibit products presenting a serious risk are based on the ground of a harmonized EU general risk assessment methodology, as suggested by the European Commission for example in 2015/2016 (Figure 4), this calls for more documents to be respected.

RISK ASSESSMENT PHASES	RISK ASSESSMENT STEPS
a) Risk identification	1. Defining the product; 2. Identifying the hazard(s) 3. Identifying the subject(s) at risk
b) Risk analysis	4. Describing how the hazard may harm the subject; 5. Describing the potential harm
c) Risk evaluation	6. Determining the severity of harm; 7. Determining the probability of harm; 8. Determining the risk level by combining the severity of harm and the probability of that harm occurring in the scenario described.

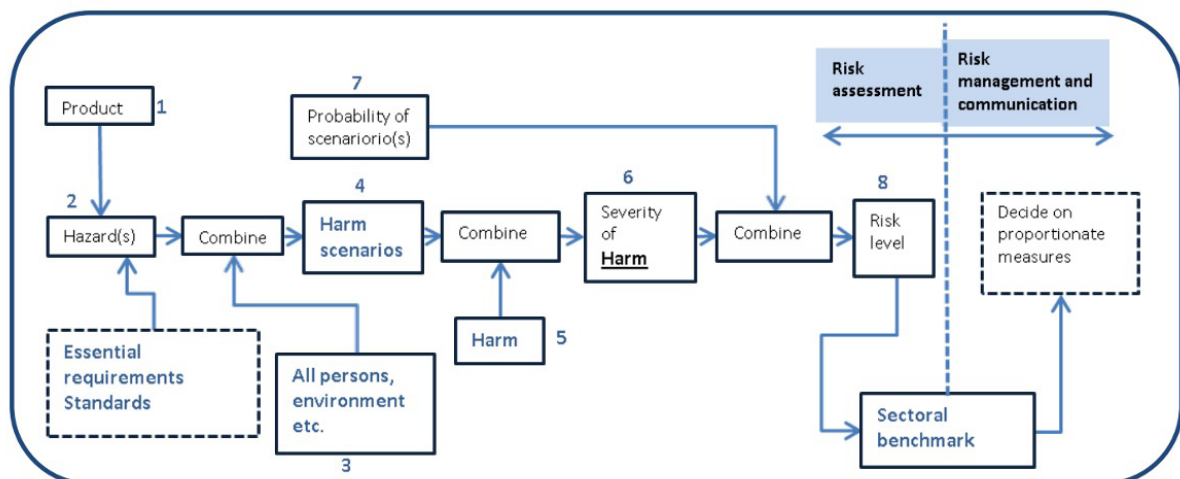
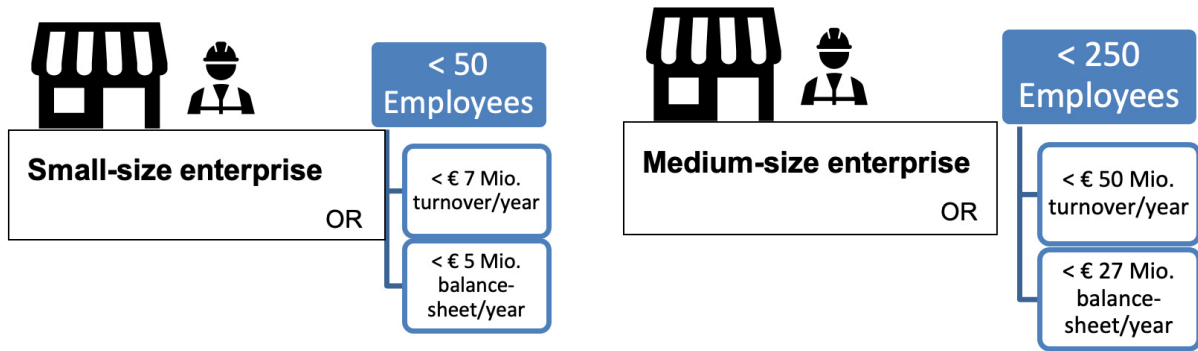


Figure 4: Proposed risk assessment methodology exclusively for the purpose of market surveillance activities. From [16].

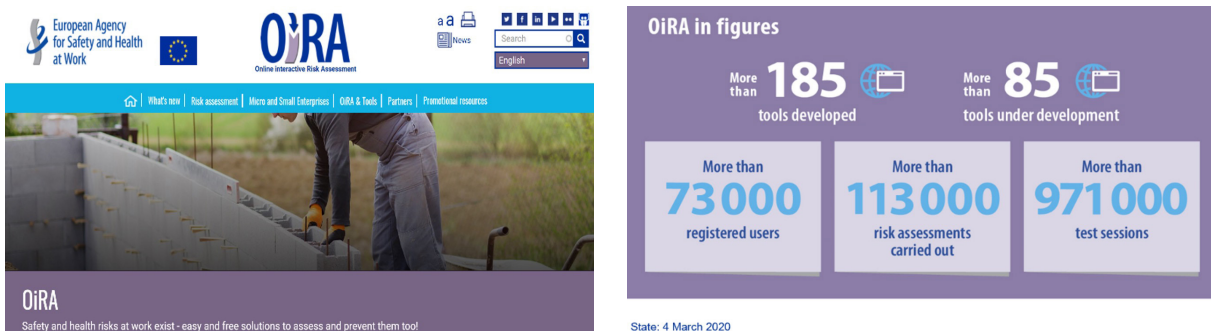
## 2.1 Risk assessment programmes in Europe - good practice case

The EU made several attempts to ensure a harmonised risk assessment, at least between the approaches made by different scientific advisory committees of the Commission, of the increasing number of the EU Agencies and other international and national bodies. However, especially for small- and medium-sized enterprises (SMEs – Figure 5) it is hard to find and challenging to conduct the correct RA.



**Figure 5:** Independent small- and medium-sized enterprises are defined as enterprises which have less than 250 employees and have either an annual turnover not exceeding € 40 million or an annual balance-sheet total not exceeding € 27 million. Small enterprises are further defined as an enterprise with less than 50 employees and either an annual turnover not exceeding € 7 million, or an annual balance-sheet total not exceeding € 5 million. Independent enterprises are those which are not owned by either one or several other enterprise(s) holding more than 25 % of the capital or the voting rights. [17]

As a consequence, the European Agency for Safety and Health at Work (EU-OSHA) developed an internet platform providing RA tools in any language and in an easy and standardised way called ‘Online interactive Risk Assessment’ (OiRA – Figure 6). It comprises a collection of risk assessment instruments and documents made by different stakeholders and approved by experts.



**Figure 6:** OiRA – Online interactive Risk Assessment – is a web platform that enables the creation of sectoral risk assessment tools in any language in an easy and standardised way. It is developed and maintained by the European Agency for Safety and Health at Work (EU-OSHA) and it is based on the Dutch risk assessment instrument RI&E [18].

Most risk assessment programmes in Europe (ERAP) focus on the employer since they are responsible for running a risk management system and for conducting and documenting risk assessments. Most enterprises in Europe are small and medium-sized enterprises (SMEs) and most occupational injuries occur in SMEs. Consequently, a lot of ERAPs focus on SME. Since 2010, EU-OSHA’s online platform OiRA aims to support sectoral social partners (employers’ and employees’ organisations) and national authorities (ministries, labour inspectorates, federal institutes, etc.) to produce sector-specific risk assessment tools also targeting SMEs. Its concept is based on a Dutch risk assessment tool known as RI&E, which has proved to be very successful and well used. The RI&E tool is named after the Dutch word for risk assessment (RA) (‘Risico Inventarisatie- en Evaluatie’) and was

among the first online risk assessment tools developed in Europe. All together OiRA offers a total of 185 tools that can be linked to risk assessment programmes. Most of them are unfortunately limited to single cases of a certain country.

## 2.2 Evaluation of European risk assessment programmes (RAP) & selection of national RAP examples

In general, occupational safety and health measures not only save lives but deliver economic returns which can be 3-10 times greater than the monetary investment [19,20,21,22]. And in the last decades in Europe overall occupational safety and health enhanced remarkably. This may be due to the implementation of risk assessment by the OSH Framework Directive and the related documents. According to the EU, risk assessment should at least:

- identify any significant risk related to work;
- enable the employer to identify and prioritise the measures that need to be implemented to comply with the relevant statutory provisions;
- be appropriate to the nature of work and in a way that it remains valid for a reasonable period of time.

But how effective is the European system of risk assessment? It is hard to estimate the effect of the return on investment regarding the introduction of risk assessment in Europe because there is a limited amount of studies that address the full benefits of OSH investments. However, occupational injuries, diseases and deaths result in high economic costs to individuals, employers, governments and society. First, the costs of occupational injuries and diseases could be indicated in terms of absence from work and loss in life. Figures from the last ten years show that each year 23 million workers (7.9 % of the workforce) in Europe suffered from occupational health problems, of which 36 % (~ 8 million) resulted in absence from work for at least four days [23,24]. Approximately 6 million per year were work-related diseases and 2.4 million were non-fatal accidents. 3,182 fatal accidents (those that lead to the death of the victim within one year of the accident taking place) per year were reported in EU Member States [25,26,27]. The International Labour Organization (ILO) estimates that globally some 2.3 million workers succumb to work-related accidents or diseases every year; and hazardous substances alone are estimated to cause 651,279 deaths [28]. Further, early retirement, the loss of skilled staff, absenteeism as well as presenteeism (when employees go to work despite illness, increasing the likelihood of mistakes) caused by occupational injuries, diseases and deaths result in high negative effects to the economy that can be expressed in loss of gross domestic product (GDP). In 2017 EU-OSHA estimated that 3.3 % of the European GDP is spent on dealing with occupational injuries and diseases.

This shows that in terms of work-related accidents or diseases and in terms of loss of GDP Europe is doing it well in comparison to the 2,3 million death victims or average 3.9 % loss of global gross domestic product (GDP) worldwide. But there are still some weak points regarding the dissemination of the requirements, the accessibility of SME and the proliferation of healthy workplaces. And there is still a focus mainly on negative

risks, ignoring the benefits of positive risk proliferation. For example, data from the sixth `Eurofound's European Working Conditions Survey' (EWCS) from 2015 show the association between working as well as the physical and mental health conditions of workers and both, absenteeism and presenteeism [29]. Overall, the survey found limited progress in job quality and satisfaction in the last 10 years, resulting from structural inequalities and differences in terms of gender, employment status and occupation. In 2012 the Commission already noted that the EU legislation does not provide for a comprehensive and integrated assessment [30]. Although the Framework Directive and its additional directives as well as the CLP and REACH regulation describe all requirements to conduct a mature risk assessment, it constitutes a very complex system and comprises approximately 40 "core documents" [31]. Also, the complexity is seen as a clear obstacle that hampers the recognition and conduction of a "European risk assessment strategy". That might be a reason why many European countries transferred and initiated own OSH standards and programmes, especially regarding risk assessment. And an EU-OSHA study from 2019 concludes that some countries in Europe are performing better than the European average [32]. The reason for that lies in the specific risk assessment programmes in those countries.

Additionally, standards for occupational health and safety management systems like the Global Reporting Initiative (GRI) standard 403 or the ISO standard 45001 aim at supporting the development of an organisation's occupational health and safety policy, and participate in the processes necessary to plan, support, operate, and continually evaluate the effectiveness of the occupational health and safety management system and programmes [33,34,35,36,37].

A major weakness of RAP approaches is the limited coverage of small enterprises, largely due to limited resources of specialist agents of the health and safety system such as regulatory inspectors and occupational health services. However, instead of running individual risk assessment programmes on ERAPs on the one hand and RA at company level of the other hand, branch specific risk assessment programmes seem the most promising compromise for a reasonable risk assessment prototype to reach a high spreading and usage by stakeholders [19,38].

In comparison to other European countries the UK, Ireland and the Nordic countries have produced a lot of strategies and tools regarding risk assessment. Especially when it comes to the control for substances hazardous to health, UK's Health and Safety Executive (HSE) has developed a control banding approach [39] that inspired countries such as Germany and the Netherlands to further improve their online risk assessment tools into mature risk management software instruments like the Stoffenmanager® [40].

Regarding the efficiency of national risk assessment programmes, data show that the number of fatal accidents at work ranges from 0.4 to 4.5 per 100,000 with an average of 1.65 in Europe [41]. The Netherlands, the UK and Germany have very low accidents rates with 0.59, 0.88 and 0.89 respectively. In 2016, incidences per 100,000 workers ranged from 1.0 or less in the UK and the Netherlands to over 4.0 in Romania, Latvia and Estonia [42]. Germany has

also relatively low cases.

Consequently, the risk assessment programmes of UK, Germany and the Netherlands will be discussed more in detail in the following section – not only because of their historical development or their economic importance but also and mainly due to a very good combination of investment and effectiveness of the risk assessment programmes.

### **3 Report of three European national RAP**

#### **3.1 Risk assessment strategy in the United Kingdom**

The Health and Safety at Work Act of 1974 is the primary piece of legislation covering occupational health and safety in the United Kingdom (UK). The Health and Safety Executive (HSE) – together with local authorities (and other enforcing authorities) – is responsible for enforcing the act and other statutory instruments (regulations) relevant to the working environment.



Further, the management of the health and safety at work regulations from 1999 state that in the UK an employer must take reasonable steps ‘for the effective planning, organisation, control, monitoring and review of preventive and protective measures. In summary a risk assessment must be ‘suitable and sufficient’, i.e. all the following aspects are ensured:

- a proper check of the machines, substances and tools at the workplace is made,
- it is clear who might be affected,
- all obvious significant hazards are addressed and dealt with, taking into account the number of people who could be involved,
- precautions are taken reasonably, and the remaining risk is low,
- employees or their representatives are involved in the process.

In general, HSE provides a lot of helpful information, guidance and case studies on risk assessment and management on their website, sorted by industry, company size or hazard (Figure 7). Over 850 science and engineering experts contributed to provide evidence-based guidance in an easy and customer friendly way.

Regarding HSE, overall risk assessment should begin with a walk-through observation where potential hazards in the workplace are accurately identified. It is also recommended to check manufacturers’ instructions or data sheets for products, chemicals and equipment, to look back at accident and ill-health records, to take into account non-routine operations (e.g. maintenance, cleaning operations or changes in production cycles) and to include long-term hazards to health (e.g. high levels of noise, exposure to harmful substances, common causes of work-related mental illness).




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# Managing risks and risk assessment at work

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2. [Steps needed to manage risk](#)
3. [Risk assessment template and examples](#)
4. [More detail on managing risk](#)

## The basics for your business

### [Appoint a competent person](#)

Choose who will help you manage health and safety in your business

### [Risk assessment](#)

How to identify hazards and assess risks at work

### [Provide information and training](#)

Tell your workers what their health and safety duties are

### [Prepare a health and safety policy](#)

What a policy is and how it helps you manage health and safety

### [Consult your workers](#)

Involve your workers and inform them about health and safety

### [Have the right workplace facilities](#)

Have toilets, washbasins and other welfare facilities workers need

### [First aid in work](#)

Advice on your first aid kit, training workers and appointing first aiders

### [Get insurance for your business](#)

Find out why you may need employers' liability insurance

### [Report accidents and illness](#)

You must report certain injuries, near-misses and work-related illnesses to HSE

### [Display the law poster](#)

You must display the poster or give workers the equivalent leaflet

### [The law](#)

The Health and Safety at Work Act, criminal and civil law

**Figure 7:** HSE website offering risk assessment and management guidance. <https://www.hse.gov.uk/simple-health-safety/risk/index.htm>

The next step should be to interview the employees about what they think the hazards are and if they have any ideas on how to control these risks. Having identified the hazards, the next step is to decide how likely it is that harm will occur. This means balancing the level of risk against the measures needed to control the risk in terms of money, time or trouble of any kind. The outcome of this risk evaluation should be a record of the significant findings – the hazards, how people might be harmed by them and what is set in place to control the risks. Any record produced should be simple and focused on assessment criteria. HSE

offers here a risk assessment template free of charge to record the findings. It strongly recommends keeping it simple, for example 'Fume from welding: local exhaust ventilation used and regularly checked'. Next to the documentation template HSE also presents an example for a risk assessment on their website <https://www.hse.gov.uk/risk/casestudies/index.htm> (Figure 8).

### Shops

- ▶ [Betting office](#)
- ▶ [Butchers](#)
- ▶ [Charity shop](#)
- ▶ [Cleaning large retail premises](#)
- ▶ [Cleaning a shopping centre concourse](#)
- ▶ [Convenience store/newsagent](#)
- ▶ [Drycleaners](#)
- ▶ [Estate agency](#)
- ▶ [Food preparation and service](#)
- ▶ [Hairdressing salon](#)
- ▶ [Off licence](#)
- ▶ [Travel agent](#)

### Motor vehicles

- ▶ [Car parking attendants \(PDF\)](#)
- ▶ [Motor vehicle bodyshop \(PDF\)](#)
- ▶ [Motor vehicle repair shop \(PDF\)](#)
- ▶ [Motor vehicle showroom \(PDF\)](#)
- ▶ [Private hire \(PDF\)](#)
- ▶ [Road haulage \(PDF\)](#)

### Office

- ▶ [General office cleaning](#)
- ▶ [Office-based business](#)

### Other

- ▶ [Administration work in a manufacturing company](#)
- ▶ [Call centre](#)
- ▶ [Chilled warehousing](#)
- ▶ [Cold storage and warehousing](#)
- ▶ [Contract bricklayers](#)
- ▶ [Factory maintenance work](#)
- ▶ [Maintenance of flats](#)
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- ▶ [Warehouse](#)
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**Example risk assessment for a betting office**

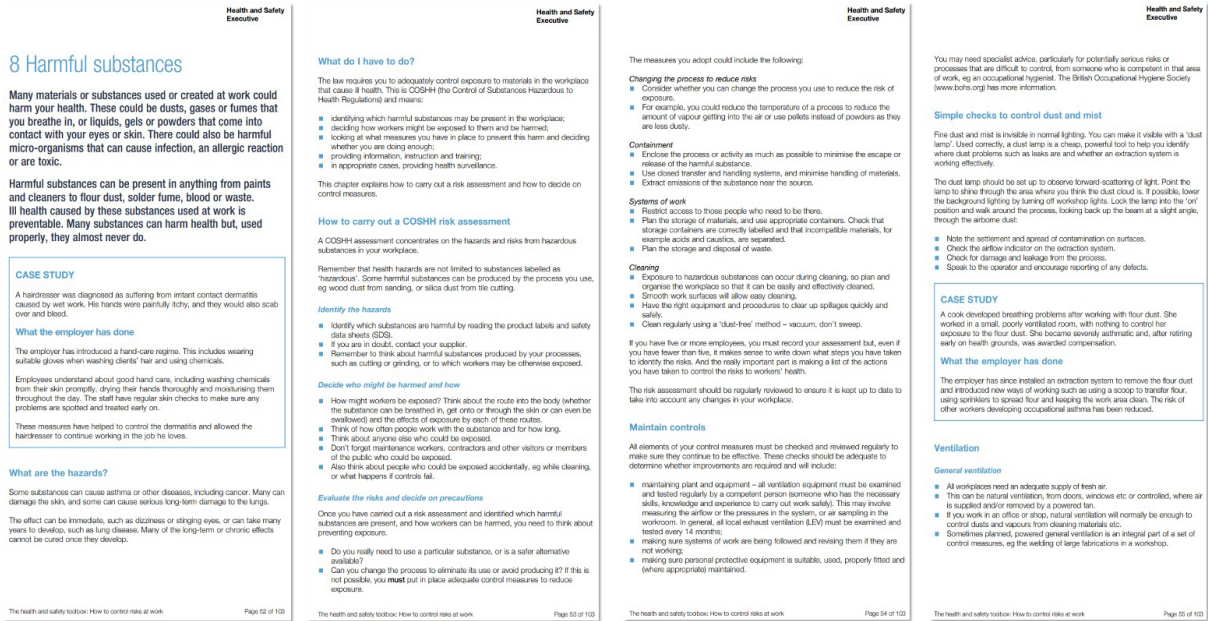
What are the hazards?	Who might be harmed and how?	What are you already doing?	What further action is necessary?	Action by whom?	Action by when?	Done
Robbery, violence and threatening behaviour inside the office. Verbal abuse.	Staff may suffer stress and/or injury from assaults, threats and abuse from members of the public.	<ul style="list-style-type: none"> <li>Staff trained not to resist a robbery</li> <li>CCTV installed and clearly visible</li> <li>Local HSE publication: Working safely: Health and safety guidance on the use of one working alone (see <a href="http://www.hse.gov.uk/workingalone/">www.hse.gov.uk/workingalone/</a>)</li> <li>Staff encouraged to report any staff working alone where necessary</li> <li>Fire alarm located out of sight</li> <li>All incidents recorded in 'incident book'</li> <li>Staff trained to provide good, polite service and not to confront customers</li> <li>Warning machines installed at cash tills</li> <li>Checking up to them out of customer's sight</li> </ul>	<ul style="list-style-type: none"> <li>Contact local police station for advice on what else can be done (e.g. sign procedures for opening up and closing)</li> <li>Manager to talk to staff about coping with disputes</li> <li>Ensure incidents of abuse investigated as soon as can be done</li> </ul>	Manager and staff	17/07	01/06/17
Robbery, violence and threatening behaviour outside the office	Staff may suffer stress and/or injury from robbery when being sent to the bank	<ul style="list-style-type: none"> <li>Trips to the bank made at different times during the week</li> <li>Staff taking cash to the bank carry a personal alarm and mobile phone</li> <li>If a taxi is used, it is pre-booked and the number of the cab recorded</li> </ul>	Contact local police station for advice on what else can be done	Manager	17/07	01/06/17
Slips and trips	Staff/cleaners risk slipping on spills, spillages	<ul style="list-style-type: none"> <li>Staff clean as they go</li> <li>Staff only mop when shop is closed</li> <li>Doormats at entrance in wet weather</li> <li>Good lighting in all areas</li> </ul>	Repair damaged floor tile near counter	Manager	21/10/07	25/07/07
Musculoskeletal disorders	Some staff working at computers or computers at food till/cashier breaks may get pain in hands and arms	Staff tell the manager if they have pains they believe are associated with using computer terminals	No further action for now			
Work at height	Falls from any height can cause bruising and fractures	Appropriate step ladders in good condition provided, if needed, and staff know how to use it safely	Remind staff to always use the step ladder when working at height and not to stand on chairs or stool ladders	Manager	26/07/07	17/07/07
Contact with bleach and other cleaning chemicals	Staff who clean risk skin irritation or eye damage from direct contact with cleaning chemicals. Vapor may cause breathing problems	<ul style="list-style-type: none"> <li>Mugs, brushes and strong rubber gloves are provided and used</li> <li>Staff always have to use cleaning products safely, eg follow instructions on the label, dilute properly and never transfer to an unlabelled container</li> </ul>	<ul style="list-style-type: none"> <li>Replace 'white' chemicals with milder alternatives, where possible</li> <li>Staff reminded to check for dry, wet or lumpy sites on their faces</li> <li>Staff reminded to wash gloves before taking them off carefully and then wash</li> </ul>	Manager, then all staff	07/07/07	06/07/07
Electrical	Staff could get electrical shocks or burns from faulty electrical appliances	<ul style="list-style-type: none"> <li>Staff trained to spot and report to manager any defective plugs</li> <li>Discontinued sockets, damaged cables and frayed cables, and to take any defective equipment out of use</li> <li>Staff know where the fuse box is and how to safely turn the electricity off in an emergency</li> <li>Clear access to the fuse box</li> <li>Qualified electrician does regular checks on televisions</li> </ul>	Qualified electrician does safety check of building's electrics every two years	Manager	26/07/07	19/07/07
Fire	Smoking, faulty electrical, arson	Fire risk assessment done, see <a href="http://www.comundat.gov.uk/fire">www.comundat.gov.uk/fire</a> and necessary action taken	Remind staff to keep backdoor gate locked out of hours to stop intruders getting in	Manager	26/07/07	20/07/07

Assessment review date: 17/08

Figure 8: Example by the HSE for a risk assessment approach recommended for small businesses or workplaces (here: "betting office"; available online).

Since 2014 the 'Health and safety toolbox' (Figure 9) replaces HSE's most popular guidance book 'Essentials of health and safety at work'. It provides advice on precautions to reduce the risks of dangers in the workplace (available online and free of charge: <https://www.hse.gov.uk/toolbox/index.htm>).





**Figure 9:** HSE's 'Health and safety toolbox' provides guidance especially to SME on 103 pages regarding RA. The figure gives an example on harmful substances with case studies from a hair salon and a restaurant.

In addition to toolboxes, guidelines and information sheets the HSE provides posters and leaflets explaining health and safety laws in the UK and lists what workers and their employers should do. Every employer is obliged to either display the health and safety law poster or to provide each worker with the equivalent health and safety law leaflet. The majority of the documents are free of charge.

In the UK comprehensive and robust data about the cost of work-related injuries and ill-health is available which was extracted from well-developed academic and non-academic sources of data about the costs of occupational injuries and ill-health that go back for a number of years [19,20,21-27]. Although job-satisfaction is good, 21 % of workers in the UK think that their job affects their health in a negative way; only 11 % regard it as positive. The UK data indicates that the average number of accidents resulting in at least four days of absence is 5.6 per 1,000 employees, with the fatal injury number 0.45 per 100,000 workers. Data show that UK's labour inspectorate has approximately one inspector for every 12,000 workers.

### 3.2 Risk assessment strategy of the Netherlands

The 'Working Conditions Act' of 1994 is the primary piece of legislation covering occupational health and safety in the Netherlands (NL) more elaborated in the Working Conditions Decree or the Working Conditions Regulations. Initially, all employers had to contract certified multidisciplinary occupational health services to assist them with occupational health and safety as well as sickness absence management. In 2002, the coverage of the working population by OHS services reached almost 100%. Since 2004, employers are free to contract either a certified occupational health services or hire a board-certified occupational health and safety expert for specified tasks - due to deregulation and tailoring of protective legislation. By 2008, more than 85 % of all companies had a contract with either an OHS

or an individual expert. A positive effect was the enhanced empowerment of employers and employees who are primarily responsible for occupational health and safety policy. Negative effects resulted from the decrease in experts (although the number of specialists is still high in comparison to other countries), visits and inspections and consequently worse coverage of the working population by OHS. The fact that the negative effects were not long-lasting and were outweighed by the positive effects may be the result of the so called 'Polder Model'. Due to the well-established Polder model, government and social partners are involved in sustaining each other in their respective roles by means of consultation and cooperation on several levels.

The Dutch polder model is characterised by the tripartite cooperation between employers' organisations, labour unions and the government and applies to Dutch industrial relations as a whole. In this context, the role of the government is to primarily develop legislation/regulation including levels of OSH protection, provide relevant information to social partners, facilitate and support their actions and, finally, enforce legislation (e.g. through the labour inspectorate). The primary role of social partners is to contribute to the development of means and tools to facilitate the implementation of an OSH-related legislation and policy. A key factor of success is the 'declaration of intent' – an agreement between employers and employees regarding OSH to be laid down for the sector as a whole. These agreements are embodied in the Social-Economic Council that serves as the central forum to discuss labour issues and has a long tradition of consensus, having defused labour conflicts or avoided strikes. The declaration of intent led to a collection of risk assessments as well as related measures and solutions which companies from different sectors can choose from in order to comply with the rules. The support of the agreement on working conditions grew with the participation of trade unions and the trade association for each sector contributed by drafting appropriate occupational health and safety measures.

Special attention is paid to small and medium enterprises. After having developed a sector-specific approach in 2004, several additional services have been added on to the RA system that currently consists of the following key elements:

- Ministry of Social Affairs and Employment website interlinked with
- Social-Economic Council website
- Inspectorate website
- a dedicated central website ([www.rie.nl](http://www.rie.nl)) providing access to all the RI&E tools:
  - » tailor-made digital RA tools, many approved by the inspectorate,
  - » a support point hosting the system and providing general support,
  - » a Help Desk for sector developers and end-users,
- a system of social partner acknowledgement of RA tools.

All the sector-specific RA tools are available online on one website ([www.rie.nl](http://www.rie.nl)), either via a direct link or, if the specific tool is not digital, by offering contact details of the relevant sector organisation and where the paper-based risk assessment tool can be obtained from.



**Figure 10:** Collage of the Social-Economic Council’s website, the central risk assessment and support point website and the ‘declaration of intent’ agreements’ website. Important websites regarding risk assessment and management guidance in the Netherlands are strongly interlinked and invite Dutch social partners and companies to participate or develop a new ‘declaration of intent’ or online risk assessment instruments.

In the beginning, the Dutch government provided a questionnaire consisting of paper-based lists of generic health and safety related questions to be answered by the employer. However, this approach presented several problems, especially to the smaller businesses. In their perception risk assessment meant loss of time, money and complex and unnecessary paperwork. These findings led to the development of the first digital risk assessment tool in the Netherlands, a generic tool, launched in the spring of 2004. The tool allowed businesses to download the RI&E questionnaire and fill it in offline. However, this tool can be used as a basis for sectors to develop their own sector-specific RI&E instrument. As not all employers were able to adopt the structure, content and technique, the Ministry of Social Affairs and Employment decided to co-fund the development of sector-specific versions and in 2004 tailor-made RA tools for 20 different sectors were launched. After these sector-specific tools had been developed, a further step was made to take the unions on board. In this tripartite setting – in line with the ‘polder model’ – more than 80 additional tools were designed on the basis of the generic tool. Since 2011 a total of 172 different sectors have developed their own risk assessment tool which are directly (or indirectly) available on the RI&E website <http://www.rie.nl/instrumenten/algemeen-mkb-rie/> and free of charge (Figure 10).

In general, Dutch research estimates the return on investment is 2,20 Euro for every invested Euro. However, the ROI is even higher when a comprehensive risk assessment is carried out following the Dutch 5 step strategy:

- inventarisation of risks
- evaluation and prioritisation of these risks
- planning risk managing measures (RMM)
- control for the risk assessments' outcome including RMM effectivity
- documentation and reassessment scheduling

The intention of Dutch sector-specific digital RI&E instruments is that they should be easy to use and that the business owner only needs to answer questions that are really relevant to his or her particular field. It should be possible to complete the RA including an action plan within 2 hours. In reality, the time frame and – most important – the quality of the risk assessments are good or very good only if the responsible person is supported by an OSH expert. Actually, about 1,600 occupational physicians, 500 occupational hygienists, 2,000 safety engineers and 160 organisational experts are now delivering occupational safety and health service in the Netherlands. Another remarkable development that took its origin in the Netherlands in 2003 was the development of a web-based software for the information gathering and dermal and inhalation exposure assessment as part of the risk assessment process. Today ten European institutions and one Taiwan institution keep the software, called Stoffenmanager®, up to date (Figure 11). With small adoptions Stoffenmanager® can be used to implement a full risk assessment programme in a company. Consequently, Stoffenmanager® might be further developed to a European risk assessment instrument with a concerted assessment strategy.

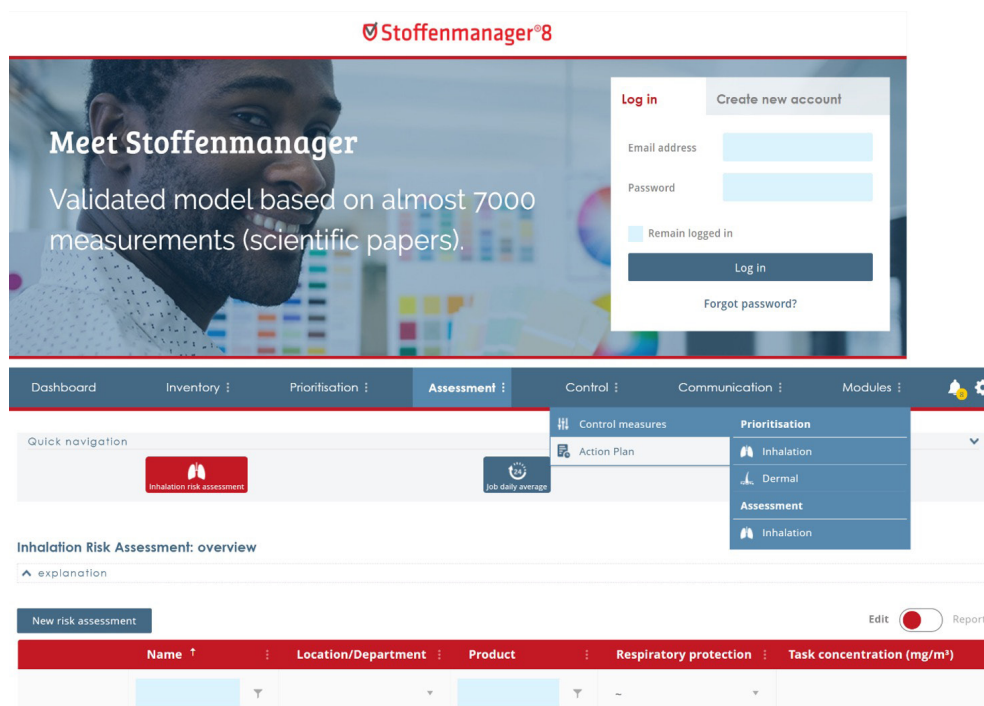


Figure 11: Stoffenmanager® website – after login in with a free account, different functionalities are available that can be used to carry out risk assessments online.



Although the number of new risk assessments and inspections are low compared to UK, the compliance is on a high level and 24 % of workers think that the work affect their health positively. In Europe only Sweden and Norway are scoring higher on that question (with Sweden having a higher percentage of workers that think their work affects their health negatively).

Data from the Netherlands indicates that the average number of accidents resulting in at least three days' absence is 875 per 100,000 employees and the fatal injury rate is 0.4 per 100,000 workers. The Dutch labour inspectorate has approximately one inspector for every 31,500 workers.

### 3.3 Risk assessment strategy of Germany

Since 1974 the law in Germany defines employers to be responsible for the health and safety at the workplace, and if they have employees, they must be advised by two professionals; an occupational physician and a safety engineer. Since 1996, employers are obliged to carry out risk assessments. Several technical rules for biological agents, construction site, hazardous substances, premises, medical, noise, radiation, vibration and workplaces are provided by the government [https://www.baua.de/DE/Angebote/Rechtstexte-und-Technische-Regeln/Technischer-Arbeitsschutz/Technischer-Arbeitsschutz\\_node.html](https://www.baua.de/DE/Angebote/Rechtstexte-und-Technische-Regeln/Technischer-Arbeitsschutz/Technischer-Arbeitsschutz_node.html). Next to the government, the German social accident insurance and its member associations for the public institutions (Unfallkassen) and the statutory accident insurance and prevention institutions (Berufsgenossenschaften) elaborate sector specific rules that can serve as risk assessment tools. The state (at federal and land level) enacts legislation and promulgates regulations and the rules of state boards. After close examination of their needs and with the approval of the federal and state governments, the statutory accident insurance institutions release their own accident prevention rules. For actual implementation within companies, the rules are supplemented by information, written in clear language and filled with various illustrations and examples, e.g. codes of practice and sector-specific checklists. All documents can be found and downloaded free of charge under <https://publikationen.dguv.de/regelwerk/>.

Whereas the two-column system of federal and social insurance institutions is functioning successfully regarding the generation of information, the accessibility and visibility of relevant documents is even more complicated than at EU level (Figure 12). Additionally, it seems that only two mandatory experts are not enough to advise and especially encourage companies to carry out risk assessments [43,44]. The situation is in fact worsening due to vast lack in occupational physicians in Germany [45]. "Preventive care as well as the supervisory and consultancy activities of the state and social insurance institutions seems unfeasible for SMEs throughout the country, as merely 10% of the enterprises with fewer than 200 employees carry out health promotion measures" [46]. Micro- and small enterprises with less than 50 workers can benefit from the so-called "entrepreneur model". The model is offered by the statutory accident insurance bodies to their members, i.e. companies. Employers qualified in special trainings are exempted to some extent from the statutory OSH services and may reduce the agreed number of hours with each safety expert.

The number of new risk assessments and inspections are low, compared to the UK and the Netherlands and 21 % of all workers believe that their work affects their health negatively. The German data indicates that the average number of accidents resulting in at least three days absence is 2,100 per 100,000 employees with a fatal injury rate of 1.1 per 100,000 workers. The German labour inspectorate has approximately one inspector per 31,500 workers. A study from 2010 found that the return on prevention is 1.60 Euro for every Euro spent.

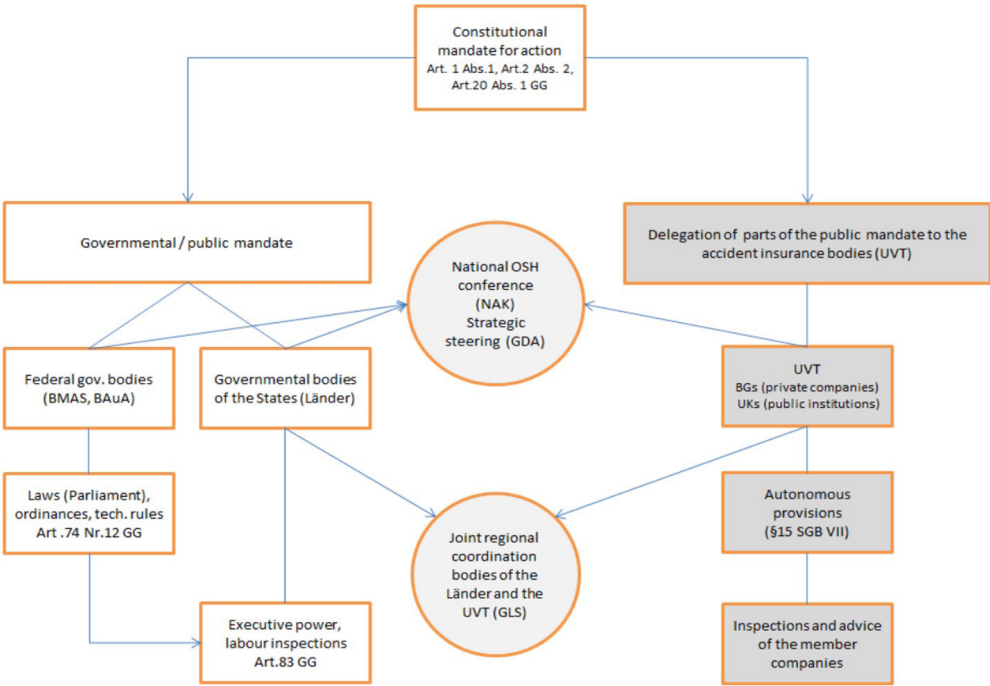


Figure 12: Different stakeholders in the German OSH system produce several regulations, rules and recommendations. Source: [47]

## 4 Selection and presentation of a case study

### 4.1 Case study from the Netherlands

When comparing the three European countries described before it can be concluded that all three countries have developed and implemented risk assessment strategies that are suitable to protect the majority of their workforce. The national strategies discussed above all have their strengths and weaknesses, but often perform above European average in the discussed parameters, like number of accidents and fatal injuries. Thus, the selection of one country depends on the focus an advisor applies. As a matter of fact, the Netherlands are outstanding regarding their quick implementation of EU OSH regulation and developments in that area and even better known as a major player in pushing these developments. The OECD has found very good words on that:

“Whilst administrative burden reduction has been a key focus of Dutch Better Regulation policy over the last few years, other important policies have also been developed. These include reform programmes for inspection and enforcement, from 2001; programmes to address administrative burdens on citizens which includes elements of regulation inside

government, starting in 2003; further work on the legal quality framework for developing new regulations, including assessment of alternatives to regulation; and a growing engagement with the EU institutions over the development of Better Regulation at EU level. Recent developments are extending these foundations. Notably, there is an increasingly vigorous and targeted communication programme, the development of what was previously known as the administrative burden reduction programme, now known as the regulatory burden reduction programme, to cover a much wider scope of issues, moves to strengthen public consultation through the Internet, as well as renewed efforts to work at EU level and with likeminded EU partners to strengthen EU Better Regulation policies.” [48]

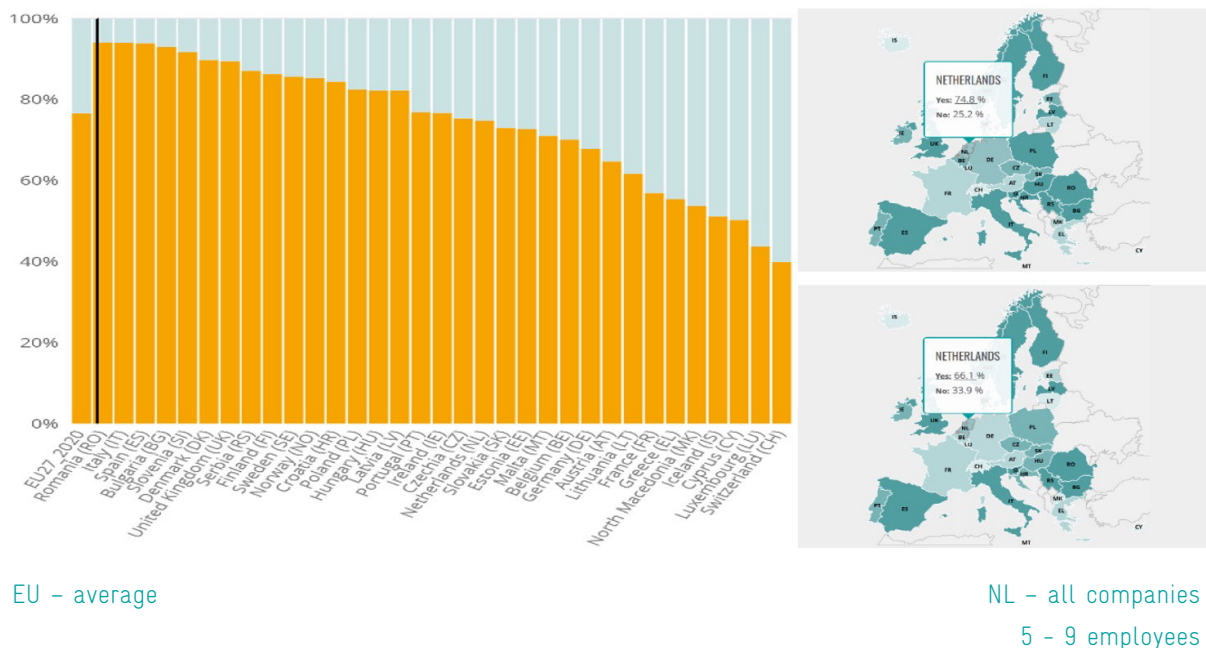
The following findings underline the Kaizen minded understanding of the Dutch OSH system to constantly improve itself and explain why the Netherlands should be selected from the three countries to discuss a case study in detail:

- from the early 1980s, the government only defined basic principles on health and safety, leaving it up to the so-called “social partners” – the organisations representing employers and employees – to come up with the details [49]. The effect was that creating good, safe working conditions became a customised, workplace-specific process and that the workforce increasingly identified itself with the requirements and took more responsibility.
- the amendment to the Working Conditions Act, which came into force on 1 January 2007, offers employers and employees the opportunity to compile a ‘Health and Safety Catalogue’ at sector level. The Catalogue describes instruments, methods and solutions for the main work-related health hazards in the sector.
- the Dutch tools were among the first online risk assessment tools developed in Europe. The Dutch RA tools and the web application system to generate RA tools has inspired EU-OSHA to use the Dutch model as a basis for developing the Online Interactive Risk Assessment (OiRA) for Europe as a whole.
- the European Union defines small and medium enterprises (SME) as the most important target group to enhance workplace health and safety. The key challenge in this regard is how to reach the SMEs and encourage them to make the necessary changes. The data collected for the evaluation indicates that SMEs do not react well to written guidance (often finding it too complicated) and that they rely on external services to a greater extent than large establishments.
  - » The Netherlands have a system of five key professionals supporting employers regarding environment, health and safety requirements. They can call in further experts. This system is very helpful for employers because they do not have to search for several experts as the key professionals will do that for them.
- SMEs are best targeted through a more personalised approach, combining enforcement and guidance. EU-OSHA recommends continuing the further development and dissemination of already existing effective tools, in particular the OiRA tool. More than 80% of the Dutch digital risk assessment tools are based on OiRA.
  - » Most Dutch RA tools are designed to ensure that SMEs comply with the legal obligations to execute a risk assessment and to reduce the administrative and financial burden on

them in doing so. Furthermore, the aim is to improve their level of health and safety; to improve general awareness about the existence of the RA tools and finally to stimulate the development by the social partners of new sector-specific RA tools.

- » Sector-specific RA tools are available via a single, central website, either via a direct link or if the specific tool is not digital there is at least the contact details of the relevant sector organisation from which the paper-based risk assessment tool can be obtained from.
- EU-OSHA recommends to make the essential requirements of the Directives more accessible and mentions one specific example; to further explore the potential of the 'Control banding' approach to managing chemical hazards such as 'Stoffenmanager®' developed in the Netherlands to assist SMEs [47].
- the introduction and constant improvement of a regulatory impact assessment is another example of the Netherlands long-standing commitment to innovative regulatory policies, dating back to the 1980s [50]. Regularly documentation of the labour inspectorate allows to monitor the implementation not only by the ESENER study (Figure 13) but also by the national inspectorate.

## Does your establishment regularly carry out workplace risk assessments?



**Figure 13:** ESENER 2019 comparison of the percentage of companies that carried out a workplace assessment. From <https://visualisation.osha.europa.eu/esener#!/en/survey/overview/2019>.

- the Dutch Government has made significant progress since 2011 by introducing an integrated regulatory impact assessment framework for quality testing. Its desired outcome of an efficient, effective and transparent administrative and political decision-



making process is a strong example of this continued commitment to improving the evaluation system. An OECD review team also noted the continued strong political support across ministries during the fact-finding mission for the principles subject to the regulatory impact assessment framework [50].

- in terms of prevention the Netherlands have a good return on investment for companies and obviously relatively low invention resources regarding inspectorate and governmental organisations as can be seen from
  - » lower number of accidents when compared to Germany,
  - » the lowest number of fatal injuries when compared to Germany and the UK.
- the accidents and injuries numbers are the lowest in Europe, but the number of workers that think the work is impairing their health negatively are very low, too.
  - » the percentage of worker who think that work effects their health positively is very high (24 %) when compared to Germany or the UK values.

The OECD states in their key emerging trends and issues which are captured in the reviews of 15 European member states: “The growing interest in a broader social/citizen dimension to regulatory policy extending scope beyond the business community, for example, links with social welfare objectives and the emergence of sustainability impact assessments”. Even here, the Netherlands rank top in work-life balance and above the average in jobs and earnings, education and skills, subjective well-being, social connections, environmental quality, personal security, civic engagement (Figure 14).

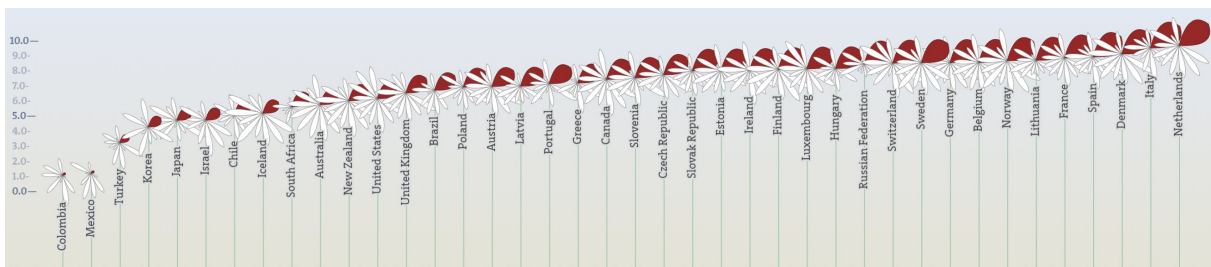


Figure 14: OECD Better Life Index show that the Netherlands have high scores regarding work-life balance and other work-related topics. Source: <http://www.oecdbetterlifeindex.org/topics/work-life-balance/>

## 4.2 Dutch case study for the successful implementation of a RA

All companies including SMEs have to be affiliated with a certified Occupational Health and Safety Service. This requirement is part of the implementation of the European Framework Directive on Health and Work in The Netherlands. Companies up to 25 workers have the opportunity to use an approved risk assessment tool instead of entrusting an occupational health consultancy agency. However, the implementation of such a tool, and a related Occupational Health and Safety Catalogue respectively, is often accomplished by one of the so called ‘core OSH experts’. By law all companies are obliged to:

- carry out a risk-inventory and risk-evaluation,
- have a structured policy on preventing absenteeism,
- have a periodical health and work investigation,

- offer employees the opportunity of a consultation with the occupational health service doctors and set up company medical support.

The process of carrying out a risk assessment is divided into four different steps in order to make it more manageable for those involved. The steps differ depending on the target group. Sector organisations are enforced to develop:

- a sector specific tool,
- an acknowledgement,
- an implementation concept,
- a maintenance programme.

Companies are obliged to:

- identify the risks,
- evaluate the risks,
- make an action plan,
- and assure regularly update.

Since 2008, the inspectorate controls the implementation of a risk management system by checking at least 9 items:

- is there a risk assessment?
  - » is it approved?
- is there an action plan?
- is there a documentation of work injuries?
- is there a contract with an OSH expert (group) or usage of an Occupational Health and Safety Catalogue (Figure 15)?
- is there a sick leave regime (documentation)?
- is there a first-aid system?
- is there an internal safety officer?
- is there an OSH meeting at least once per year?
- is there a OSH training of the workers?

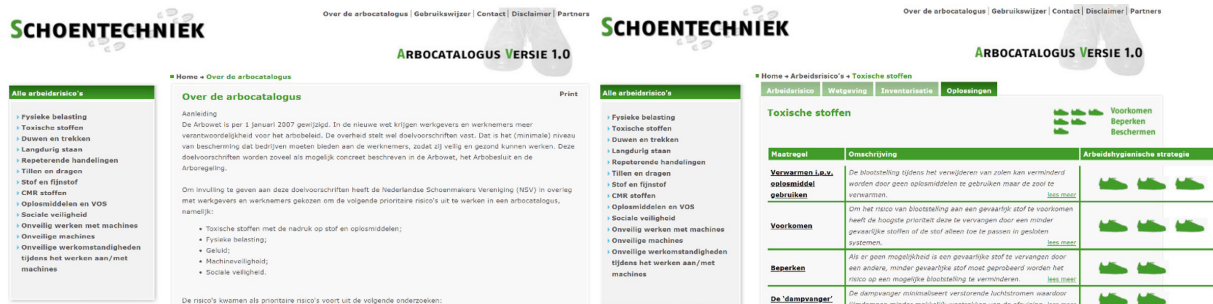


Figure 15: Example of the Dutch online risk assessment tool 'Occupational Health and Safety Catalogue'. From: <http://www.arboschoenmaker.nl/index.aspx?id=39>

Especially the enhancement of the development and usage of the Occupational Health and Safety Catalogue is a key success factor that is documented by the inspectorate monitoring.

The need for developing tailor-made sector-specific tools was strongly promoted by both, social partners and the government and between 2004 and 2010. During the same time (2003–2007) a national funding programme contributed mostly to make available information more visible and knowledge better placeable, aiming especially at SMEs. Stoffenmanager® was the most successful instrument developed as part of this programme. Over a period of 11 years, Stoffenmanager® has become a mature and validated tool for the management of risks in the field of hazardous substances and is recognised as such by the Dutch Labour Inspectorate and the European Chemical Agency (ECHA). Apart from SME users with relatively few substances, Stoffenmanager® has also attracted larger organisations with a multiplicity of substances. Thus, there is good reason to focus the case study on the implementation of a sector specific risk assessment programme by using the Stoffenmanager®.

#### **4.3 Case study for the successful implementation of a RA in the rubber & plastics manufacturing industry by using the Stoffenmanager® software**

In 2008 a study was made to evaluate the Stoffenmanager® algorithm using data from 63 companies from inter alia chemical, construction, metal and rubber industry [51]. In several other studies conducted by international experts, the Stoffenmanager® was validated [52,53,54].

In a two-year intervention study, Dutch occupational hygienists from the inspectorate and the Stoffenmanager® consortium examined the implementation of Stoffenmanager® for qualitative and quantitative risk assessment of exposure as well as chemical risk management in a wider sense [55]. The project was structured as an intervention, encompassing three phases. In the first phase (pre-implementation), five to six occupational hygienists guided the process and carried out the training for the and support of the software key features (Figure 16) as well as the analysis of success and failure factors in the participating companies. They also developed a so called “implementation evolutionary ladder” (Figure 17) and conducted a baseline survey with a structured interview protocol with 48 questions on:

- general characteristics of the organisation and of its representative in the project;
- general occupational health and safety (OHS)-policies and policies towards chemicals within the organisation;
- the organisation’s progress in, and experiences with, using Stoffenmanager®.

Key feature	Explanation
Dashboard	<ul style="list-style-type: none"> <li>■ Overview of key figures and risks graphically presented. Also, to be used in a management review</li> </ul>
Inventory	<ul style="list-style-type: none"> <li>■ generate register dangerous products</li> <li>■ generate register CMR-substances</li> <li>■ flagging substances according to several hazardous substances lists</li> <li>■ create predefined processes and workplaces (templates) to be used in the risk assessment</li> </ul>
Prioritisation	<ul style="list-style-type: none"> <li>■ inhalation control banding</li> <li>■ dermal control banding</li> </ul>
Assessment	<ul style="list-style-type: none"> <li>■ quantitative inhalation exposure assessment</li> <li>■ calculation job daily average</li> <li>■ risk assessment REACH</li> </ul>
Control	<ul style="list-style-type: none"> <li>■ view control measures and / or calculate the effect of control measures</li> <li>■ create plan of action</li> </ul>
Communication	<ul style="list-style-type: none"> <li>■ generate and disseminate workplace instruction cards (chemical safety cards) / safe uses</li> <li>■ generate reports and overviews in Word and Excel</li> <li>■ log files and notifications</li> <li>■ multiple users with different rights and roles</li> </ul>
Additional modules	<ul style="list-style-type: none"> <li>■ SHARE: publish workplace instruction cards and SDS by URL; in this way the latest versions are always available on a pc, tablet or smartphone</li> <li>■ PGS 15 (Dutch only): storage dangerous products</li> <li>■ ATEX-137 (Dutch only): explosion safety at the workplace</li> <li>■ Nano: inhalation control banding</li> <li>■ PIMEX: instruction movies visualising the effect of control measures</li> </ul>
Languages	<ul style="list-style-type: none"> <li>■ Multi-language: English, Dutch, German, Finnish, Swedish, Polish, Spanish, French, Italian and Danish.</li> </ul>

Figure 16: Key features of the Stoffenmanager® web-based control banding tool. Retrieved from [https://oshwiki.eu/wiki/Stoffenmagager%C2%AE\\_for\\_smart\\_chemicals\\_management\\_and\\_business\\_continuity](https://oshwiki.eu/wiki/Stoffenmagager%C2%AE_for_smart_chemicals_management_and_business_continuity)

The second phase was the actual intervention (implementation) that consisted of collective and individual training, consultancy, and support of the companies. The third phase (postimplementation) consisted of an effect survey among the participants, largely using the same protocol as was used in the baseline survey.

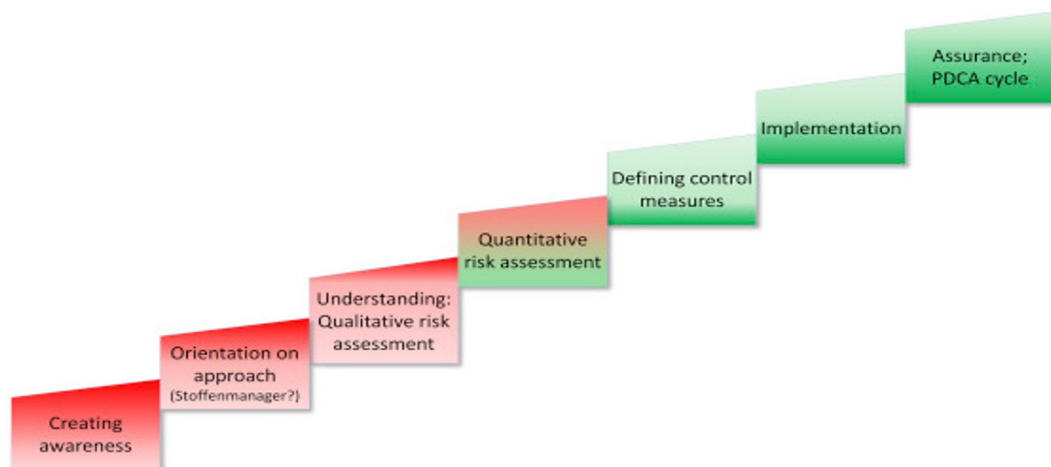


Figure 17: The “implementation evolutionary ladder” describes seven steps of the implementation process. For every step a distinct number of core criteria was defined to classify if only a general OSH risk assessment is available which contains a section on chemicals (ladder step 1); the representative knows the Stoffenmanager® model, has a login code and has taken a look at it (ladder step 2); data on chemicals have been entered into Stoffenmanager®, and the qualitative model has been used (ladder step 3); the quantitative exposure assessment model in Stoffenmanager® has been used (ladder step 4); potential control measures have been selected, and their impact on the exposure has been calculated by using Stoffenmanager® (ladder step 5); the feasibility of control measures has been evaluated in detail, and/or their implementation has started (ladder step 6); the plan-do-check-act cycle has been assured; responsible people and means are available (ladder step 7). Adopted from [51].

At the end, each company was assigned to one of the seven phases of the implementation ladder. The results show that at the beginning 60% of the participants were assigned to either step 1 or 2. After the intervention, 62% were assigned to step 5, 6, or 7 - a considerable shift of the companies towards selecting and assessing potential control measures, and in starting to implement these. Among other for the participating chemical and plastic companies several conclusions can be drawn:

- by using both a general (joint meetings) and individual approach (site visits), most companies clearly improved on the implementation evolutionary ladder;
- active training and coaching help companies to improve their chemical risk management;
- active training and coaching help to avoid making mistakes when using risk assessment instruments;
- use of validated tools embedded in a community platform supports companies to organise and structure their risk management in a business-wise manner;
- implementing a good risk management as a consequence from risk assessments largely depends upon motivated OHS-professionals, management support, and willingness to invest time and means.

## 5 Recommendations for the implementation of a RAP

Built on the development of risk assessment in Europe, advanced by the national strategies and the personal experiences **systemkonzept** has made recommendations for general aspects of a risk assessment regarding occupational health and safety (OSH) as well as for the system and concept to establish and control such a risk assessment can be given. Moreover, the last years and recent developments clearly show that aspects of social responsibility and sustainability can't be regarded separately from OSH. Consequently, threads to the environment, fellow colleagues and customers should be respected in the risk assessment, too.

Thus, risk assessment should have the goal to enable the employer to take the measures necessary in order to:

- avoid or minimise negative risks to the health and safety of the worker and the environment
- support the proliferation of health, safety and sustainability at work.

A risk assessment should comprise following steps:

- inventarisation of risks factors
  - » information gathering
  - » hazard identification
  - » opportunity identification
- evaluation of these risks
  - » probability
  - » impact
  - » prioritisation

- defining objectives
  - » compliance
  - » health promotion
  - » protection
  - » empowerment
- planning of risk managing measures (RMM)
  - » capability planning & project scheduling
- implementation,
  - » communication RMM
  - » training of the workers
  - » evaluation &
  - » documentation of RMM
  - » efficiency of communication RMM
- regular monitoring of RMM effectivity
- scheduling provisions of improvement and reassessment

## 5.1 General aspects of a risk assessment system

After defining the objectives of a risk assessment, it is important to define the supportive processes and the necessary roles to implement an appropriate risk assessment management. A sound risk management is fundamental to effective business and the decision making of an enterprise. By trying to minimise the probability of failure from hazards and increase the likelihood of success from opportunities, all entrepreneurs and managers intrinsically conduct a risk assessment. While being good in finding opportunities, reducing negative risks – especially regarding OSH – often is challenging to managers. A fortiori it must be part of the core processes of an enterprise. Regarding negative risks the following process is recommended:

- develop a coherent overall prevention policy which covers the influence of factors related to the
  - » activity
    - process
    - task
  - » working environment & condition,
  - » technology, organisation and personal aspects of work, and
  - » social relationships
- establish a structure of competencies and resources capable of anticipating, identifying, predicting, evaluating and controlling work-related risks
  - » the less competence the more advice shall be given by an ergonomist, occupational hygienist, occupational physician, occupational psychologist or safety engineer
  - » the smaller the company the bigger the platform those companies can match, work together and bundle their resources (EHS management shouldn't allow or enable rivalry)

- assure a continuous improvement in the level of protection afforded to the environment and the workers,
- implement a transparent documentation system that indicates the handling of the results from the risk assessment; the risk management measures, their efficiency and regularly control
- giving appropriate instructions to the workers and make the process visible to third parties.

Another feature of entrepreneurship that can be used in OSH processes, too, is proactivity. Instead of taking action after something has happened and thus only acting in a corrective manner, risks should be evaluated a priori and actions should be preventive.

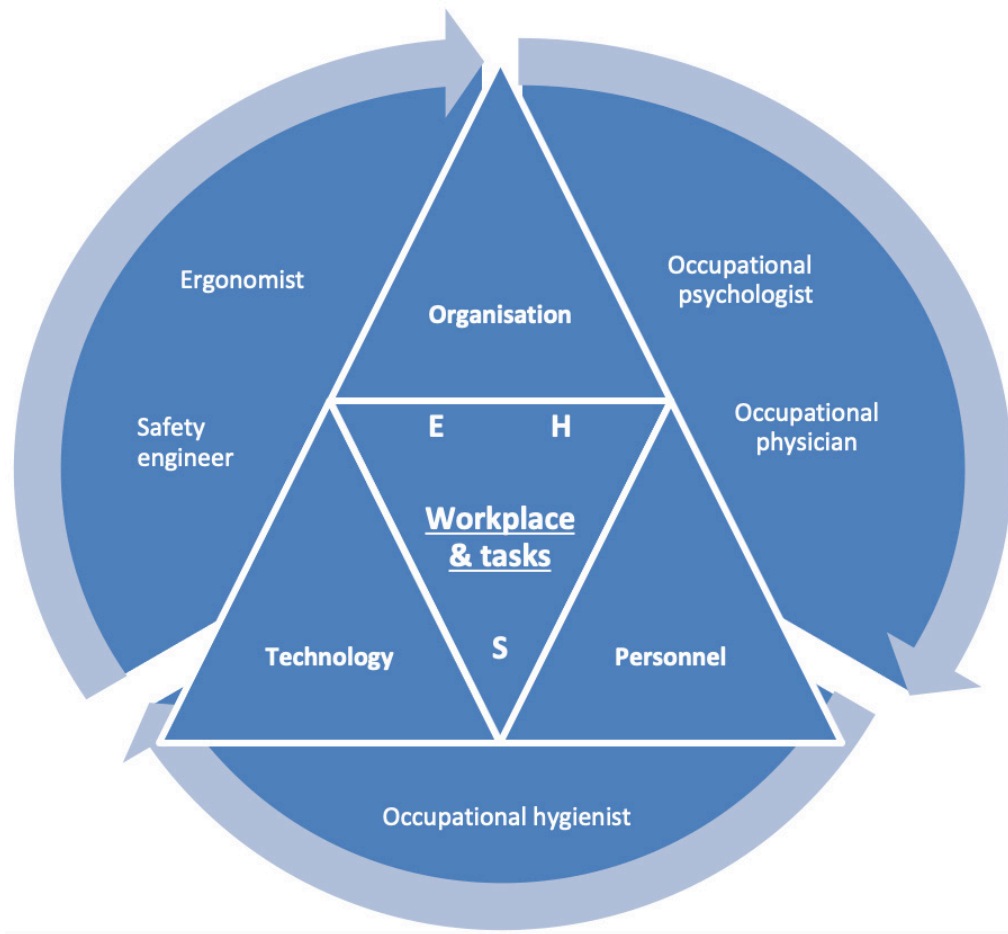
Regarding prevention the following process should be applied:

- evaluate the potential negative risks before starting the work or tasks
- replace the dangerous (to human and/or nature) with the non-dangerous or the less dangerous
- enhance positive risks, e.g. training effects
- start with adapting the work, then the input (energy, substances, etc.), the process, the place (technical) and last: the individual (e.g. behaviour),
  - » consequently, combating the risks at the source;
- regularly check and adapt if needed to state of the art;
- chose collective protective measures (e.g. exhaust ventilation, containment, etc.) over individual protective measures (e.g. respiratory protective equipment);

Risk assessment relies on several roles in order to address the various target groups. These roles and target groups can be divided into external and internal. External targets are depended by several factors and must be identified by each enterprise individually. External roles can be advisors, auditors, customers, inspectors and professionals.

OSH professionals are established in most countries and can refer to a long history and sound qualification. One of these established and well-founded professionals that is of utmost importance in most countries is the safety engineer. Especially in Germany, qualification concepts like that of the German Social Accident Insurance that was mainly elaborated by systemkonzept [56] ensure a sound education and training of these professionals. Another professional that is qualified and trained especially in the conduction of risk assessments and mitigation of biological, chemical and physical risks is the occupational (or industrial) hygienist. In several countries like the United states or the Netherlands occupational hygienists are important connectors between the employer, employees and certain other OSH professionals. Regarding physical strains and the evaluation of workflow, ergonomists are another valuable profession. At least occupational physicians and psychologists should be part of a multi-disciplinary team especially in medium-sized or large enterprises of high risks sectors. Figure 18 shows how those aspects are interrelated.





**Figure 18:** Environment (E), health (H) and safety (S) are depending variables of the organisational, personnel and technical aspects in the workplace. All the six items can be interdisciplinary assessed by established professionals like ergonomists, occupational hygienist, occupational physicians, occupational psychologists and safety engineers.

Next to qualified professionals, valid standard procedures are an important pillar for a sound risk assessment. Often those procedures can be found in technical standards of the regulator, a standardising committee or labour union. For the recommendations of standardising committees or labour unions it is recommended to have a superior authority to evaluate the meaning and quality. This can be a Commission likewise the Commission for Occupational Health and Safety and Standardization (KAN), see <https://www.kan.de/en/>.

## 5.2 Concept to establish and control a risk assessment

Quondam the strategy to evaluate a successful implementation of a risk assessment was to control what was done. However, it is more efficient to see how things are done and why. Consequently, the employer, being responsible for the work that is done for him, has to show how health and safety to the worker and the environment are ensured. Exemplary, the employer has to declare and document his will to implement a preventive health and safety policy. As a guide he tends to achieve a culture of prevention. However, he can pass over certain duties to his management, including the responsibilities concerned.



The management being responsible to build the structure to implement the risk assessment by means of resources. But before spending time and money on external advisors, one should first look for internal OSH stakeholders. Those are, for example, first aiders and appointees to certain hazards like fire, explosion, radiation etc.

If the employer or the management is not competent enough to evaluate all risks related to the work, competent external services or persons have to be enlisted, although this does not discharge the employer or his management from his responsibilities in this area. It is important to monitor the efficiency of the risk management system. At least three items are important to this end:

- number of accidents
- days of sick leave
- quality of the risk assessment

If a company has an unsuitable risk assessment process but low number of accidents, the implementation could still be improper. It might be a matter of time, until accident rates will enhance. Conversely, if the number of accidents is high although the risk assessment process is appropriate, it will be a matter of time until the accident rates will decline- especially if the risk assessment process follows a continual improvement strategy.

Figure 19 shows how a successful implementation of a risk assessment can be evaluated by an external or internal assessor.

Quality of the risk assessment system	Inadequate measures	Adequate measures
No resp. Minor shortcomings	Matter of effort →	STATE OF THE ART
	Matter of time ↓	
Several resp. Major shortcomings	STATE OF THE ART	↑ Matter of effort
		← Matter of time

**Figure 19:** The combination of indicators for the efficiency of the risk managing measures and the number resp. quality of shortcomings can be used to assess the quality of the risk management system. The indicators must be defined at individual cases.

### 5.3 A programme to implement a risk assessment strategy

In order to be effective, a suitable RAP should follow certain guiding principles that can be distracted from the discussed RA strategy.

Important developments in the Netherlands were:

- use of an online risk assessment software;
- simplifying OSH legislation;
- communication and implementation by central support;
- communication by the ministries and inspectorates to promote the legislative changes.

Carrying out risk assessments and implementing associated programmes in the workplace also relies on the accountability of the employer, yet it must be complemented by employee participation as well as professional support and technical surveillance, too. The EU-OSHA's new 'Healthy workplace campaign – Lighten the load' contains several aspects featuring case studies and practical suggestions on how collaboration between workers and employers can create a strong culture of risk prevention. These suggestions are useful for risk assessment implementation, too. Regarding work-related musculoskeletal disorders (MSDs) one specific guide looks at the importance of early intervention and helping workers with MSDs return to work, as well as considering who is at particular risk and why it is important to promote good musculoskeletal health from an early age [57]. Naturally, this can also be transferred to other hazards.

RA should be divided into logical steps that can be taken in a reasonable time frame and where responsibilities are defined and easy to understand for employers and employees. These steps are:

- determination of all risks per task and workplace with the help of employees or their representatives; vulnerable groups should be considered before they take up employment
- anticipation or evaluation and prioritisation of the risks in terms of their negative or positive impact by employer accompanied by internal or external OSH experts (occupational hygienists, psychologist, safety engineers etc.)
- planning of risk managing measures (RMMs) and positive risk promotions (PRPs) by an OSH committee
- review of the implemented (existing, adapted) RMMs' and PRPs' effectivity by OSH experts (occupational hygienists, psychologist, etc.)
- review of the risk assessment's outcome including RMM & PRP efficiency by an OSH committee
- training of employers and employees including vulnerable groups
- documentation and reassessment scheduling by the employer and employees' representatives

Hence, RAP should follow this "harmonised" approach and give examples that help transferring these steps into the specific sectoral working environment. The examples should include a hierarchy of measures for negative risk prevention also known as the 'general principle of prevention'. The hierarchy of measures is:

- avoid hazards;
- replace dangerous activities/machines/processes/substances with non/less dangerous ones;

- evaluate the risks and minimise negative risks which cannot be avoided;
- developed a coherent overall prevention policy which covers technology, organisation of work, working conditions, social relationships, and the working environment;
- deal with negative risks at source level, promote positive risks at the individual level;
- adapt work to individuals, especially regarding workplace design, choice of work equipment and working/production methods;
- prioritise collective protective measures over individual ones;
- adapt to technical progress;
- give staff appropriate instructions.

To improve qualification and enhance identification with the considered RMMs or PRPs training material should be edited in a way that it can be used for different target groups like younger workers, trainees, students or even pupils. Workers might even become experts and ambassadors for specific RMMs or PRPs if they are able to teach a content. Despite a growing importance of gender- and age-friendly workplaces, there has been limited research on the intersection of gender and age and OSH in relation to safety and health issues and sustainable workplaces. Nevertheless, relevant information is available from studies on gender by EU-OSHA and Eurofound. A gender-related dimension is important, for example, with regard to addressing measures to balance work and care responsibilities for elderly workers, and addressing the impact of physical work on women in relation to, for example, musculoskeletal disorders (MSDs), and the impact of stress and burnout resulting from emotionally demanding work carried out by women.

An internet-based architecture that collects and provides multiple sectoral examples can serve as a knowledge hub, offering controlled and standardised content which closely corresponds to the specific aspects of each occupation. In contrast to the presented European RAP, a more differentiated process should be elaborated and communicated by public available guidance sheets and websites. First of all, the relevant scope of the RAP must be defined and relevant scenarios must be developed that aims to eliminate, reduce or suitably control any associated risk to the health, safety and wellbeing of individuals involved with (or affected by) specific task/activity in question.

For SME the RAP's content should also offer risk management methods and instruments in general that enable users to check on a regular basis if a reassessment is required. Indications for a reassessment are (author's abbreviation: "I CARE"):

- Incidents or accidents (e.g. near misses) at the workplace
- Complaints by workers or their representatives
- Availability of new state of the art risk assessment and control measures
- Remarks made by national inspection authorities
- Entering a new technology, organisation, or other activity that alters the workplace;
  - » including new prevention measures when former measures were found to be inadequate

An impressive example is the development of online risk assessment tools in the Netherlands that can be interlinked with a so called ‘Occupational Health and Safety Catalogue’ to fulfil all relevant legal requirements for risk assessment – being approved by the respective inspectorate in some cases. When embedded in a free website and held up-to-date by OSH experts, this is surely the most promising way to help companies of all sizes and branches to carry out a risk assessment and still have resources left to implement corresponding RMMs and PRPs. Finally, the website provides links to frequently asked questions and access to an online help that provides technical assistance to developers and users. Information about risk assessment is increasingly provided by using social media. Regular updates and issues provided e.g. via twitter or LinkedIn massive enhance the publicity and support of a risk assessment tool.

Last but not least, data on the evolutionary process of implementing risk assessment tools should be collected and documented in a professional way. Research in Germany suggests a systematic approach and quality assessment process based on occupational health and safety management systems and strategies comparable to the concepts of ISO 45001 and the European Foundation for Quality Management strategies [58, 59].

Annex 1 describes the processes of a risk assessment for a specific case. An industrial cleaning company has to evaluate the risk of nanomaterial release from plastic granulates made and handle in the chemical and plastic sector. This example shows that linkage and working together between the enterprises concerned help to ease and improve the risk assessment process remarkably.

Based on this and other experiences a government may apply following strategy to implement and support an overall risk assessment programme:

- define a clear scope, responsibilities and processes of risk assessment
- elaborate guidance and instruments for this risk assessment with professionals concerned; define assure sound qualification of key professionals
- make documents and requirements to risk assessment and key professionals available by a central institution/location idealiter accompanied by a website
- provide approved content e.g. by an ‘Occupational Health and Safety Catalogue’
- guide and control the implementation of the risk assessment in companies by monitoring the structure and process (not the content).

## Annex 1 - Exemplary case of a risk assessment of an industrial cleaning company regarding chemical hazards related to release of nanomaterial from plastic

This case study describes the example of an integrated chemical risk assessment as part of the risk management system of the enterprises BASF (European SE - <https://www.basf.com/global/en.html>), ESE Group (Dutch Co. - <https://www.esecom/home/ese-world/>), Lobbe (German Holding - <https://www.lobbe.de/en/>) and AVR (a German municipal waste disposal company - <https://www.avr-kommunal.de/>). Cause for concern was the use of nanomaterial in plastic items that may be released by recycling processes.

Lead was taken by Lobbe. As it can already be seen from their website Lobbe declares to "provide services based on the specific occupational safety and health laws, regulations and rules and ensure the protection of the environmental resources soil, water and air as a basis for action in decontamination, cleaning, collection, transport, storage and treatment services". In this case they wanted to clean a plastic grinding mill of the AVR. AVR gets some of its plastic from rejected waste bins and containers of ESE. As one component ESE use nanosize pigments obtained from BASF.

Following process lead to the conduction of a risk assessment:

- entering a new technology that might alter the risk at the workplace of AVR;
  - » evaluation if prevention measures are adequate
- availability of new state of the art risk assessment

Regarding nanomaterial, several expert groups raised their concern and the EU was working on a harmonised definition and overall estimation of the risk that nanomaterial constitute at the workplace. The Netherlands developed national reference values for nanomaterial and in Germany a technical rule TRGS 527 'Activities with nanomaterial' [60] was elaborated that recommended the conduction of a risk assessment. Christian Schumacher was one of the experts who worked in the German expert group for this technical rule as well as on the adoption of the benchmark level concept of the Institute for Occupational Safety of the German Social Accident Insurance implemented in Annex 4 of TRGS 527. Based on the following described actions the subsequent steps of the risk assessment could be recommended:

- colloquy with the director and the responsible manager of AVR
  - » Agreement on the conduction of a risk assessment regarding nanomaterial
  - » Asking of information from ESE and BASF
- determination of relevant tasks and workplaces with activities with nanomaterial by the help of the safety engineer, a representative of the employees and an external occupational hygienist
- anticipation of risks
  - » Information gathering regarding the inserted nanomaterial
  - » Estimation of possible nanomaterial release per workplace and process => mapping of possible emissions of relevance by expert judgment

- evaluation and prioritisation of the risks by using the flow chart as suggested in Annex 3 of the TRGS 527 (Figure 20)
  - » screening of processes with possible relevant nanomaterial emission by measuring nanoscale and fine dust concentration in the so called near-field (at the source)
  - » estimation of dermal and oral exposure
  - » Screening of activities of workers that may lead to inhalation exposure by measuring nanoscale and fine dust concentration at the workers (personal air sampling)
  - » combination of possible nanomaterial hazards and heights of emission
  - » Combination of possible nanomaterial hazards and heights of exposure amended by duration and frequency of the activities that lead to the exposure
- presentation of the results to the responsible managers and workers of AVR and Lobbe
- planning of risk managing measures (RMMs) and positive risk promotions (PRPs) by the OSH committee
- review of the implemented (existing, adapted) RMMs' and PRPs' effectivity by OSH experts (occupational hygienists, psychologist, etc.)
- review of the risk assessment's outcome including RMM & PRP efficiency by an OSH committee
- training of employers and employees including vulnerable groups
- documentation and reassessment scheduling by the employer and employees' representatives

As a result of the inventarisation of the tasks the exchange of the filters of the local exhausted ventilation was determined as the task with the highest possible nanomaterial release and emission.

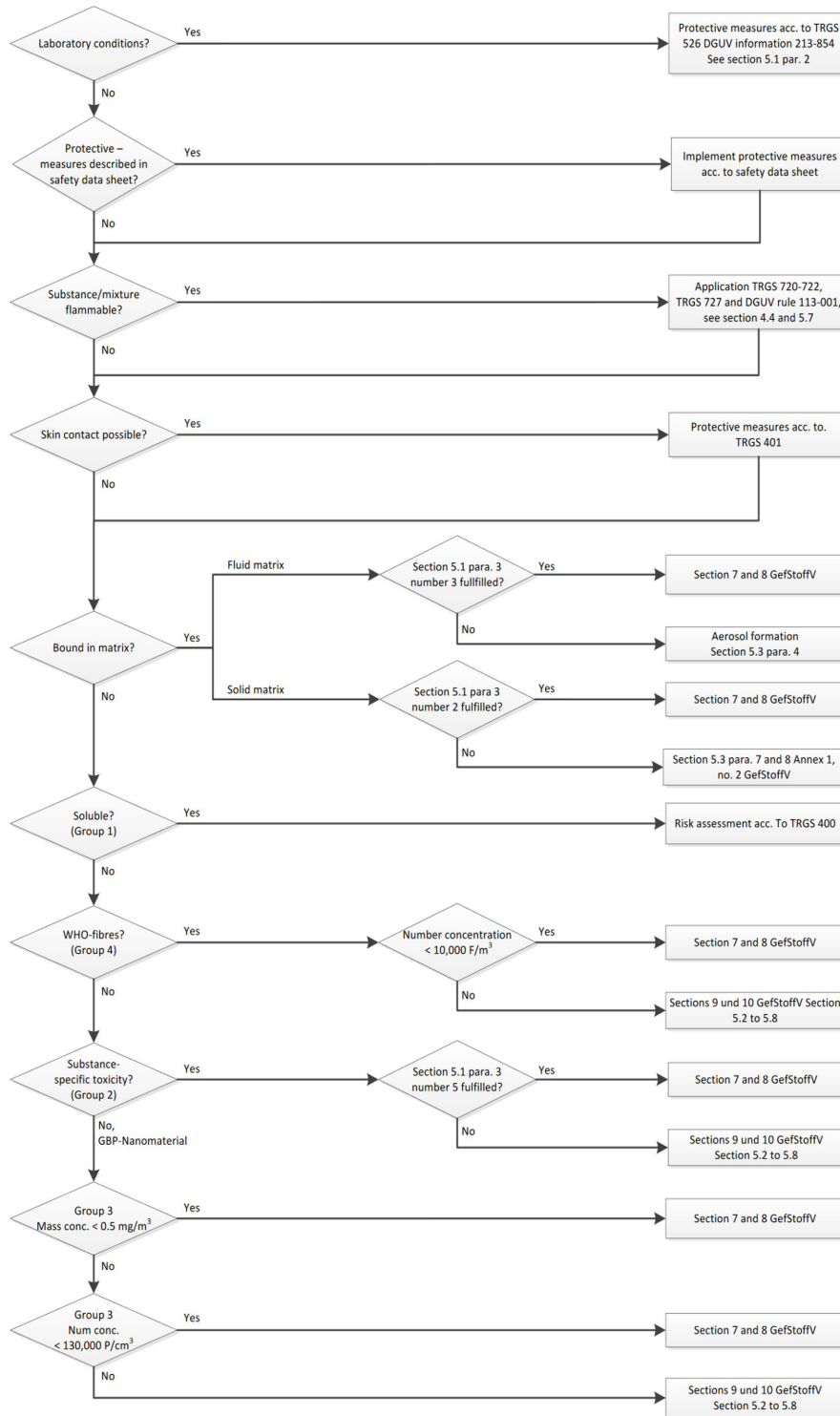
Although the evaluation showed the exposure of the responsible worker of the AVR was low – incorrect/inadequate organisation of work could lead to exposure of other workers in the room, too. That exposure can be even higher than the exposure of the worker who is changing the filters; e. g. when he or she is wearing respiratory protective equipment (rpe) while the other workers in the room don't wear rpe.

Consequently, during the exchange of filters as a RMM the stay and permission into the room was prohibited except for the workers who is conducting the task.

Regarding communication of the results it was suggested to use a tool called Nanorama to raise attention concurrent with training (Figure 21).

Because of the score system, those Nanorama could be used not only for internal schooling but to instruct the workers of Lobbe when coming to AVR to conduct their work.

**Annex 3: Flow chart with a simplified illustration of the procedure for the risk assessment for nanomaterials**

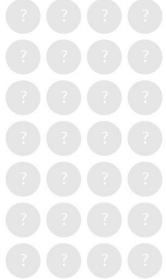


**Figure 20:** The assessment of the hazard caused by nanomaterials is additionally realised on the basis of the flow chart determined in Annex 3 of the TRGS 527.



**Kunststoff-Recycling**

Für Hinweise zur Suche  
über die Punkte fahren.



Punkte **0/62**

Neustart Über

Entwicklung

die  
Innovations-  
gesellschaft



**Figure 21:** At the moment five Nanorama - a novel E-Learning tool in which the user enters a virtual room in which he can move and explore workplace situations - are available via the website <http://nano.dguv.de/nanoramen/>. They were developed by The Innovation Society Ltd., St.Gallen as the result of a project supported by the German Social Accident Insurance (DGUV). The 360° workplace panorama shows products, materials and occupational situations which deal with nanomaterials and technologies in the respective industry and in every-day workplace areas. It focuses on the use of nanomaterials as well as on the appropriate workplace safety measures when handling nanomaterials. The picture shows the suggestion for a sixth Nanorama for plastic recycling.



## Annex 2 - Example how to adopt RA in times of the Corona virus infection disease 2019 (CoVID-19)

The coronavirus pandemic presents one of the biggest obstacles across the world employers and employees have ever had to face. A European solution on risk assessment in general can be of huge value regarding well-co-ordinated and harmonised risk management measures. Although the composition and intensity of implementation vary, all EU/EEA countries and the UK have introduced a range of organisational measures like 'stay-at-home' policies (recommended or enforced) and physical distancing. Unfortunately, personal protective equipment for the workplace, again, is primarily discussed, ignoring the occupational hygiene strategy of risk management measures; that is substitution before community measure (technical or organizational) before personal measures (like personal protective equipment). Indeed, as can be assumed from the many cases of infection of workers that are well trained in using respiratory protective equipment (RPE) e.g. in hospitals, using RPE might be less effective to avoid infection than community measures. Technical or organisational measures seem to work well even for workers who are not trained to wear RPE adequately. Thus, risk assessment should try to identify activities and tasks where workers might be exposed to other people and aim to avoid those situations. In addition, an appropriate regime for natural as well as local exhaust ventilation should be implemented following the World Health Organisation's recommendation [61,62]. For employers and employees in non-healthcare settings EU-OSHA elaborated a guidance based on guidance published by WHO (<https://www.who.int/docs/default-source/coronaviruse/getting-workplace-ready-for-covid-19.pdf>), CDC (<https://www.cdc.gov/coronavirus/2019-ncov/communication/guidance-list.html?Sort=Date%3A%3Adesc>), ECDC (<https://www.ecdc.europa.eu/en/publications-data/rapid-risk-assessment-coronavirus-disease-2019-covid-19-pandemic-ninth-update>) and HSE (<https://www.hse.gov.uk/news/coronavirus.htm>). The "COVID-19: guidance for the workplace" is available at [https://oshwiki.eu/wiki/COVID-19:\\_guidance\\_for\\_the\\_workplace#See](https://oshwiki.eu/wiki/COVID-19:_guidance_for_the_workplace#See)

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As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

**Published by:**

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Bonn and Eschborn, Germany

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**Design/layout, etc.:**

Abu-Ghazaleh & Co. Consulting, Amman

On behalf of German Federal Ministry for Economic Cooperation and Development (BMZ)

September, 2020