

VISION DOCUMENT – SAFETY

Safety in the Dutch maintenance market in 2020



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Colophon

Vision Document – SAFETY 2020

The Netherlands Association for Effective Maintenance (Nederlandse Vereniging voor Doelmatig Onderhoud – NVDO) 2011

The Vision Document on Safety has been produced at the conclusion of a two-year European campaign for health and safety at work, in a partnership between NVDO, TNO, SBD, ARBOUW and Ernst & Young.

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Recommendation

A healthy and safe working climate in a company leads to healthy and satisfied employees. These employees are less often ill, tense or unable to work, and they usually perform better. Because of this, employers save themselves the often unnecessarily high costs of illness, replacement employees and insurance premiums, not to mention substantial legal claims for damages, which are being submitted more and more often and with increasing success. This in turn does no good to the financial returns and the image of your company or organisation. There are also benefits for society: lower demands on healthcare funds and higher tax revenues, a highly contemporary theme that benefits all of 'Holland plc'.

The Health and Safety Inspectorate is responsible for ensuring that work in the Netherlands is carried out in healthy, safe and fair conditions. Fortunately you won't find us on the workforce every day. Ideally we wouldn't have to be there at all, in the confidence that safety is firmly embedded in your company and that it is an element of day-to-day operations on the workforce. Another important aspect is that working conditions are fair: if companies do not stick to the rules and, for example, deliberately neglect to provide fair working conditions motivated purely by their own economic gain, then the whole business sector suffers as a result. We keep a close eye on these companies.

Safety is certainly not a task for the Health and Safety Inspectorate alone. There are many parties that can, and in my opinion must, make a contribution. As far as I am concerned, the motto is 'working in partnership for a healthy and safe workplace'. That's why I am so pleased with this vision document from the NVDO at the conclusion of the European 'Safe Maintenance' campaign.

All too often I see reports of horrific accidents, and all too often it turns out that many of them could have

been avoided. That leaves a rather bitter aftertaste, to put it mildly. In the Netherlands, around 1,850 employees still die every year as a result of exposure to hazardous substances. Sadly we still see some 220,000 accidents leading to injury and absence from work, and every year around eighty to a hundred employees do not come home at the end of the working day because they have been the victims of fatal accidents. It gives me great satisfaction that my professional role in the Health and Safety Inspectorate means I can contribute to making work in the Netherlands a little safer. And that is a feeling shared by many of my colleagues. The Health and Safety Inspectorate works to ensure that all employers and employees obey the law. The rules apply to everyone! The motto here is 'hard where necessary, soft where possible'. This means that inspections are more frequent in sectors and companies where the risks are high and the legislation is poorly adhered to, and firm action is taken (with sanctions such as official requirements, fines, official reports and suspension of work). In sectors and companies where the risks are low and the legislation is adhered to well, inspections are usually less frequent and actions are more flexible. And the outstanding companies are left alone: they are given an 'inspection vacation'.

But of course our organisation does more than just carrying out inspections and enforcing the law. We also have a major focus on education and prevention. We promote self-motivation among both employers and employees. And not only around the negotiation table with social partners, even though they form a key link in the chain: what is particularly at issue is safe behaviour on the workforce itself, whether you are an employee, a manager or a director. The real knowledge of how risks on the workforce should be tackled, and the concrete measures that should be taken, are to be found within the companies themselves. An essential instrument for identifying and tackling health and safety risks is the

risk inventory and evaluation (RI&E) and its associated action plan. Together they form key building blocks for an effective health and safety policy, so it is with good reason that they are a legal obligation.

An accident with a cutting machine, a builder who falls from scaffolding, a cleaner who accidentally inhales hazardous fumes, a remover who suffers a back injury, a teacher suffering from burnout, a sailor who falls overboard... there are health and safety risks in almost every workplace. Prevention is better than cure, and it is also better than having to pay compensation for damages. So employers are obliged to identify the health and safety risks in their companies. They also have to draw up an action plan indicating when and what measures are necessary to remove these risks, or limit them as far as possible. And the watchword in this is: as much as possible, eliminate the risk at its source. Better to have electronically controlled machinery than to have an employee inhale diesel fumes. How to develop the most effective possible response? Here too, partnership is the key. An occupational health and safety service or a company-specific health and safety coordinator or prevention officers can help you in this. The Works Council is another important player, often with a clear view of the realities on the workforce.

Partnership for safety does not only apply internally within your own company. It acquires an extra dimension in situations or at locations where several companies are brought together. This has long been the case on building sites, but we also see it more and more often in other working situations. The Health and Safety Inspectorate does not only look at individual companies, but certainly also at the ways in which partnership between different companies is organised, from design through to implementation. New forms of contracts call for a clear structure for the ways in which the various RI&Es of the collaborating contractors are integrated in a safety plan. A good plan, structure of responsibilities, coordination and supervision on the workforce are essential for this.

With the realisation that too many industrial accidents still occur in the Netherlands, the question arises of how we can more effectively prevent accidents, and

how we can improve safety in the workplace. Scientific insights show that three issues are involved:

1. Improvements to the 'hardware': safer machinery, safer equipment. Technological developments are bringing about constant improvements, so that materials are becoming safer and more environmentally friendly, more ergonomic and economical to use, and offer a higher level of protection. Innovation, production and safety go hand in hand here.
2. Improvements in the organisation of the work: how are matters arranged regarding the workplace, the working processes, agreements, working hours, protocols (for example concerning what must and must not be done during unexpected malfunctions) and – not unimportant – how supervision is organised.
3. Improvements in behaviour and mentality on the workforce: working on safety awareness. Is it normal for safe working to be discussed in your company? Or is it ignored? Do you personally set a good example? Do you take safety seriously, and how is this reflected in your company? There can be any number of procedures, regulations or safe machines, but it is ultimately the employee who has to deal with safety issues. And at the same time, this is the factor that is most difficult to influence.

Both new and 'old' knowledge and insights on these issues have been brought together in recent years in an initiative by the Ministry of Social Affairs and Employment: the Safety at Work Action Plan. Industrial sector organisations, knowledge institutions, businesses and the Health and Safety Inspectorate work together on this, each from its own field of expertise and strength. The collective aim is to reduce accidents in the workplace. Tried and tested tools and instruments are available through the Action Plan, such as cost-benefit analyses, manuals, checklists, information materials, and so on. Businesses can take part in a network to exchange experiences, or call in innovation advisors who can help with innovations that are both smart and safe.

I see two key points for the future. Firstly, safe working begins with learning to work safely. The Health and Safety Inspectorate aims to make a contribution to the firmer anchoring of healthy and safe working in professional training. This involves the promotion of

'safe craftsmanship' and competencies among young trainees, so that they can approach risk situations professionally and with the right knowledge and skills, and act to prevent risks as far as possible. After all, the young people of today are the employees of tomorrow: and we need to handle them with care! Secondly, sharing knowledge and joining forces to continually work on improving working conditions: that's where gains can be made.

It is both useful and necessary to regularly identify key points to bring your goals closer. The same can be said of this vision document, and particularly of the results of the Safe Maintenance campaign. I hope it will provide inspiration for the further reduction of accidents and the enhancement of the Safe Workplace for all!

Anja van Vlerken

Health and Safety Inspectorate/Strategy Team

Introduction

Buildings, machines and other structures that are not regularly maintained become unsafe for the people who work with them, and also for those around them. For instance, if machinery is poorly maintained, or even not maintained at all, it presents risks to the people who work with it, and other employees are also put in danger. Maintenance is essential for a healthy, but also for a safe working environment. What is more, good maintenance contributes to value creation in Dutch industry. Every day, safe, efficient and accessible buildings, installations, processes and infrastructure help to ensure that money is earned in the Netherlands. In most of the recently identified top nine industrial sectors, safe and efficient maintenance is a strong link in the value chain.

In the European standard EN 13306, maintenance is defined as '(the) combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function.'

Alongside the fact that maintenance is crucial for a safe workplace, it is also important that the maintenance work itself is carried out safely, whether this concerns personal safety, constructive safety or safety in the outsourcing chain.

In Europe, a level has been reached in recent years where safety levels are only seeing limited improvements. To make the leap to improve safety levels still further, maintenance needs to be given a higher priority in the design of systems. Experience also provides valuable knowledge. By learning from earlier incidents, new incidents can be avoided.

Major industrial accidents have a great influence on the world we live in, and also attract a great deal of attention in the media. We can learn lessons from accidents like the one in the Gulf of Mexico, in chemical companies and in the construction industry: incidents that teach us that there was insufficient consultation on the workforce, or that management systems in the outsourcing chain were not working in unison.

Technological innovations offer new opportunities to carry out fewer critical activities at unsafe locations. This can be taken into account in constructing new buildings and renovating old ones. It is therefore also essential to involve the end user in the design phase. This will also result in less exposure of employees to potentially dangerous situations.

If maintenance is needed less often, this also means that there are fewer risks of accidents during the work. Reliability engineering offers numerous opportunities in this regard through improvements in the design and use of data systems. The maintenance sector will also have to work more closely with universities and universities of applied sciences to more widely apply relatively new developments such as nanotechnology, sensor technology and analysis technology. The analysis of operational information and maintenance-specific data can improve the maintenance of safety-critical installation components, as well as reducing its frequency. Partnership within the chain between operators, employees and specialists such as designers and reliability engineers is an essential condition for the improved planning and preparation of working activities.

Less maintenance, greater safety and improved accessibility of installations. These call for vision and leadership. Clear leadership on the workfloor is essential to improve the many moments of transfer and collaboration between the implementing parties, advisors and clients on the workfloor. It also demands leadership to develop partnerships between industrial sector organisations and interest groups. Adding value to business objectives is the primary purpose of maintenance departments, and the prevention of accidents and incidents is a core activity in this.

This vision document forms a conclusion to the two-year European campaign focused on the safe performance of maintenance work, and has been produced in collaboration with the various

partners who were involved in the campaign. The vision is therefore broad, and formulated from a variety of perspectives: it is a vision that is intended to emphasise the importance of safe working and the maintenance of critical operational equipment. On the basis of recent research and statistics, this document examines focus areas that can contribute to increased safety and more efficient business operations in the coming years.

Following a summary of the main points of the campaign (part 1) and an overview of the current state of affairs concerning safety in the maintenance sector (part 2), the third part of this document gives a vision of the possible future of safe maintenance work with reference to developments within a number of themes.

On behalf of the partners who have collaborated on the production of this vision document:

The Netherlands Association for Effective Maintenance (Nederlandse Vereniging voor Doelmatig Onderhoud – NVDO)

Arbouw

The Dutch Roofing Industry Regulatory Foundation (Stichting Bedrijfstakregeling voor de Dakdekkersbranche – SBD)

Focal Point Nederland

PART I: A SUMMARY OF THE TWO-YEAR SAFETY CAMPAIGN

Background, facts and figures

European focus on safe maintenance: the campaign

The European Union attaches great importance to safe maintenance. So much importance, in fact, that in 2010 a two-year campaign was launched to draw the attention of employers and employees to this issue. In this chapter you can read about what we in Europe know about safe maintenance, the situation in the Netherlands in the field of maintenance, how the campaign progressed and what it delivered.

1.1 The definition of maintenance¹

Maintenance is everywhere. It plays a role in every sector, at every workplace and with every employee. Maintenance work can therefore be seen as the heart of a healthy and, especially, a safe workplace. In the European standard EN 13306, maintenance is defined as '(the) combination of all technical, administrative and managerial actions during the life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function'. This may concern workplaces and machinery, but also means of transport such as ships, aeroplanes and motor vehicles.

Although maintenance is a collective term, a distinction can be made between:

- Corrective maintenance: taking measures if something is not functioning;
- Preventive maintenance: preventing something from not functioning, usually by means of regular and planned maintenance work.

It will be clear that corrective maintenance in particular entails risks, because it mainly involves unexpected interventions and often has to take place under time pressure in order to disrupt

production as little as possible. Preventive maintenance, however, is also certainly not without its hazards.

1.2 Maintenance work in all sectors

Almost all companies in the Netherlands are involved with 'maintenance'. The maintenance sector therefore forms a cross-section of all columns of industry. For example, maintenance is carried out on dykes, roads and railways, factories, pipelines, packaging machines, hospitals, aeroplanes and climate control installations.

The Netherlands Association for Effective Maintenance (*Nederlandse Vereniging voor Doelmatig Onderhoud* – NVDO) divides the maintenance market in the Netherlands into six sectors. These are defined as follows:

- Process industry

Maintenance on and around the production processes of solids, liquids and gases (for example the chemical industry, oil refining, blast furnaces and paper production).

- Real estate

All the building-related maintenance on residential and utility buildings, and industrial real estate (such as operational and fabrication areas).

- Infrastructure

Maintenance on road, water, rail and other infrastructural constructions, such as harbours and airports, but also on cables and pipeline networks (including the gas, water and electricity networks).

- Manufacturing

Maintenance in the manufacturing environment of the (discreet) production of goods and product units.

- *Food and drink industry and pharmaceuticals*
Maintenance in the manufacturing environment of the batch production of goods and product units within the food segment (including the drinks industry) and pharmaceuticals.
- *Fleet; transport by road, water and air*
Maintenance on road vehicles (including private cars), ships and aeroplanes in professional transport by land (including rail), water and air.

In a number of other European countries, including Finland, Belgium and Spain, there are registrations of accidents among the target group of maintenance employees.² These key figures show that there are indeed enormous numbers of industrial accidents during maintenance work. In Europe, an average of almost one in five (15 – 20 percent) of the total number of accidents in the workplace are connected with maintenance activities. What is more, European research shows



1.3 Key figures on maintenance activities

Because maintenance work takes place in every sector and every workplace, the monitoring of accidents is problematic. Registrations of accidents in the Netherlands do not state whether maintenance work was involved in causing an accident. It is not currently possible to give reliable figures of accidents that have specifically occurred in connection with maintenance work.

that 10 – 15 percent of all fatal accidents are connected with maintenance. The clear conclusion is that maintenance entails risk, which is expressed in a higher risk of accidents in comparison with the rest of the working population.

1.4 So much maintenance work, so many risks

Maintenance work is extremely diverse in nature, and so the risks to which maintenance person-

nel are exposed are also diverse. They can include the danger of a direct accident, or risks arising from unsafe working or exposure to hazardous situations. In addition, overdue or high-risk maintenance can present hazards to third parties. The dangers are not only dependent on the task and the sector that is being worked in: the duration and intensity of the exposure also play an important role.

The main dangers during maintenance work are:

- *Falls from height*

A fall from height is seen as a major risk in maintenance work in the construction industry and other disciplines. Although there are no specific accident statistics for maintenance work, we can say that a fall from height often occurs among all employees in construction work. More than half of the incidents of falls from height in the construction industry involve a fall from scaffolding, and in one out of six cases the victim has fallen from a building or part of a building³. No information is usually registered concerning the cause of the fall, but we can say that the consequences of a fall from height often include absence from work and even hospital admissions. Four out of ten victims admitted to hospital have damage to the torso/spinal column, while a quarter of the victims have head injuries.

- *Contact with an object*

During their work maintenance workers can become trapped, cut themselves on an object or come into contact with a moving object such as a machine or vehicle. For all workers in industry and mining, in 70 percent of emergency treatments following an accident, injury was caused by contact with an object⁴. Accidents involving cuts make up the largest segment (31 percent, 3,700) followed by injury through contact with a moving object (22 percent, 2,600).

- *Climate*

Maintenance is carried out everywhere and at all times. It takes place in various conditions such as cold, rain, wind and high temperatures. These climatic conditions can have negative consequences for the safety of the maintenance worker. The concentration of employees can be reduced in a very cold, wet or windy environment, or in high temperatures. With extreme cold there is also the risk of reduced blood circulation to the hands and feet. In wet, snowy or icy conditions, problems connected with the presence of water can arise, so that safety at the location is compromised. There is also an increased risk of falling when scaffolding and roofs are wet.

- *Working with pressure systems/danger of explosion*

In the processing industry in particular, there are situations where work is carried out in an environment where pressure systems are present, and where explosive substances are worked with. Accidents involving pressure systems or explosions of volatile substances often cause injury to both maintenance workers and third parties, as well as environmental damage.

- *Health risks of environmental factors*

In addition to the environment in which the work is carried out, factors such as noise, radiation, physical working load, chemical substances and dust play an important role in the risk of accidents. Exposure to noise can be the cause of damage to the ear canal. In addition, employees in maintenance work regularly have to lift, hold or move heavy components and other objects. Over time, this physical working load can lead to an increased likelihood of complaints of the musculoskeletal system. Chemical substances can be released during maintenance that form a hazard for health and for the environment. Asbestos also remains a hazard for employees during repair

work and/or when removing asbestos in an existing building, or in ships or installations. In the case of work carried out outdoors, ultraviolet radiation in sunlight, but also from machinery, can reach the employee. The hazards following exposure can be severe, varying from burning to skin cancer. When working with materials in a variety of sectors, dust that is released - from quartz dust when grinding roof tiles to particles in the air during grinding and welding - can also form a major health hazard.



Aims of the European 'Safe Maintenance' campaign

- Create awareness of the safety and health risks associated with maintenance activities.
- Promote good practice and initiatives in maintenance activities.

1.5 The European 'Safe Maintenance' campaign

Maintenance work is carried out throughout all sectors and branches of industry, and often has a low risk level. Fortunately there are increasing numbers of companies, organisations and government agencies that make great efforts to identify risks at an early stage and take the necessary preventive measures. Yet despite

The European Agency is responsible for the development, collection and dissemination of information on safe and healthy working to help bring about better workplaces in Europe.

Focal Point Nederland is the Dutch national representative of the European Agency. In this role it is responsible for the coordination of the campaign in the Netherlands. In addition, Focal Point promotes knowledge transfer concerning working conditions between the Netherlands and Europe as a whole.

this positive development, the number of incidents remains high. To reduce the number of incidents in 2012 by 25 percent, the European Agency decided to launch a two-year supporting campaign: Safe Maintenance. The campaign, organised by the European Agency for Safety and Health at Work and the various European countries, took place in 2010 and 2011.

Aim of the European campaign

The aim of the European campaign is to raise awareness that maintenance is an integral component of an effective culture of safe and healthy working. The European Agency aims to promote a structured approach to maintenance.

Who is involved in the campaign?

The search for further optimisation of safety mainly involves an improvement in collaboration between industrial sector organisations, companies, training institutions and healthcare initiatives for people at work. With this campaign, Focal Point – the ‘envoy’ of the European Agency in the Netherlands – aims to act as the link between the stakeholders that are most involved. The partners who took part in the campaign are listed on the www.arboineuropa.nl/campagne website. The partners with the highest level of involvement – NVDO, Arbouw and SBD – have also actively contributed to the formulation of the vision presented in this document.

Finally, and not unimportantly, the professional health and safety journals and maintenance journals have regularly published articles on safe maintenance during the campaign.

What did the campaign consist of, and what was achieved?

Because of its size, Focal Point is not able to approach the companies in the Netherlands itself, so it has adopted the strategy of offering targeted support to intermediary organisations in the Netherlands. Entering into partnerships with these organisations and creating links between them was a key element of the campaign.

In the European context, a great deal of knowledge has been generated concerning the subject of safe maintenance. This knowledge finds its way to the companies in a variety of ways. Detailed reports have been published for specialists and policymakers, and for other people materials have been produced ranging from simpler factsheets to animations featuring the character ‘Napo’ that illustrate various maintenance situations in a striking way. All this material remains available in digital form on the Focal Point website: www.arboineuropa.nl.

An important element of the campaign is the collection and dissemination of good practice from companies, showing that it pays to invest in safe maintenance and that it does not always have to be complicated or difficult. To ‘discover’ this good practice, a competition was held: the ‘Good Practice Awards Competition’. Initially this involved a national competition in which two examples of good practice were nominated to compete for the European award. There are many textbook examples in Europe that can be disseminated more widely, and these can be found on the Focal Point website. Two Dutch nominations went forward to compete for the awards on the European level, and both of them won prizes. Glass Handling Technic won the European award with their innovation the ‘Repair Shuttle’, a new, safe method to repair the roofs of greenhouses from the outside. *Twence Afval and Energie* received a special commendation for their good practice, the ‘safe boiler scaffolding’, which is used when cleaning combustion boilers.

Various conferences, meetings, study days and excursions were organised by participating



organisations during the campaign. A great deal of work was done on the campaign theme, with subjects including 'Impact of leadership and pressure of work on safe maintenance', 'Obstacles to safe cross-border maintenance', 'Lifting

standards for roofing materials' and 'Safe maintenance, the work goes on'. A highlight was the brainstorm on 'building blocks for safe maintenance' in the year 2020, which contributed to this maintenance vision document.



¹Safe Maintenance in Practice, European Agency for Safety and Health at Work, 2010; ISSN: 1830-5954; ISBN: 978-92-9191-338-1

²Maintenance work and safety and health at work – a statistical view'. *Factsheet 90* <http://hw.osha.europa.eu>

³Source: TNO (2011), 'Accidents at Work – Sector Profiles'

⁴Source: TNO (2011), 'Accidents at Work – Sector Profiles'

PART II: SAFETY IN 2011

Where are we now?

Introduction

The second part of this vision document is concerned with the safety situation on the workfloor in 2011. How safe and healthy are our workplaces at this time? Where are we now? What is the role of legislation, technology and (partner) organisations in this safe and healthy workplace? What good practice can be found? What developments have taken place?

Partly on the basis of the outcomes of the two-year safety campaign, the main results of which are discussed in outline terms in the first part of this document, this section gives a description of the main current developments concerning four 'building blocks' for safety in the workplace:

- Legislation and regulations
- Technology
- Safety culture and human behaviour
- Chain collaboration

2.1 Legislation and regulations, general

Working Conditions Act, Decree and Regulations

In the Netherlands, the legal provisions concerning the safety and health of employees are contained in the Working Conditions Act. In fact, the legal provisions as a whole can be found in the Working Conditions Act, Working Conditions Decree and Working Conditions Regulations. The working conditions legislation primarily regulates the responsibilities of various actors in the field of working conditions, such as the tasks of the employer, the duties of employees and the powers of the Health and Safety Inspectorate. This organisation is concerned with controlling the compliance with the working conditions legislation, and helping companies to set up a prevention policy. However, education concerning

the Working Conditions Act, Working Conditions Decree and Working Conditions Regulations is not a primary task of the Health and Safety Inspectorate. This is mainly a task for the industrial sector organisations, and the employers' and employees' organisations, such as Arbouw in the construction industry and SBD in the roofing sector, for example with the campaign '5 times better – working is healthy'⁵, which is aimed at improving working conditions and reducing absence through illness in their sectors.

The legal RI&E obligation

Under the terms of the Working Conditions Act, companies are obliged to carry out a risk inventory and evaluation (RI&E). The aim of the RI&E is to identify and evaluate the safety and health risks for employees. 'The risk inventory and evaluation (RI&E) is an obligation for all companies to identify and evaluate the safety and health risks for employees.' If the RI&E is drawn up by a company, the risks that must be tackled quickly can be identified. An RI&E action plan should be formulated, and this must be submitted to an occupational health and safety service or an individual occupational health and safety (core) specialist for evaluation (testing). Finally, an RI&E, including the action plan, needs to be approved by the Works Council or the representative of the personnel. To support companies in the implementation of the RI&E, digital RI&E instruments that can be easily used by a company have been developed for many sectors (see www.rie.nl). As a consequence of recent amendments to the legislation, from 1 April 2011 smaller companies – up to 25 employees – that make use of an RI&E instrument that is newly certified or established in the Collective Labour Agreement are exempted

from the obligatory testing of their RI&E by a certified occupational health and safety service or occupational health and safety specialist, who will generally be less familiar with the company and/or the specific situation.

health and safety catalogues. All of these catalogues can be found at www.arboportaal.nl.

The Health and Safety Inspectorate employs the occupational health and safety catalogues as the starting point for its checks. Sectors that have



Occupational health and safety catalogues

The amended Working Conditions Act 2007 mainly contains prescriptions for targets that determine the level of protection for the employee. The government leaves it to employers and employees to make agreements on the way in which these targets can be achieved. The techniques and methods, good practices, standards and practical guidelines that lead to the required level of protection must be included in the occupational

carefully compiled the occupational health and safety catalogue can count on a flexible approach from the inspection service. In sectors with high risks, where there is no occupational health and safety catalogue, the inspection service will make more frequent inspections. Firm action is taken in the event of serious infringements and abuses. Deviations from an occupational health and safety catalogue are permitted, but the employer who applies non-standard measures

must demonstrate that in any event the required level of protection has been achieved.

Legislation and regulations specifically concerning the safe performance of maintenance work

Not all the regulations that are relevant to the safe use and maintenance of objects are currently included in the Working Conditions Act, but rather in the regulations that apply to these objects. For example, occupational health and safety regulations that are relevant for the safe use of a building are included in the Buildings Decree (see text box).

'Alongside the Working Conditions Act there are also various regulations and guideline recommendations for better and safer working conditions in various branches of industry.'

In addition to various standards that apply to maintenance work, for example the maximum permitted weight to be lifted in the case of repairs, there are also specific agreements and measures in a number of sectors. These concern specific agreements and measures between employers and employees, but also clients,

Spotlight: Safe maintenance of buildings in the new Buildings Decree

In the new Buildings Decree (1 January 2012) the safe maintenance of existing and newly constructed buildings is included in the design phase of such projects. There are currently no manuals or guidelines available that make this possible. The new legal framework requires a meticulous design process. The tasks and responsibilities of those concerned have to be attuned to one another, in order that the designer fulfils his or her obligations in the design and makes provisions to enable the safe construction and maintenance of the building. In the 'Basic Document on the Safe Maintenance of Buildings', high priority is given to the possibility of safe maintenance within the meaning of the Buildings Decree.

The Buildings Decree includes a specification of the behaviour that may be expected of everyone working in the design process. The document sketches out the contours of the integration of the safe maintenance of buildings. The aim is the analysis and definition of the tasks, authorities and results for those involved in a building that can be safely maintained. The results can be expressed at the level of objectives, but in some cases can be worked out in detail in solutions. The document presents the steps that must be followed with those involved in the design process. It is an overall manual or guideline for those involved in the life cycle of buildings, on the basis of which the sector organisations can formulate their own documents (guidelines) for safe maintenance.

Despite the fact that the legally required RI&E is carried out and followed up with care by most companies, in practice it does not always meet the specific requirements that maintenance work entails. According to experts, supplementary task risk analyses on the level of the maintenance activities are therefore also essential to guarantee safety on the level of maintenance work.

designers, contract document writers and manufacturers of equipment and aids within a specific sector. These agreements and measures often form an integral component of a specific occupational health and safety catalogue. An example of such a measure or agreement is the 'Arbouw Guide on Sloping Roofs', as described in more detail below.

Spotlight: Specific regulations in the construction sector: Arbouw Guide on Sloping Roofs

The Arbouw Guide on Sloping Roofs is a good example of specific agreements and measures between the various stakeholders in a sector (employees, employers, clients, etc.), and contains agreements to limit physical loading and the risk of falls for roofing workers. The guide also contains recommendations for reducing exposure to climatological conditions (cold, rain, heat, UV radiation), hazardous substances, noise and vibrations. The agreements and measures concerning employers and employees who are involved in working activities on and around sloping roofs are:

Design phase

A risk evaluation is already made in the design phase, so that risks can be excluded, or control measures can be planned in, at as early a stage as possible. This concerns issues such as the choice of materials, accessibility of the roof, choice of measures to prevent falls, facilities for safe maintenance and safe working with radio masts.

Implementation phase, preparations for work

In this phase a project-specific risk inventory and evaluation with a task risk analysis is carried out, or worked out in further detail. The general and specific hazards are included in this, and the general and specific project-specific measures are listed. This concerns issues such as the organisation of the work, the preparatory activities, supply, storage and transport, provisions for working at height, accessibility of the roof for renovation and maintenance, the erection of lifting equipment and the demolition of old roof coverings.

Implementation phase, roofing work

Because not all risks can be tackled fully in the previous phases, supplementary measures and the use of personal protection equipment are necessary during the implementation phase on the roof.

Source: Arbouw (2011) at <http://www.arbouw.nl/arbodienstverlener/brochures/alle-brochures/a-blad-hellende-daken/>

'There are general rules and specific standards for the safe use and maintenance of objects'

In addition to these more general laws and rules, there are also various specific standards for (safely) carrying out maintenance work. There are EN standards, NEN-EN standards and NEN standards. The EN standards are the standards that are drawn up at the European level. A standard introduced at the European level can generally be recognised by a prefix followed by 'EN'. For the Netherlands, it is 'NEN' (and so 'NEN-EN'). NEN standards are the national standards that have been formulated within the Netherlands, and also only apply to the Nether-

lands. Policy regulations often contain references to standards, for example NEN 1010 'Safety requirements for low-voltage installations' and NEN 2484 'Portable access material, ladders and steps'. These standards are not generally binding, but rather they define standards. Deviations from the standards are permitted, but only when it can be demonstrated that at least the same level of protection has been achieved.

'In practice, compliance with regard to specific regulations and standards in the field of the safe performance of maintenance is enforced by the employer and the client through contractual conditions.'

In practice, compliance with regard to the Working Conditions Act is enforced and checked by the Health and Safety Inspectorate. In addition, compliance with regard to specific regulations and standards in the field of the safe performance of maintenance is enforced by the employer and the client through contractual conditions and the agreements made in this regard in the Collective Labour Agreement. The specifically applicable legislation, regulations and standards for the safe performance of maintenance are an important (non-binding) condition in both the (standard) contracts between employer and employee and the contracts between the contractor and the client. In the event of non-compliance with the legislation, standards, regulations or guidelines, the contract is usually terminated immediately.

2.2 Technology

In addition to legislation and regulations, applied technology also forms an important building block in the creation of a healthier and safer workplace.

Technologies that have already been available for years and can make a contribution to safe maintenance have currently become available to a wider public. Of course they are also still in ongoing development. New materials make products low-maintenance, and equipment is becoming more intelligent, more easily employed and relatively cheaper than in the past. The state of technology makes it possible to reduce the frequency of maintenance on the basis of condition measurement. This means that people are exposed to risks less often. What is more, technology is making it increasingly possible to be aware of the condition of the installation prior to the maintenance work. Sensors in the process are affordable, and the processes can also be examined in depth with non-invasive measurements (measurements with sensors that are not inserted into an installation).

In the contribution that technology can make to safe maintenance, a distinction can be made between aids and tools, choices of materials, machinery, installations and systems and personal protective equipment.



Aids and tools

Aids and tools lighten the work of the maintenance professional. Although many aids have been designed to lighten the physical loading involved in particular working activities, the use of these aids also increases safety in the workplace.

Spotlight: The measurement of safety in the workplace in the construction sector

A variety of aids are currently available for measuring safety in the workplace. A good example of this can be found in the construction sector. With the construction safety index, this sector has developed a useful and, especially, a simple instrument with which employees can measure the safety level at the Buildings & Utilities or infrastructure construction site (<http://www.veiligheidsindexbouw.nl/>).

The construction safety index has been derived from the TUTTAVA® method developed by the Finnish Institute of Occupational Health. This is a generic methodology based on the principle that order and structure at the workplace form an indicator for the quality of the underlying processes. More information on the method can be found on the EU-OSHA website: <http://osha.europa.eu/data/case-studies/safe-and-productive-working-habits-tuttava>.

Good Practice: 'Rooftopper'

The SBD introduced the 'Rooftopper' Flat Roofs Health and Safety Prize to promote the improvement of working conditions. Two promotional prizes were launched in 2010. The first was awarded to *Verkoelen Dakspecialisten*, who independently developed a mobile cage that can potentially be used throughout the sector. The second promotional prize was awarded to *R&R Isolatie en Dakbedekkingen*. This company has devised a construction with which an anchor point can be raised to a height of 2.5 to 5 metres. Here too a mobile system is used, so that the anchor point can be easily positioned and removed.

Good Practice: M.A.R.S. II (Traffic Service Nederland)

One of the most hazardous maintenance activities in the Netherlands is carrying out maintenance on motorways. To allow the maintenance employees to work as safely as possible, the roads being worked on are closed. Carrying out this task entails various risks. Traffic Service Nederland has found a solution to this in the form of the M.A.R.S. II, a machine that can automatically close roads in a safe way.



'Alongside the selection of the appropriate aids and tools, the choice of materials is also of great importance for the safety of employees in the workplace.'

Choice of materials

Alongside the selection of the appropriate aids and tools, the choice of materials is also of great importance for the safety of employees in the workplace. Through a choice of specific materials, ergonomic packaging and a careful consideration of the logistic process, the risks of physical loading and exposure to hazardous materials in particular can be greatly reduced.

For example, in roofing work the physical loading is often greatest when moving materials by hand. Agreements on the maximum weight to be lifted per person are intended to provide protection in this regard. In addition, it applies in principle that materials must be transported and applied mechanically. In the same sector there is also a risk of exposure to bituminous fumes and combustion gases. This can be counteracted by replacing combustion with cold adhesion, with a waterborne adhesive being recommended. For the roofing sector, the obligation currently applies that, when working with details that present a fire risk, processing methods without the presence of a naked flame must be used.

Although the roofing sector is used here as an example of a sector in which the choice of materials can contribute to safer maintenance, this

also applies to many other sectors. For example, in the painting sector the agreement has applied for many years to use types of paint that do not contain any solvents. And in the insulation sector, there is the agreement to mainly use mineral substances (rock wool) in order to greatly reduce the risks of the insulation material for the workers.

Machinery, installations and systems

The machinery, installations and systems used for maintenance and inspection purposes can also make an important contribution to safety on the workfloor. Some good examples of this are:

Good Practice: Repair Shuttle

The greenhouses used in the horticultural industry are becoming ever higher and larger, so that replacing the panes of glass is becoming more difficult. The Glass Handling Technic partnership was set up to find a reliable and safe method of carrying out repair work. The solution was found in the design of the Repair Shuttle: a safe and efficient repair system that can be used on glass roofs. This dramatically reduces the risk of falls, and the chance of injury is extremely small. What is more, the work itself has become less physically demanding.



Good Practice: safe maintenance and less obstruction of rail traffic

ProRail and VolkerRail together developed the Mobile Workplace for maintenance on railways. The Mobile Workplace was developed to improve the safety of the railway workers and reduce obstructions to the train traffic as a result of maintenance work. In addition, the use of the workplace makes the work faster and more comfortable. The Mobile Workplace is made up of a 25-metre long wagon with no floor, and it is mainly used for small-scale maintenance such as inspections, work on points, grinding rails by hand and renewing welded joints.

circumstances where the use of personal protective equipment is not legally required⁶.

'The necessary personal protective equipment should be specified in the risk inventory and evaluation (RI&E).'

Personal protective equipment always forms a supplement to measures that tackle risks at their source. The necessary personal protective equipment should be specified in the risk inventory and evaluation (RI&E). Most personal protective equipment is intended to protect vital areas such as the head, eyes, ears, hands and



Personal protective equipment

If the client and the employer have not succeeded in arranging a safe workplace and the safe performance of the maintenance work, then employers should provide individual employees with personal protective equipment (PPE). Employers are also responsible for providing effective training on its use and maintenance. This also applies in

feet, and it can considerably reduce the risk of (permanent) injury.

2.3 Safety culture and human behaviour

Despite the focus on the correct application of safety methods and equipment in safe maintenance, in recent years there has been a greater focus in both political circles and the business community

on the creation of an effective safety culture and behavioural change within organisations.

Creating the right culture: safety first

The 'safety first' attitude has become a central issue within the various layers of organisations in recent years, among both directors and higher management and middle management, staff and workplace employees. And not only in organisations that carry out the management and maintenance work, but also among clients and suppliers. It is not only the formation of the right awareness among employees that is an important precondition for the creation of a good safety culture within organisations. Proactive involvement by the management of organisations is also an absolute necessity.

An approach aimed at cultural and behavioural change among employees also turns out to have a wider positive effect than on safe and healthy working alone. The approach increases employees' personal responsibility, and encourages

them to actively think about and contribute to operational issues and employee satisfaction. The approach also has a positive influence on companies' productivity (fewer malfunctions), innovation and profitability.

'The theme of safety has also acquired a significance in terms of business economics, because attention to it can at the same time lead to increased profitability.'

Proactive involvement of the management as a precondition for a good safety culture

There have been many publications, not only in the Netherlands but internationally, on the subject of safety culture and cultural change. Research recently commissioned by the Health and Safety Executive in the UK clearly shows that active involvement of the management forms a crucial component of the creation and preservation of a good safety culture. Among other results, it shows that the management has an influence on

Spotlight: Advice to the Social Economic Council concerning cultural aspects of safe and healthy working

The fact that the creation of a safety culture and behavioural change on the workforce at all levels in the Netherlands has been acknowledged is shown by a recent request for advice sent in writing by the Secretary of State for Social Affairs and Employment, Mr Paul de Krom, to the chairman of the Social Economic Council in June 2011.

In the request for advice, reference is made to various policy developments in the field of safe and healthy working:

- a business economics approach to safe and healthy working, as an integral component of the

business operations and as a means of increasing operating profits;

- a development from after-care to precautionary measures, as in other policy areas: the emphasis is more firmly laid on preventive policy rather than curative policy;
- the EU Safe and Healthy Working strategy, which is aimed at a 25% reduction in the number of accidents in the EU as a whole in the period 2007-2012;
- the increasing emphasis on the importance of organisational culture in the policy for safe and healthy working, also internationally.

Source: Ministry of Social Affairs and Employment (6 June 2011), Request for advice to the SEC: 'Cultural aspects of safe and healthy working'.



this culture in various ways, for example through the style of communication and supervision, and the degree of openness and honesty with which employees are approached. The management must also provide a good example of the policy to be implemented.

The role of managers is crucial in the culture of an organisation. Problems can arise if a line manager is tackled on issues other than the direction of the control measures. For example, when all the emphasis is on production while the motto is 'safety first', a manager loses all credibility, with possible consequences for the implementation process. In this way tensions such as role conflicts, contradictory messages and conflicting tasks can arise.

'An important factor in the creation of a good safety culture and behavioural change is that the management creates the right conditions.'

Human behaviour as an important basis for safety

Human behaviour also forms an important variable in the creation and preservation of a good safety culture in organisations. The fact that work is not always carried out safely, despite a good safety management system, is therefore in many cases also due to inappropriate behaviour by employees. And the fact that in practice the subject of safety is a difficult topic for many entrepreneurs and managers to discuss with employees does not improve the situation.

There are currently a number of initiatives to further promote sustainable safety behaviour among employees. One of these is the important first step of making safety open to discussion. The Consumer and Safety Foundation has devised the 'guardian angel' Alerta for this purpose. Guardian angel Alerta draws everyone's attention to their own responsibilities for safety, because she cannot sit on everyone's shoulder 24 hours a day. She opens up safety for discussion in a non-threatening way. As a follow-up to

this campaign, the 'I'm not Doofus' campaign was launched in 2011. This campaign emphasises a step-by-step approach in bringing about better safety behaviour. For more information, go to www.werkveilig.nu.

Various successful initiatives have been also been developed within companies to encourage sustainable safety behaviour among employees and a safety culture within organisations. For instance, Spie Nederland has set up a Safety, Health, Environment & Quality (SHEQ) Focus Award to encourage employees to report shortcomings in the fields of safety and health, the environment and quality. And there are more good examples in the business world:

Good practice: 'Get the SAQ'

The organisation Gebr. Janssen from Beugen got to work on its core values of **S**afety, **F**ulfilling **A**greements and **Q**uality (SAQ) with the aim of presenting an image of reliability. 'Get the SAQ' is an integrated method in which technology, safety and psychology are linked together into a single safety culture, in such a way that introducing and preserving it takes almost no effort.

'The creation of the right safety awareness among employees is the first step on the way to a good safety culture within organisations.'

Good Practice: 'Safe & Sound on the Roof'

Roofing workers often work at great heights and in all weather conditions. The Dutch Roofing Industry Regulatory Federation (*Stichting Bedrijfstakregeling voor de Dakdekkersbranche* – SBD) set up the 'Safe and Sound on the Roof' project in partnership with a number of other organisations. The aim of this project is to train every roofing worker to identify risks and take appropriate action in relation to them. To put this into practice, two permanent health and safety instructors were appointed who visit construction projects on

a daily basis and give roofing workers practical advice, for example concerning attitudes to work. Other creative approaches are also encouraged, such as using photo cameras and webcams to observe the roofing workers and identify the areas that went well and where improvement is needed. As well as the above examples there are also more integrated aids and approaches that can be used to encourage the right human behaviour in and around the (maintenance) workplace and involve employees in setting up safer processes, such as the TUTTAVA® method⁷. This methodology is based on the principle that order and structure at the workplace form an indicator for the quality of the underlying processes. With the use of this six-step method, a company can not only improve working conditions, but also reduce the number of accidents, raise the standard of hygiene and possibly also decrease environmental impact. An associated benefit of this approach is that it is positive in nature, where positive behaviour by employees is elicited on the basis of a common interest of both the employee and the employer.

Good Practice: NedTrain

The subject of safety is often discussed in organisations. However, it is a challenge to also truly involve employees in this process. To promote this involvement, NedTrain has developed an approach whereby all necessary safety activities are measured, and so can be improved. The activities are divided into nine processes that are found in the organisation. Each process is given a score, and in this way the scores can be monitored. The scores are shown on large scoreboards in the workplaces, so that employees are involved in the improvement of their personal safety on a daily basis.

2.4 Chain collaboration

Finally, effective chain collaboration offers an important contribution to the safe performance of maintenance. Chain collaboration begins with the design of the object to be maintained, such as a building, machine or installation. By bringing together the experiences of maintenance companies, clients, designers and users at an



early stage, safe maintenance during the object's entire working life can be taken into account in its design.

Safety is a personal responsibility, but in many cases also a shared one. New forms of subcontracting, a growing number of one-person businesses, the ageing of the supervisory middle management and increasingly flexible contracts of employment are creating a vacuum on the workforce. It is a challenge to motivate and coach workers in the field of safety, especially if in some cases there are four or five companies between the customer and the last subcontractor.

'The selection and evaluation of the right contractor partners in the chain is not only essential for the achievement of operational objectives, but also for safety objectives.'

A number of effective steps in the right direction have been taken in the field of chain collaboration in recent years, but the sector is also faced with a number of challenges in this area. The main challenges will be discussed with reference to a number of topics: Procedures, Tasks and Responsibilities, Culture and Communication, Project Organisation, Project Planning and Collaboration.

Procedures

The topic of procedures can be subdivided into two aspects. On the one hand there are procedures that apply to all of those involved. Examples of these include legislation and the requirements of certification systems. On the other hand, every client has specific rules and procedures. For contractors who work for different clients, the situation can be complex and unmanageable. To work safely and efficiently, it is important that everyone works in accordance with the same rules, and that all the procedures of the various parties work in unison. Uniform,

overarching procedures can help in this, provided they remain limited in number and do not once again lead to an unchecked expansion of procedures and rules. Examples of this are the SCC certification and a uniform work permits procedure throughout a particular region or sector.

'To work safely and efficiently, it is important that everyone works in accordance with the same rules, and that all the procedures of the various parties work in unison.'

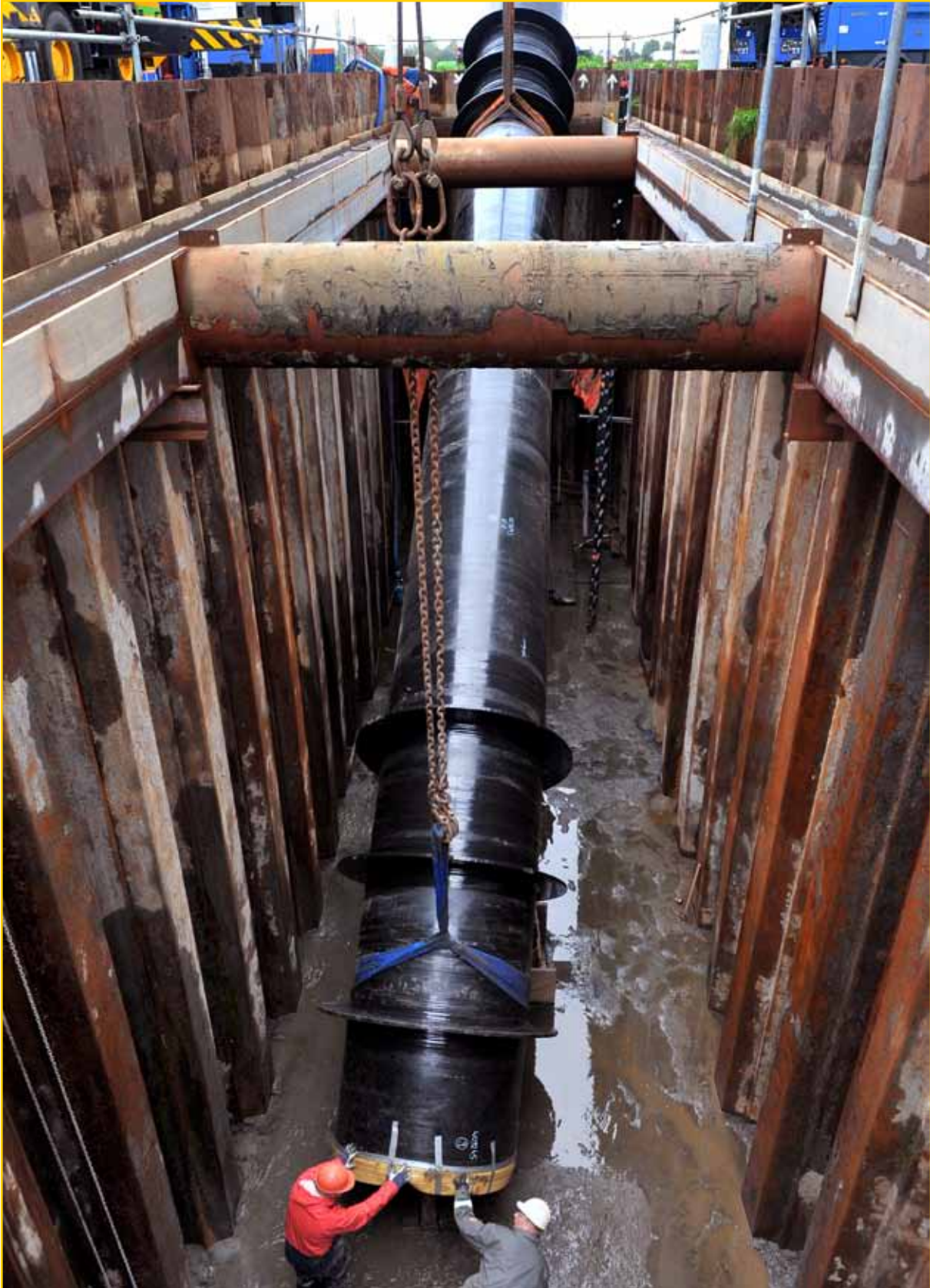
Good Practice: Safety as primary process, according to a maintenance team leader at Tronox⁸

'The first step in safe working is the work permit. Without the right work permit, no work can be carried out on the site. Every work permit is like a marriage certificate between production and maintenance, sealed with the signatures of the foreman, the maintenance supervisor and the work permit holder.'

Tasks and responsibilities

It is often unclear in which cases the client, the main contractor or the subcontractor is responsible for the safety of the work or the health of the employees on the site. What is more, with the increase in complexity it is not clear to those involved who is accountable to whom, and where the limits of the project organisation lie. For good chain collaboration it is therefore important to achieve clarity concerning the division of tasks, roles and responsibilities, not unimportantly to also make expectations concrete. A complicating factor here is the move towards more temporary contracts.

'For good collaboration in chains it is therefore important to achieve clarity concerning the division of tasks, roles and responsibilities.'



Culture and communication

Culture and language are important aspects when working in chains. One of the following aspects is often chosen for this: either all employees communicate in a language that can be understood by the client, such as Dutch or English, or the foremen of a subcontractor must be able to communicate with the personnel carrying out the work.

However, this second solution has the disadvantage that when, for example, foreign mechanics are working independently there is not a foreman present, so that instructions cannot be followed immediately. That can form a problem in case of emergencies. During the construction of the new North-South Metro Line in Amsterdam, it emerged that the cultural differences between managers, government employees, contractors, architects, etc. are enormous. People communicate from the basis of their own frames of reference, so that different meanings can be intended, even within the same language. The same applies to culture, including safety culture. The parties involved may have different safety cultures

and employ different safety levels, which leads to a complicated organisational structure in which it is difficult to effectively manage safety at work.

'Open communication between all parties in the chain is essential for the assurance of a safe and healthy workplace for all of those involved in a project.'

In projects it often turns out that there is a lot of consultation, documents are written and amended, but that there is no communication. Checking that the message has been received correctly, and feedback on this issue, are often neglected. The complexity of the project organisation often leads to misunderstandings and the loss of information. The exchange of information is often inadequate at the time of the transfer of personnel or the initiation of a project. Those concerned are not always fully informed about, for example, the planning or the agreements concerning safety aspects.

Spotlight: Chain approach in the construction process with the H&S planner

For construction projects where several parties work in collaboration, and for high-risk projects, an H&S plan must be drawn up. This contains the agreements that have been established between the various parties in the field of safety and health. The H&S plan must include a risk evaluation and inventory of the work on the project. This requirement is specified in the Working Conditions Decree, article 2.28, Safety and Health Plan.

With the provision of a digital H&S planner (see www.arbouw.nl/werkgever/tools/vg-planner) Arbouw offers a practical tool for construction projects in the Buildings and Utilities and the Groundwork, Road and Hydraulic Engineering sectors, both for the design and the implementation phase. Anyone involved in the planning and preparation of construction work can use the Arbouw H&S planner.

Project organisation

It is important that safety and health are considered and evaluated in the pre-evaluation and tendering process. Contractors are then evaluated and selected on the basis of their safety records. The aim is to create a project environment in which safe working is a central theme. The education and training of internal and hired-in personnel, including management and project leaders, also contribute the safety awareness and involvement in safety issues of all participating parties. An ongoing training process is needed to bring about the awareness that everyone is responsible for their own and other people's safety. Refresher training and so-called 'toolboxes' can be used as aids for this purpose.

'An ongoing training process is needed to bring about the awareness that everyone is responsible for their own and other people's safety.'

Good Practice: The Safety Awareness Project of Twence Afval en Energie

Twence Afval en Energie employs 210 personnel, and works together with many contractors who speak different languages. Since 2007, the company has only worked with contractors who are SSC (Secure Site Certificate) certified. In addition, a health and safety plan has been formulated, and this must be signed in advance, and thus adhered to, by the contractors. The safety awareness project, which was started in 2007, makes use of a so-called 'safety barometer', on which the contractors are given a score. The score is determined with the use of checklists. Thanks to this approach the number of incidents has fallen.



Project planning and design

As well as the necessary improvements in the technical design of the object requiring maintenance, safety at work should also be given a more prominent place in the planning phase of the maintenance of an object. It is important to involve contractors and subcontractors in the identification control of risks at an early stage. Contracts often include specific provisions concerning prices, the quality of the work and delivery dates. Contractors' safety records and safety measures are not usually dealt with in the contract phase. When a project is divided into separate activities at an early stage in the planning, the risks for each activity can be identified. Specific measures

for each activity can be included in the design of the project plan.

Collaboration

For optimum chain collaboration, all actors in the chain must be involved in chain management. They will have to make out a case for the elimination of complexity. In addition, it is a well-known fact that long-term partnerships have a positive effect on collaboration. When the parties who have to collaborate do not yet know each other, it is important that the expectations in relation to each other and to the project are explicitly stated.

Good Practice: Contractor safety clusters at NAM

A great deal of work is contracted out in the oil and gas sector. 80 to 85 of people who are exposed to risks in this sector are contractors or subcontractors. These parties play a major role in improving safety performance. For this

reason, NAM has set up five Contractor Safety Clusters. These are networks of contractors and subcontractors in the same field of work, who have daily contact where necessary concerning risks and solutions. NAM facilitates these clusters and provides the further contact.

Good Practice

A good example of chain collaboration is the 'Contractors' Standard': a helping hand for a safer North Netherlands'. The contractors' standard is an aid for clients to work together with contractors towards a safe workplace and safe working in this workplace. It is intended to lead to a reduction in the number of accidents, changed behaviour leading to increased safety and the lengthening of the Safety Checklist Contractors chain. The core of the contractors' standard is that safety is a collective responsibility of the client and the contractor.



Spotlight: Safe maintenance in practice – success factors

Buildings and other structures that are not regularly maintained ultimately become unsafe, for the people who work in them but also for the general public. When machinery is poorly maintained, or even not maintained at all, the working conditions for the people who work with it may become unsafe, and other employees can also be put in danger. Maintenance is therefore essential for a healthy and safe working environment, but the maintenance work itself is often not without its own risks. Every employer has to protect his or her employees against possible work-related hazards. The report 'Safe Maintenance in Practice' by the European Agency shows that many European companies, insurers and authorities have devised innovation solutions to face up to the risks associated with maintenance work. The examples in this report form the basis for a number of success factors for risk prevention in maintenance work, including:

Involvement of the management, and a safety-oriented corporate culture

Involvement from the management is essential for safety and health at work, and this applies even more to maintenance work. The commitment of the management is probably more decisive than any other factor for the safety culture within an organisation. After all, the management decides what resources (time, people, money) will be expended on safety and health, and how strongly people within the organisation are motivated to be consciously involved in this issue.

Employee participation and involvement

When employees are actively involved in the health and safety policy, a sense of responsibility with regard to safety is created at all levels, and the unique knowledge that people have of their own work can be utilised effectively. They often already know how risks can be simply eliminated or reduced.

A good risk assessment

Before maintenance work is begun, a risk assessment must first be carried out. All employees must be involved in the initial risk assessment, because they will possibly have to carry out additional evaluations during the work.

Preventive measures in accordance with the prevention hierarchy

The risk assessment leads to a number of possible preventive measures. In its implementation, constant reference must be made to safe working strategy: elimination – replacement – technical solution – administrative control mechanisms – personal protective equipment.

Combining preventive measures

Preventive measures or measures concerning occupational hygiene are more successful when they are applied in combination. For example, a risk assessment and the introduction of safety procedures and safe working systems must be accompanied by behaviour-oriented initiatives, training and education.

Safe procedures and clear guidelines for maintenance

A clear workflow must be drawn up for every maintenance task, and there must be safe working procedures that are effectively communicated and understood by all. There must be procedures for unexpected events. A safe working system is set up in such a way that work is stopped when an unforeseen problem or a problem that cannot be solved personally arises.

Effective and permanent communication

All information that is relevant for the maintenance work must be known by all those concerned. This does not only include the employees who are directly involved, but also anyone who can be affected by the consequences of the maintenance or who works in the

immediate vicinity. Communication between maintenance and production workers, and between the various contractors involved, is essential.

Continuous improvement/development

The safety factors during maintenance work must be constantly evaluated and improved on the basis of audits and inspections, risk assessments and investigations of incidents, accidents and near-accidents, as well as feedback from employees, contractors and safety officers.

Safety training

Employees, including contractors, who carry out maintenance tasks must be qualified for their areas of

responsibility. They must also be given training in the field of health and safety, and be informed about safe procedures and the risks associated with particular tasks. Employers are legally obliged to give information and training on health and safety to all employees who need it, including temporary employees and contractors.

Maintenance as a component of general safety management

Maintenance tasks and their associated safety aspects should form an integral part of a company's general safety management. The safety management system must be constantly developed and improved.

Source: Safe maintenance in practice – success factors; summary of a report by the Agency, 2010, ISSN: 1681-2158

⁵This is a joint campaign of a number of organisations working in partnership in the metal sector, such as Metaalunie, FME-CW, FNV, CNV and De Unie. For more information, see www.5xbeter.nl

⁶Source: *SZW Arboportaal* (2011) at <http://www.arboportaal.nl/onderwerpen/veilig-werken/persoonlijke-beschermingsmiddelen>

⁷Source: www.tno.nl/downloads/0289_TNO_IBSISIS_4_HR.pdf

⁸Source: SPIEVisie



PART III: SAFETY – A VISION FOR THE FUTURE

Safety within the Dutch maintenance market in 2020



3.1 Introduction

This third and last part of the Safety Vision Document examines the future of safe maintenance. And although the future cannot be predicted, the developments of today that can have an influence on tomorrow can be identified. One trend with a significant influence on maintenance work in the Netherlands is the move from 'building' to 'preserving'. In other

words, many of the capital goods or assets that will be maintained in 2020 have already been built today.

In every sector of Dutch industry, maintenance will be a key link in the value chain. And that maintenance must be carried out safely. The trends and developments that can influence this safe maintenance are discussed in this third section.

Spotlight: Looking to the future: the influence of the changing context

In discussing the future of safe maintenance it is essential to realise that the future is not a linear continuation of the past. Under the influence of various developments in the fields of, for example, technology, demographics, the environment and politics, but also social developments, the world in which maintenance takes place is constantly changing.

To understand the changes in maintenance equipment, materials and situations over time, it is important to make a distinction between three levels within which the changes in surrounding factors can be described:

- The level of the *material, product* or *tool*.
- The level of the *interaction* between the maintenance worker and the material, product or tool.

- The *context* in which this interaction between the maintenance worker and the material, product or tool takes place.

In the development of a vision for the future for a safe and healthy workplace in 2020, it is important to look at this future 'from the inside out'. Questions that can be asked in this regard are then: What changes in the context will occur in the coming years? What effects will these changes have on the function and position of the maintenance worker? And finally, what effect does all of this have on the materials, products and tools that a maintenance worker will use in 2020 in implementing a project?

Source: Paul Hekkert and Matthijs van Dijk, 'Designing from Context: Foundations and Applications of the VIP Approach'

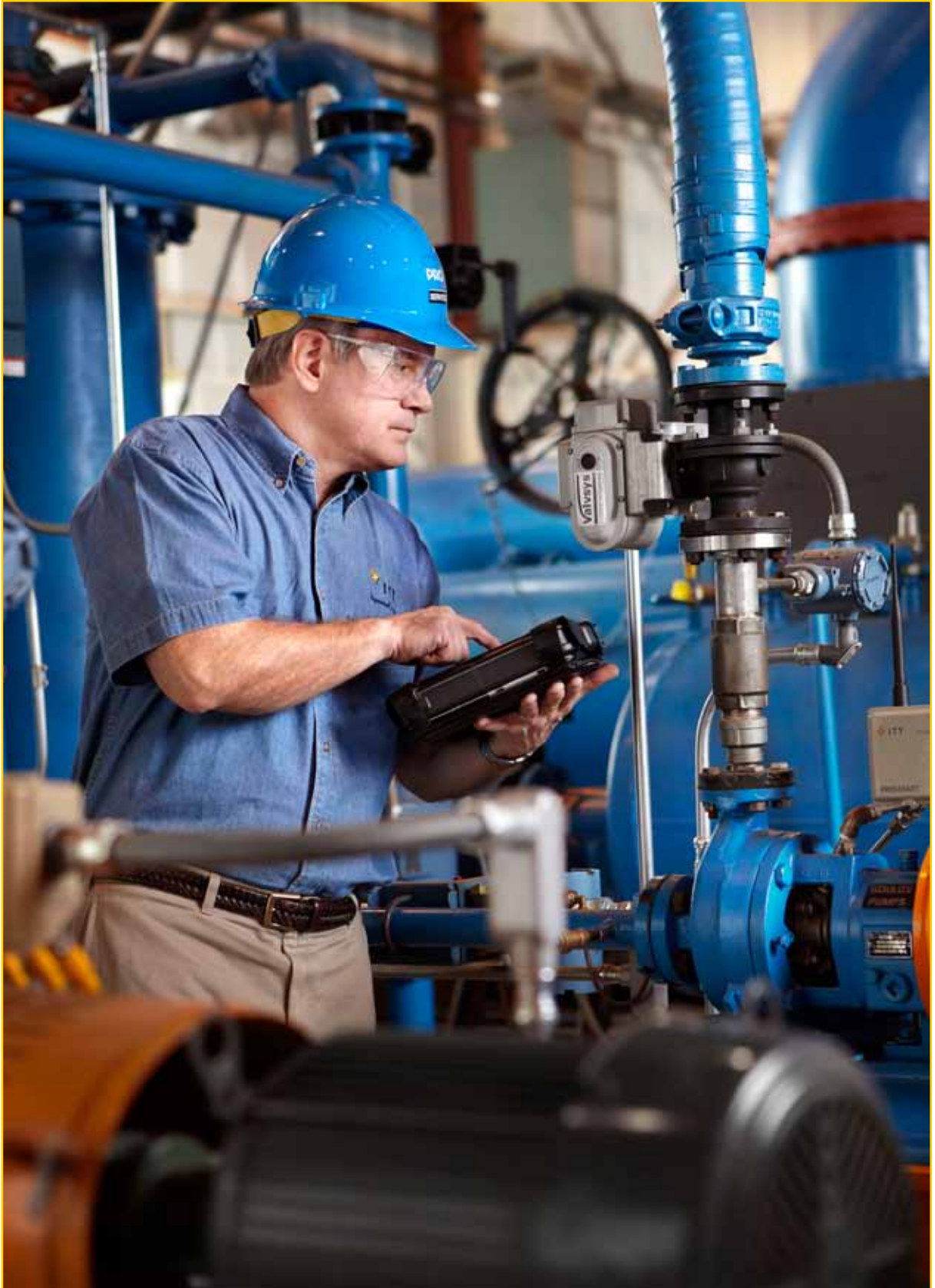
3.2 Technology

Technology and innovation can have a major influence on maintenance work. Both the frequency of the maintenance work and the work itself will be influenced if technology is applied effectively in the right places.

2020 will see less maintenance and more safety. New technological developments and collaborations with specialised partners are leading to a higher availability of operational resources. The maintenance and improvement of integrity parameters is a significant challenge, because the maintenance sector is faced with ageing systems and installations. Buildings, infrastructure and installations will mainly be preserved rather than newly constructed in the coming years. The (underground) infrastructure in the Netherlands for gas, water and electricity is a striking example of this. This large and complex network is ageing, and will need to be maintained. Com-

plete renewal is expensive, and with the use of the right techniques it is often unnecessary.

The application of new technological developments in combination with an increasingly integrated approach to maintenance is leading the Netherlands to the top. New developments in the field of probabilistic management and maintenance call for a new generation of reliability engineers. In this discipline of maintenance, historical data and the latest analysis techniques are used to discover how the reliability of installations can be maintained at the highest possible level. Good information management, whether or not this is available in real time via cloud computing⁹, forms a solid foundation for the further professional development of the maintenance sector. In addition, predictive maintenance through the integration of IT systems leads to less maintenance, lower costs and greater safety. In the coming years more companies will



make use of the possibility to link and analyse IT and, especially, information from the boardroom to the workforce.

In the construction industry, the use of Building Information Modelling, or 'virtual building', where a three-dimensional design model is used, and in which quality, quantities and sustainability are established, is rapidly gaining in popularity. A focus on working conditions increasingly forms a part of these virtual representations, with a design also being tested for maintainability by carrying out maintenance in a virtual environment. 3D modelling will also be further developed in the production and processing industries. Even before a building or installation is constructed, the maintenance technician can take a 'virtual walk' through it to monitor the maintainability of the design.

Corrective and unplanned maintenance will possibly be phased out with the help of technology. In the performance of maintenance work, improved insights will lead to a lower pressure of work, and managers will not have to ask employees to carry out so much unplanned work. Knowledge concerning maintenance and installations is more accessible, and so less fragmented within organisations. And the availability of knowledge is less dependent on one person or department. Examples of the application of technologies to further improve the safety of maintenance work in 2020 may include:

- A) The widespread use of PDAs and remote maintenance monitoring. These tools increase the speed and precision of information, and so help in the reduction of maintenance work. This can lead to a reduced need for maintenance, and so to lower safety risks.
- B) Maintenance information systems. These are also undergoing continued development, so that reports on KPIs, including cost reports, are made available to higher (technical) management more quickly and easily. In turn, this

visualisation strengthens the role of maintenance in the organisation, including its safety aspects. One can think here of the costs and other consequences of maintenance stops and breakdowns, for example.

- C) Another example is the further development of systems and machines that themselves indicate whether maintenance is needed, and can even carry out malfunction analyses. For example, large machines that are used in the infrastructure sector already have integrated systems in which all the information about the machines is recorded and that, without any intervention by the user, pass on this data to the manufacturer. In this way information on unforeseen wear and unintended use is also stored. In the event of a malfunction the machine analyses the problem and automatically sends a message to the supplier's breakdown service.
- D) Risk-Based Maintenance. By constantly monitoring the condition of a building or installation, and knowing the consequences of a malfunction in a component of the installation, it can be determined whether maintenance is needed or not. In this way the balance for operationally critical components is shifted from corrective to even more preventive maintenance. This shift makes the planning of maintenance easier, with positive consequences for costs and safety. The success of these risk-based techniques and actions is determined by a combination of modern inspection tools, inspection skills and an efficiently functioning maintenance information system.
- E) Improved inspection and analysis techniques with, for example, infrared and ultrasonic technologies. The availability and practicality of these resources will continue to increase. An example is the development of systems to inspect pipelines internally using so-called intelligent pigging tools for smaller diameters.

'Corrective and unplanned maintenance will be phased out as far as possible.'

3.3 'Source approach' in the design phase

In the last twenty years, safety in the field of maintenance work has improved significantly. Employees are also working more healthily. However, research shows that even greater gains can be made in the coming years if clients and employers take account of risk factors connected with the maintenance of an object during its working life in the design phase of that object. To further improve the safety of maintenance work in 2020, people will have to 'work smarter' in the coming years. A 'source approach' in the design of objects is one of the ways to achieve this.

'In the design phase, decisions can be taken concerning implementation methods, with these maintenance-related safety aspects being integrated in the design of an object.'

On the basis of the vision of a 'source approach', the safety of the maintenance process is primarily concerned with the management of safety risks for employees who are responsible for the maintenance of an object such as a building, a packaging line, a chemical installation or a section of road or rail. Various investigations in the field of a 'source approach' show that the decision to use alternative systems and materials in the design phase of an object can significantly reduce the risks for maintenance workers throughout the working life of the object.

In applying a 'source approach' during the design phase, materials can be selected that require very little maintenance, or none at all, throughout the working life of the object. New nanotechnology will also play an important role for maintenance in this regard. Self-repairing materials are currently in development, and there are examples

of self-cleaning wall panels that prevent fouling caused by the growth of algae and fungi by means of photocatalysis.

'New nanotechnology will also play an important role for maintenance... Self-repairing materials are currently in development.'

The extent to which maintenance-free materials or systems are chosen is of course highly dependent on the design orientation and the available budget for the initial investment. However, when the total cost of ownership of an object is examined, the use of usually more expensive low-maintenance or maintenance-free materials in the design is often well justified.

Good practice: self-cleaning aluminium wall panels¹⁰

The regular maintenance and cleaning of a building's exterior walls can cost substantial sums of money. For this reason, Alcoa Architectural Products has developed a self-cleaning wall panel in partnership with EcoClean. This panel cleans itself, and also purifies the air around it. Self-cleaning, air-purifying glazing and roofs already existed, thanks to the addition of titanium dioxide, but self-cleaning aluminium wall panels are now also provided with this added ingredient. Thanks to their self-cleaning properties, these aluminium wall panels only have to be cleaned once every three to five years, which is not only safer but also less damaging to the environment, as well as providing substantial savings in maintenance costs. Within other sectors too, such as the processing industry, a number of initiatives have now been launched to improve the safety of the maintenance process from its core. Process safety is seen in the industry as an integrated risk approach between the three separate operational segments of design and construction, management and production, and maintenance and optimisation.

Safe maintenance is largely dependent on an optimal collaboration between these three disciplines. Incident analyses show that there is regularly miscommunication, or sometimes even an absence of any form of collaboration, so that the synergy needed to achieve the best results is lacking. This has provided the market with the understanding that in the coming years a greater focus on process safety than on personal safety will be needed. For this reason, the NVDO supports all initiatives in the field of sustainable asset management, with the monitoring of technical and operational integrity as a key factor.

In the field of industrial safety, it is expected that the traditional safety experts will work in integrated collaboration with designers, industrial safety specialists and the reliability engineers of the maintenance organisation. This means that account must be taken of technical integrity, safety and maintainability in the design phase of operational assets, but also that management systems will be set up at an early stage and be made available before the operational assets are delivered to the manager and the maintenance department. This calls for a different style of working and communicating from design agencies, clients and companies in the supply industry. Installation managers and asset managers need to fulfil a facilitating role in this.

A standard for the management of capital-intensive goods that has emerged in recent years is ISO55000. In the coming years a similar standard will be developed that will provide comprehensive guidelines for asset management. The model offers a framework to ensure that all aspects of asset management are considered. It says what has to happen, not how. A key contribution of a standard such as ISO55000 is that work is being carried out to create organisations with a culture based on quality, employee safety, risk management and permanent improvement.

It appears that companies will have less of a tendency to impose their own regulations, but will seek synergistic benefits with sector organisations. Companies are unique in their nature and type, but are often comparable on a system level. The power of partnership will also prove itself on this front.

Technology in design, inspection and maintenance can bring about a reduced need for maintenance, so also lowering exposure to risks. But technology does demand a higher level of knowledge from the people who have to apply it: professional expertise will become just as important as the technology itself.

Employment market

The employment market will also become much more volatile in the coming years. Most people do not work with one organisation for a long period, and they often change jobs. There will be considerably fewer employees on 'permanent contracts' in ten years' time than there are in 2011. Many personnel are hired in as freelancers. Companies often work in collaboration, in rapidly changing configurations and with a highly diverse workforce. In this way a business can constantly focus on its core competencies, and if necessary hire in specialists on a contract basis. This calls for greater collaboration between companies to ensure that the personnel remain healthy at work. Many temporary or project-specific agreements are therefore made to safeguard the safety and health of the personnel involved.

Growing scarcity of technically trained personnel

The scarcity of technically trained personnel will only rise in the coming years. The ageing of the working population and the fall in the number of science and technology students together form the main driving force behind this scarcity. In the coming years the ageing of the population of the Netherlands will accelerate. There will be

an additional half a million people aged over 65 in the period 2011-2015, whereas this increase was 'only' a quarter of a million¹¹. In 2010, 14.2 percent of the total working population were aged between 55 and 65 years¹². The potential working population of 20 to 65-year-olds amounted to 10.1 million people at the end of 2010. A fall of 0.8 million in this figure is expected up to the year 2040. Of the potential working population at the end of 2010, 26 percent were over 65. It is expected that this will increase to 49 percent by 2040.

'In view of the threat presented by scarcity in 2020, it is essential to stimulate the vitality of the current population of employees, and so retain them for the industry as long as possible.'

The low inflow of technical professionals onto the employment market also contributes to the scarcity. Because of the declining interest of young people in technology, the number of science and technology students has fallen sharply in recent years. Improving the image of technology will be crucial in the coming years to increase the inflow to both technical educational programmes and the technical employment market. The maintenance industry will also have to find ways of facilitating new working patterns for sections of the working population. This will make working in the industry more attractive.

In the coming years knowledge management will be a key success factor for maintenance companies. By applying smart solutions to tackle the large-scale outflow of knowledge and experience, knowledge can be retained. Knowledge that is now retained in the heads and routines of employees must be translated into work instructions and information banks. The continuous professional and technical development of (existing) employees is also essential, both to accommodate the sharp fall in the inflow of technical professionals onto the employment market and to

continue to be able to meet the demand from the market in 2020.

'Continuous improvements in the field of safety, health and welfare aspects form a key precondition for the maintenance sector to be able to take on the competition from other sectors in terms of the scarcity of technical talent in 2020.'

Changing competency requirements

Life-long thinking is also applicable to people's competencies. Continuous improvement in the field of health and welfare aspects is well organised in the Netherlands. Employees will have to be capable of constantly adapting to the situation. But patterns in our heads are difficult to influence. Certainly when the pressure increases, our brains push aside rationality and all recently learned lessons, and older knowledge is completely dominant. A new way of thinking, working and learning has to turn this tide. Managers tend to fall back on the first models that they learned, so these are a prominent presence in their minds. The rapid evolution of communications technology, maintenance techniques and systems also calls for a more creative leadership style.

Partly because of the scarcity in the employment market, the maintenance sector makes greater use of flex workers, temporary contracts and freelancers. That calls for a greater focus from managers to manage the diversity of quality, culture and behaviour. In addition to technical parameters, scorecards need to be introduced to manage HR aspects in a workforce with a rapid turnover. These are personal development plans that are defined by sector organisations and supported by employers and clients. The regular (technical) education system will also have to adopt this approach.

'Resilience: the ability to cope well with expected and unexpected situations'



Resilience

A change in the manner of working, thinking and learning can best be described as resilience. Resilience can concern the individual (the employee), the social environment (the maintenance team) or the organisation (the maintenance company). A resilient person, team or organisation is able to:

- Respond flexibly to expected and unexpected situations.
- Learn from occurrences that have gone wrong in the past, and try to understand why they went wrong.
- Identify threats and short-term developments, and apply risk models to them.
- Anticipate long-term threats and opportunities.

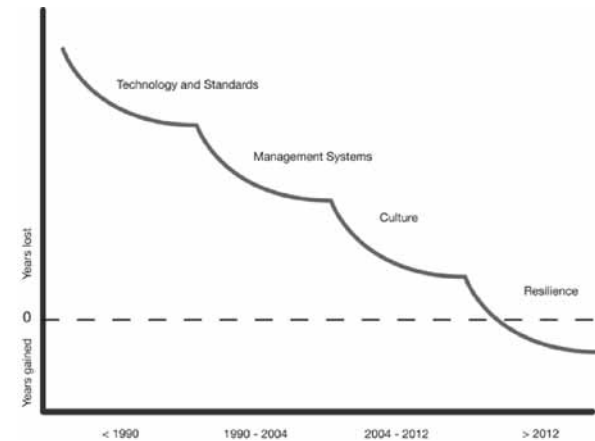
The concept of resilience is attracting ever greater interest¹³. Resilience – of people and organisations – is a positive characteristic that will be in great demand in the coming years. This does not only concern the protection of employees against specific risks such as stress, pressure of work, aggression and incidents, as is the case with risk management. Resilience stands for the development of the capacity to cope with sometimes inevitable difficulties and disappointments. In this sense, resilience is complementary to risk management.

The application of the concept of resilience in safety and risk management is a fairly new phenomenon. In a rapidly changing world, the traditional solutions are not successful in raising safety to the next level. A paradigm shift is needed. Resilience can form the key to coping effectively with these developments, such as cutbacks and continuous change, which manifest themselves in society, businesses and other institutions.

Internationalisation – globalisation

The world is becoming ever more globalised, and so is the maintenance sector. The num-

ber of 'migrant workers' will further increase as we approach the year 2020. The term 'migrant workers' refers to a highly diverse group of people with a wide variety of reasons to migrate and an equally broad range of educational levels. The relationship with the theme of safe maintenance mainly concerns the attraction of personnel from other countries to carry out maintenance work in the Netherlands. It concerns workers who are generally prepared to work for lower wages, and who perhaps are sometimes not so meticulous when it comes to issues affecting their safety and health. We can also see that there are some employers who take advantage of the position of workers from other countries by exploiting them. The European Agency for Safety and Health at Work states that 'foreign workers are often over-represented in high-risk sectors and in so-called '3D' jobs (dirty, dangerous and demanding)¹⁴. When it comes to the safe performance of maintenance work by migrant workers, there are three points for concern:



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When it comes to the safe performance of maintenance work by migrant workers, there are three points for concern:

- The large number of migrants working in high-risk sectors.
- Language and cultural barriers that obstruct communication and training in the field of safety and health at work.

- The high levels of overtime and/or the often poor health among migrant workers, so that they are more susceptible to work-related accidents and conditions.

With the scarcity of Dutch employees on the employment market, migrant workers will provide a partial solution. For these employees to be deployed safely, clients will have to take responsibility for communication, skills and healthy working conditions.

Improved registration of accidents in the future

For the next level of safety at work to be achieved, lessons must be learned from earlier mistakes. For this to come about, there is a need for effective registration both at company level and by sector. Registration will also become increasingly important in the coming years. At this time there is as yet insufficient insight into how many accidents take place in the context of maintenance and how many occur when carrying out regular work. Even though companies already have a legal requirement to register accidents, this statutory obligation is barely enforced, or is not enforced at all. To ensure mutual comparability, legal requirements for the form of registration should be drawn up, and enforcement should be improved. Work is being carried out aimed at regularisation and transparency concerning re-registered accidents, both at the European level and in the various industrial sectors. With clear information on the nature and cause of an accident, appropriate policy can be developed.

3.4 Government, legislation and regulations

At the start of 2011 the Dutch government concluded the programme that was carried out in recent years to examine the future of government. A concise summary is given in the policy document presented by Minister Donner to the

Lower House of Parliament. The core concept of this project is expressed in the policy document on the Central Government Reform Programme in terms of the following ambition: 'We are looking at a less compartmentalised central government that is more of a result-driven, problem-solving organisation. This central government employs competent civil servants, where necessary working together on government-wide programmes. They work at standard workstations that are equipped with good IT facilities. This new-style civil service makes policy the implementability of which has been tested, which does not involve unnecessary regulations and complex supervisory mechanisms, and which is based on trust in the public rather than distrust.' Central government will be smaller and broader in the coming years. The role of the government in ensuring compliance with legislation and regulations will change in a similar way. In line with trends that are already taking place, clear standards and rules will indicate what is permissible and what is compulsory. It is expected that controls will shift more to the market, with inspection and enforcement being carried out by sectors and sector organisations. Central government will continue to oversee compliance with the regulations in broad terms. Parties who have earned it will receive few inspections, but where necessary a sector or company will be examined very closely. In addition to national legislation and regulations, European and even global standards will acquire a major influence on the frameworks within which safe working should be carried out.

Because the role of trade unions has also declined, because of a fall in the number of union members, there are much fewer Collective Labour Agreement rules. General safety and health regulations will be sharply reduced in number. The Health and Safety Inspectorate will mainly focus on preventive work concerning the major social

risks, and will only apply sanctions in the case of serious industrial accidents.

In addition, (nonlife) insurers have become rather more proactive. This means that the insurers will place more demands on their policyholders, imposing concrete safety and health requirements on them. Part of the responsibility for health and safety will also be assigned to employees. For example, in 2020 it will have become easier to dismiss employees if they do not adhere to a company's safety and health regulations.

'Insurers will impose concrete safety and health requirements on their policyholders.'

It is clear that government agencies will carry out supervisory tasks in a new way. Greater responsibility will be given to the asset owners. The 'polder model' of pragmatic consensus politics no longer exists in the Netherlands in 2020. Central government has withdrawn in many areas, including safety and health at work, and leaves a great deal to the market. The consequence, however, is that there are many specific safety and health agreements; considerably more than in 2011. Much more than in 2012, companies have to submit a claim for damages if things have gone wrong. In addition, jurisprudence has come to play a greater role in calling one another to account for inappropriate behaviour. The European culture in the field of safety and health has increasingly come to resemble the American claim culture.

3.5 Chain collaboration and chain liability

The maintenance sector in the Netherlands is proud of what has been achieved through collaboration. This vision document contains many examples and themes that together give an impetus to World Class Maintenance in the Netherlands. Chain collaboration, lifelong thinking, risk management and skilled professional leadership are themes on which the Dutch

maintenance sector positions itself as a top innovative performer. To reach this top position, innovative leaders with a clear vision of technical integrity and personal safety are needed.

'Collaboration in the chain from construction to maintenance will grow further in the coming years.'

In the most complete form, market parties will be contracted for long periods; not only to design, to build and/or to manage the project, but often also to finance it. The most common form of this type of arrangement is the DBFM (Design, Build, Finance and Maintain) contract. In this system, defined responsibilities are transferred to market parties with the aim of the achievement of added value: projects are of the same quality at a lower price, or of a better quality at the same price. It goes without saying that in 2020 social responsibility is a key precondition for this type of collaboration in the chain. In addition, in the coming years increasing numbers of partnerships will arise that cross the traditional borders, including those between sectors, for example through collaboration in service provision at the cutting edge of safety, building maintenance and healthcare.

There are still numerous opportunities in the field of chain collaboration through which parties can work more effectively and safely. This raises effectiveness and improves mutual relations. It also calls for trust at all levels, resulting in enhanced safety, job satisfaction and motivation.

'Mutual trust and a common strategy between sector organisations, spheres of industry and professional associations will lead to greater uniformity in the fields of subcontracting, competency requirements and specific regulations.'



Mutual trust and a common strategy between sector organisations, spheres of industry and professional associations will lead to greater uniformity in the fields of subcontracting, competency requirements and specific regulations. The Netherlands has a number of organisations in this area, such as Deltalinqs and NOGEPa, which form an important platform for coordinated improvements. The initiative to prevent accidents associated with earthmoving work by formulating uniform rules for semi-public organisations, private companies and individuals ('KLIC') is also an example of best-in-class collaboration. In the context of the top sectors policy, central government can fulfil a major promotional and coaching role in this field. As more benchmark data becomes available, the industry is able to

identify generic performance-killers on the basis of aggregated performance data. This information allows foremen and operational employees to be managed more effectively. Greater delegation of responsibility to the workforce is possible because a great deal has been learned about performance contracts in the intervening years. The work is carried out at the place where it is needed, and this is facilitated at other levels in the organisation. In this way, lines of communication on activities and responsibilities at the time of the handover of work on the workforce are organised more efficiently. There is a greater emphasis on technical integrity, maintainability and commercial exploitation in the chain, which will lead to a shift in focus among safety experts.





⁹Cloud computing' is the provision of software and data over the internet, in much the same way as power is provided through the electricity network

¹⁰Source: www.gebouwbeheer.nu (September 2011)

¹¹Source: Statistics Netherlands (December 2010), Press release, 10-083, 'Speed of ageing increases'

¹²Source: Statistics Netherlands Statline (June 2011), table: 'Working population; gender and age'

¹³See also: NVVK Congress 2009, Resilience engineering: Hype or Hyper? Johan K.J. van der Vorm, Dolf van der Beek, Raphaël Gallis and Niek Steijger

¹⁴http://osha.europa.eu/nl/press/press-releases/news_article.2008-01-09_MigrantWorkers

Partners

Deze uitgave is tot stand gekomen door een nauwe samenwerking tussen de volgende partners.



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