OSH in the green economy – a victim or an integrated aim?

We are in the process of transforming production and consumption in the direction of more environmentally adapted products and processes. How good are we at applying a holistic perspective and including a healthy and safe working environment as an integrated aim of the sustainable and green businesses and workplaces?

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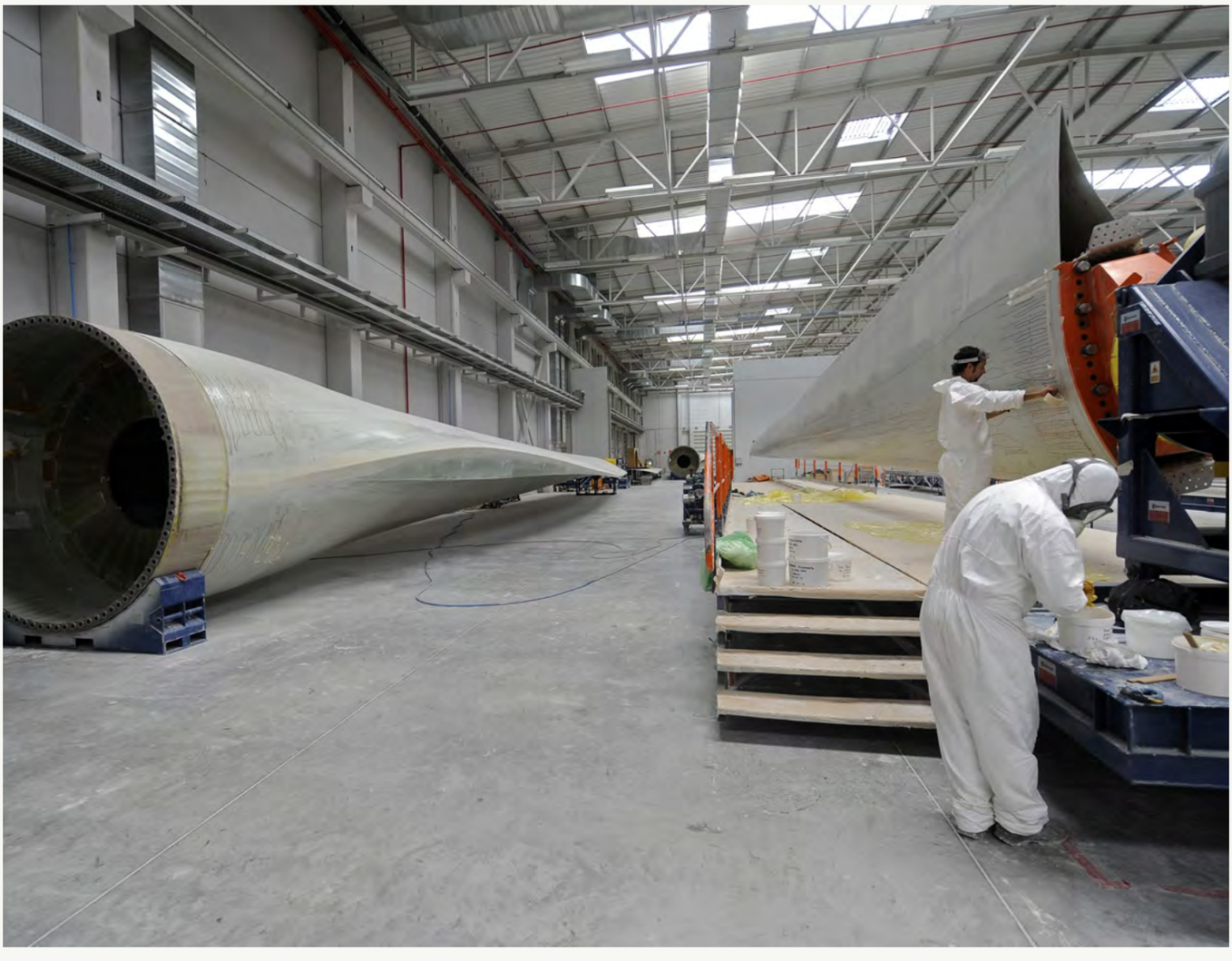
Toxic resins are used in wind turbine manufacture and repair.
Image: © Belga/AFP



The aim to reduce environmental load through, for example, resource efficiency, energy efficiency and detoxification of materials and processes has led to many changes such as new products and processes, new chemicals and raw materials including the increased use of renewable resources, new methods for reducing waste and for handling, reusing and recycling waste, new methods that reduce energy consumption and new methods, including biofuels, for energy production.

All these changes affect work life and working environments. New professions arise, e.g. in building and maintaining windmills for energy production, or sorting waste to make it possible to recycle it in the form of as-pure-as-possible materials, or growing energy forests for biofuel production.

Risks arising from the green economy

There are several examples of changes introduced out of an urge to reduce the environmental load and develop environmentally friendly processes that have resulted in new and sometimes severe occupational health or safety problems.

Reuse of waste such as electronic products is a very complex process. To be able to recycle material, the material has to be as pure as possible, and this sometimes demands manual dismantling which may lead to the creation of workplaces with poor ergonomics. Additionally, the exposure to flame-retardants emitted during dismantling and the risks associated with exposure to these substances has been discussed.

The introduction of windmills has introduced new and risky workplaces and operations, e.g. in the maintenance of windmills but also in their production for which hazardous chemicals are used. Maintenance on windmills includes entering the windmill and, as the construction is usually very high, it is often difficult to access the top of the windmill. Access to the exterior top of the windmill is also a risky operation.

In the process of phasing out trichloroethylene as a degreasing agent, new chemicals were introduced. Some of these had unforeseen properties that caused new health risks such as limonene (a terpene present in e.g. citrus peel) which is oxidized in contact with air and forms sensitizing substances or glycol ethers of a type which has been shown to be reprotoxic. In Sweden these new degreasing agents were introduced as the environmentally friendly solution to the degreasing problem, but were promptly phased out once these problems had become apparent (see box, p. 39).

Another example is the replacement of the amalgam (which contains mercury) used for dental fillings by acrylates. After the introduction of acrylates, allergies increased among dentists and dental nurses due to skin contact with these products. In Sweden allergies are now decreasing, as the problem has been recognized, the handling of the acrylates has improved, and skin contact has been reduced.

There are several other examples of substitutions and introduction of new chemicals and materials that have led to an increase in allergies, due to the new materials. Such examples include, for example, an increased use of biocides when solvent-based paints are substituted for water-based ones. Another example is the new preference for environmentally friendly natural materials on which mould and bacteria may grow and spread dust that causes allergic alveolitis. The use of biofuels for energy production has also led to higher exposures to microorganisms, e.g. in the handling of wood chips, peat and household waste for incineration and energy production. Microorganisms can cause respiratory symptoms and illness, e.g ODTS (organic dust toxic syndrome), which causes flu-like symptoms, and allergic alveolitis which is is an inflammation of the alveoli within the lungs caused by hypersensitivity to inhaled organic dusts.

From an environmental point of view, allergies are not always recognized as a problem, which is why, from an occupational health and safety point of view, there is a need to pay special attention to sensitizing properties of new substances and materials.

Recycling – the lessons to be learned

At the end of the 1980s a great deal of effort was put into reducing and recycling waste. The aim was to reduce the environmental impact of waste but also to reduce consumption of resources by recycling material. One of the first plants for the sorting of waste in Europe was built in Denmark. The plant employed 20 workers, 15 of whom were exposed

to dust from the sorting of waste. Nine employees developed symptoms such as upper airway infections or bronchitis and ODTS was suspected in the case of three employees. 53% of the workers developed lung disease during the first eight months of production. Inside the plant, which was enclosed and without effective ventilation, the concentrations of dust, endotoxins, bacteria and fungi were measured and found to be high. These findings led to several steps being taken to improve ventilation and reduce exposure. Though the measures were to some extent successful, the concentration of mould was still too high and eventually the plant was closed down.

In this example, the risks associated with the handling of organic waste – which may be dry or wet – were not identified and handled effectively enough. This kind of waste is an excellent breeding ground for bacteria and mould. In the handling of the waste, aerosols containing microorganisms are emitted. If the aerosols spread to the breathing zone of the workers, they will be exposed to microorganisms that may cause different kinds of lung symptoms and diseases.

It is interesting to reflect on what could have prevented the outbreak of these lung diseases. Preventive action is based on thorough knowledge of risks and potential control measures and their effect. In the case of the recycling plant, this would include the following: knowledge of the microbiological risks that may occur from handling organic waste and using that knowledge in the planning of the plant and risk assessment of the new jobs; knowledge of methods that effectively reduce the emission and spreading of microorganisms to the working environment. Knowledge alone is not, however, enough. The knowledge has to be applied in the planning and design of the plant and the work processes. Additionally, there is a need for maintenance of the plant including the control measures that prevent the spread of aerosols from the waste, in order to keep exposure to microorganisms at or below acceptable levels.

The above examples illustrate problems that may arise with the green economy. Of course, the changes implemented to reduce the environmental load do not always cause problems. There is no automatic connection between the purpose of the change and its outcome in terms of occupational health, safety, quality or costs. For example, the phasing out of both cadmium and lead is in general advantageous for the working environment. Even if there are advantages, there may also be drawbacks, which is why it is important to consider whether there are any other effects that may occur and that have to be attended to in order to prevent, for example, work-related accidents, diseases and symptoms when substances and materials are phased out.

How can drawbacks associated with green changes be prevented?

As we all know, risks can be prevented more effectively and at a lower cost if they are identified at an early stage and if there is a thorough understanding of risks as well as knowledge of the requisite control measures.

One challenge stemming from changes towards a green economy is that many of the changes are based on new technologies and materials. Some of the risks associated with the changes may be well-known but new risks may also arise that are completely unknown or that are difficult to assess. Such risks may become apparent, what is more, only when the new technology has already been put into operation.

From the evaluation of the impact on occupational health and safety of changes to reduce environmental load that we have conducted at IVL Swedish Environmental Research Institute, we can draw conclusions about what could have prevented the risks that have emerged.

It is important to include occupational health and safety experts, for example from occupational health services, early in the planning stages of new production processes and materials.

Appointing experts is not, however, enough. It is also important to ensure that the occupational health and safety expert has a thorough knowledge of similar products, processes, materials, etc. Lack of understanding of the content of the change will increase the risk of not identifying occupational health and safety risks. Even if the products, etc. are new, there is probably some relevant knowledge to be derived from experience in workplaces using similar products and processes.

In the evaluation of changes, it is important to adopt a holistic and systemic perspective on the change. It is necessary to consider the working environment as a whole, including risks of accidents, ergonomics, chemical health hazards, the psychosocial working environment, etc. It is likewise important to consider the entire production system, as changes in one part of the system may well affect other parts. Yet even with an ambitious planning of the change, it is impossible to foresee all risks. For this reason it is important to carry out follow-up monitoring of the change, in order to identify any new and emerging problems.

This way of dealing with change may seem simple and self-evident. The fact is, however, that the requisite steps and precautions are seldom applied and when this is the case the application is frequently only partial.

What is special about changes towards a green economy?

All changes are liable to create drawbacks as well as bonus-effects. This is the case with changes towards a green economy and their effects on occupational health and safety as well as with many other changes that take place at workplaces.

Whenever a change takes place, it is important to be aware of how it affects the workplace and of its potential side-effects alongside the intended and expected benefits.

From an occupational health and safety point of view, there is considerable

interest in the change towards the green economy. Is this interest unnecessary and uncalled for? I would say that it is important to keep track of developments towards a green economy and to evaluate the effects on the working environment with a view to preventing drawbacks. Sustainability is a strong driving force for development and innovation. The focus on the green economy will capture many of the on-going changes at workplaces. There are, however, many other kinds of change that it is important to monitor and evaluate.

One factor that makes the change towards a green economy especially interesting is that the new materials, technologies, etc. often include some kind of innovation. Innovation is especially interesting, as it will, by its very nature, include some unknowns. And unknowns may entail risks that it is difficult or even impossible to foresee.

Another fact that characterises many of the sustainability-oriented innovations is that they are often developed in small businesses. From a working environment perspective, this means an aggravation of circumstances, as small firms seldom have expertise of their own about occupational health and safety and rarely engage experts to support them with risk assessment, etc. if there are no obvious and recognized risks that have to be dealt with. The importance of small businesses in the context of the green economy is an aspect that should, from an occupational health and safety perspective, be attended to and discussed.

It is also important to be aware of the need for a broad perspective on changes and to ensure that the change towards sustainability will include social aspects as well as a healthy and safe working environment.

A bonus-effect of this focus on evaluating the effects of the change towards a green economy could well be a greater awareness that it is important to evaluate all changes from a working environment perspective, regardless of the causes and purposes of the change.

As it is not possible to state that all changes towards a green economy have either a positive or a negative impact on the working environment, it is important to develop strategies to deal with the varying effects on OSH deriving from the green economy. In developing such strategies, we will encounter several challenges.

For decades it has been pointed out that it is important to include OHS experts, for example from occupational health services, in the early stages of planning and development. This is a practice that still does not work very well and to make it do so is a real challenge, not only for green products, but in relation to change of all kinds.

Another challenge is related to the small businesses that play such an important role in the development of green products. How can we ensure that they will identify potential OSH problems associated with the new green products and processes and take steps to deal with the risks in question?

One challenge is that, insofar as new materials may be related to emerging risks of allergies, all allergy-related risks need to be taken seriously, for this is a form of risk that, from an environmental perspective, is not always considered important. ●

The limonene story

Limonene was first introduced as a new natural degreasing agent that could be used to replace trichloroethylene. In one of the Swedish popular occupational health journals it was even presented as "citrus lemonade". As often is the case with natural products, it was believed to be safe and healthy – almost to the point of being drinkable, hence the comparison with lemonade! The truth is that limonene is a terpene, an organic solvent, with a Swedish threshold limit value of 150 mg/m³. At my research institute, IVL, we had a project in which we evaluated new degreasing agents from an occupational health perspective. In this context, we visited a few plants that had recently started using limonene for degreasing. At one of these plants, the operator used limonene in degreasing baths and handled the products to be degreased without gloves, dipping his hands in the bath. At another plant, limonene was sprayed on to the products, without proper ventilation. In parallel with our study, another research group discovered that limonene in contact with air, e.g. in a degreasing bath, was oxidised to a substance with allergenic properties. We concluded that using limonene as a degreasing agent was risky, due to skin exposure and exposure to aerosols, so that, if use of limonene was to be continued, precautionary steps were needed. After presentation of these studies, it became apparent that limonene was in fact not a good substitute for trichloroethylene, and since then I have not seen it used for degreasing.

Further reading

Carlsson H., Antonsson AB., Andersson-Sköld Y., Solyom P. (1992) Limonen - lösningen på miljöproblemen eller...? En arbetsmiljö- och miljöteknisk utvärdering av d-limonen som avfettningsmedel. IVL-report B 1030 *(Limonene – the solution to environmental problems or ...? An evaluation of the occupational health and environmental impact of d-limonene as a degreasing agent)*

Malmros P., Sigsgaard T., Bach B. (1992) Occupational health problems due to garbage sorting. Waste management and research, 10, 227-234.

Poulsen OM. *et al.* (1995) Collection of domestic waste. Review of occupational health problems and their possible causes, The Science of the Total Environment, 170, 1-19.