# Carcinogens in the Workplace

## Information Booklet

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# 1. Introduction: the facts about carcinogens

*"To put things in context: two million people were killed every year in the fights during World War I, and everyone agrees that it was a terrible slaughter. But the reality is that it happens every year, all over the world, with the same number of workers dying as a result of just going to work".* - Kevin Myers, Chairman of the International Association of Labour Inspection (IALI)

In his speech, delivered at the Carcinogens conference in Amsterdam in May 2016, Kevin Myers made it clear that poor working conditions are a major threat to workers' health in Europe and around the world. By way of illustration, the direct cost of occupational exposure to carcinogens in Europe is estimated at €2.4 billion a year. This amount includes costs for hospital care, primary care, medication, emergency care and other care.

For Europe, the total **number of people suffering from cancer as a result of exposure to carcinogens at work is estimated at 120,000 cases per year**, with almost **80,000 deaths per year**. The costs in terms of healthcare and lost productivity in the European Union are estimated at €4-7 billion a year.

It is clear that carcinogens are dangerous in many ways. Therefore, exposure to carcinogens at work should be prevented or reduced. By taking appropriate measures in the workplace, we can considerably reduce the number of cases of cancer.

## *1.1. But what exactly are carcinogens or carcinogenic substances?*

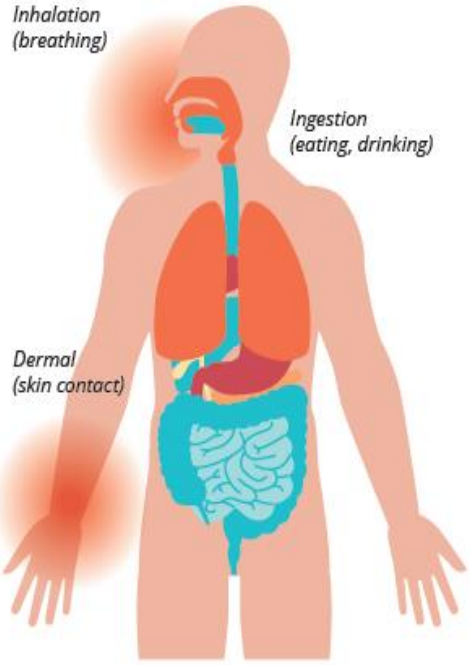
Carcinogenic substances (or carcinogens for short) are substances that can cause cancer. There are different forms of carcinogens, for example **chemical carcinogens**, such as certain types of pesticides and certain types of industrial paints. These chemicals can cause cancer because of their own dangerous properties. In other cases, a **particular process** can lead to exposure, such as **fine airborne particles from exhaust gases or wood dust**. Many carcinogens can be inhaled and end up, for example, in blood vessels and organs such as the lungs and brain. Others can also penetrate the skin. Once carcinogens enter the body, they can damage workers' DNA or change the way the body's cells work and multiply. This can lead to cancer and other health problems.

## *1.2. Different types of carcinogens can cause different types of cancer*

To illustrate this point: cancer of the digestive system, such as stomach cancer or colon cancer, can be caused by asbestos, lead compounds and gamma radiation, to name but a few causes. Lung cancer is more often caused by silica, chromium, asbestos and diesel exhaust, for example.

In principle, anyone can be exposed to carcinogens from time to time, for instance by living in streets with heavy traffic, saturated with exhaust fumes, or as a result of various other social factors. **However, in the context of occupational exposure, the risk of developing cancer is much higher. Indeed, many workers are unintentionally exposed to high levels of carcinogens on a daily basis, and this exposure lasts for many years.** It is important to note that exposure to carcinogens alone is generally not the only factor contributing to the development of cancer in a worker. For most carcinogens, what matters is how a worker is exposed to them, i.e. how, in what doses and for how long. Genetic characteristics, physiology and social determinants that affect workers' health can also contribute to cancer development. Nevertheless, exposure to carcinogens is a major risk factor for cancer, and therefore efficient solutions are needed to reduce exposure to carcinogens in the workplace.

### 1.3. How can you be exposed?




**The three ways of exposure are inhalation, skin contact and ingestion (eating or drinking).** Inhaling contaminated air is the most common way by which carcinogenic substances present in the workplace enter the body. But there are also other ways of exposure. For example, through contamination of your food or drink when you have to eat in the same room where the carcinogens are handled. Also, if there is no possibility to wash your hands easily or if there is no policy to do so in your workplace, carcinogens can be transferred to your food or drink. Training in the use of personal protective equipment is also very important, as unknowingly touching your clothes or face with the gloves can lead to contamination. There are always ways to be exposed to carcinogens without noticing. With appropriate policies around well-being, and thus protection against exposure to dangerous substances in the workplace, these risks can be reduced.

*Image 1: The different ways of exposure to carcinogens: inhalation (breathing), dermal (skin contact) and ingestion (eating, drinking, ...).*

## 2. The employer's responsibility

It is clear that exposure to carcinogens in the workplace is a major problem for workers' health: an estimated 120,000 cases of cancer are diagnosed every year as a result of exposure to carcinogens at work, leading to 80,000 deaths every year. It is therefore vital to protect workers from exposure to carcinogens. This is the responsibility of the employer of the site where the worker is employed. **It is important to realise that it is not the worker's individual responsibility to protect himself, but that it is the employer who must make the working environment as safe as possible and provide the worker with the necessary knowledge and skills to work as safely as possible.** The employer must take concrete action by carrying out a risk analysis based on concrete measurements of the possible exposure of workers to carcinogenic substances and, on this basis, be in a position to take the correct protective measures. To this end, the employer can call on experts in the field of well-being at work such as an internal prevention advisor or a prevention advisor from an external service.

### 2.1. What should an employer do to protect the well-being of workers?

Well-being at work includes not only protection against exposure to carcinogenic substances, but also protection against other dangerous chemicals, dangerous biological agents (e.g. viruses, bacteria, fungi, etc.), dangerous radiation, ergonomic constraints, psychosocial risks in the workplace and general safety (falls, stumbles, electrocutions, etc.). It is the employer who is responsible for all these aspects of workers' well-being, in accordance with the provisions of the Code on Well-being at Work. Conducting a risk analysis should be based on measurements.

A risk analysis must be carried out to identify and implement appropriate preventive measures. For example, when a carcinogenic substance is present in the workplace in liquid form, very different

technical, organisational, and personal protection measures will need to be taken than when a carcinogenic agent is present in gaseous form. This is because the gaseous substances are more likely to enter the body via the respiratory system, whereas for volatile liquids it is more likely to be through the skin. However, a combination of several ways of exposure for one carcinogen is certainly possible, and therefore combinations of different preventive measures will often be necessary. A risk analysis consists of several phases:

1. **Identify dangers and persons at risk**: Search the workplace for elements that could cause harm and identify the workers likely to be exposed to these dangers.

   With specific regard to carcinogens, the employer must check whether carcinogenic substances are used in the workplace and, if so, which ones. In addition, workers who come into contact with these substances must be identified (lists of names must be drawn up) and particular attention must be paid to the possible exposure of the most vulnerable people, such as pregnant women and young people in the workplace. Pregnant women and young people must be completely isolated from a working environment where these substances are used.

2. **Assess the risks and establish priorities**: Assess existing risks (the seriousness and probability of potential damage, etc.) and rank them in order of importance.

   With specific regard to carcinogens, the employer must know whether or not workers are exposed to such substances. This is done on the basis of measurements: concentrations in the air, on surfaces or in the workers' bodies. On the basis of these results, it is possible to determine the severity of potential exposure for each substance and to decide objectively which work processes need to be addressed first.

3. **Decide on preventive measures**: Identify the appropriate measures to eliminate or control the risks.

   With specific regard to carcinogens, the employer must take concrete decisions on the preventive measures he is going to take, in consultation with the trade union delegation/workers and (external) prevention advisors, in order to protect workers against exposure to carcinogens, if the risk analysis has shown this to be the case. In practice, this should be done according to the STOP principle: this is a hierarchical principle that states that all options at a given level must be exhausted before moving on to a lower level. STOP means that the carcinogen must first be Substituted or replaced; if that is not technically possible, Technical Measures must be implemented to avoid all exposure or to minimise it as much as possible; Organisational Measures must be applied to minimise worker exposure and, as a last resort, Personal Protective Equipment must be used to protect workers from exposure.

4. **Take action**: Implement preventive and protective measures by means of a priority plan.

   With specific regard to carcinogens, the employer must ensure that decisions taken in consultation with the trade union delegation/workers and (external) prevention advisors are effectively implemented. Specifically, this means providing enough budget to implement the appropriate prevention measures (according to the STOP hierarchy) in a qualitative and timely manner. In this respect, it is obviously important that workers are sufficiently informed and trained to cope with changing work processes. For example, they should receive appropriate

training to be able to use new personal protective equipment correctly and assess its performance.

5. **Monitoring and review**: The risk analysis should be reviewed regularly to ensure that it remains up to date.

   With specific regard to carcinogens, the employer must ensure, in consultation with the trade union delegation/workers and (external) prevention advisors, that the prevention measures (in accordance with the STOP hierarchy) do indeed provide better protection for workers against exposure to carcinogens. For example, it is useless to make entirely new technical adaptation in the workplace if this does not prevent/reduce exposure to carcinogens or if the new measures even worsen exposure. It is therefore necessary to thoroughly monitor the adaptations. To do this thoroughly, measurements (e.g. concentrations of carcinogens in the air, on surfaces or in workers' bodies) must also be taken during this stage. The results of these measurements can be used to identify potentially problematic residual exposures and to correct or adapt preventive measures. The monitoring of work processes, where, for example, dangerous substances are used, should not only take place after adjustment of the work processes, but should be repeated at regular intervals. In the case of work processes involving very dangerous substances, such as carcinogens, the employer must carry out this monitoring (or have it carried out) at least once a year.

## 3. Exposure to carcinogenic substances: the STOP principle

When it comes to carcinogenic substances in the workplace, employers must do everything in their power to prevent workers encountering these substances. As you can imagine, the best way to achieve this is to completely eliminate or replace the carcinogenic substance with a less dangerous alternative: eliminating the danger at source. When replacement is not (yet) technically possible, other measures can be taken. These measures follow a hierarchy of prevention measures, which is further defined in the STOP strategy. Each letter represents a different level of measures. **A step down the hierarchy is only allowed when there is a technical limitation. Economic reasons are not valid. When a carcinogenic substance is not replaced, exposure should be reduced as much as is technically possible.**


## *3.1. S = SUBSTITUTION (replacement)*

STOP follows a hierarchy of hazard control. For carcinogens, a step down the hierarchy is allowed only when technical constraints prevent the employer from completely eliminating exposure. Here, we focus on the highest and most desirable level, S, which stands for substitution. The substitution or replacement of dangerous substances is always the first measure that the employer should try to apply. In this way, the danger of a carcinogenic substance can be completely eliminated by replacing it with a substance that has no dangerous properties or, at the very least, with a less dangerous substance.

### Thorough research needed and avoiding regrettable substitution

So, the principle of substitution applies to all dangerous substances, but it is stricter for carcinogens. The employer must actively seek out substitute agents on the basis of thorough research. If suitable substitutes cannot be found, a well-founded argument is required. There are several websites and

resources with replacement suggestions available that can help the employer choose an appropriate alternative.

When substituting a carcinogen, the employer must of course ensure that the new substance(s) is/are not equally harmful or even more harmful to the worker's health. This process, also known as 'regrettable substitution', has unfortunately already occurred several times on a large scale. Therefore, the research that precedes substitution must be thorough and based on all possible (scientific) information that already exists of the potential substitutes.

### The benefits of substitution

Eliminating or substituting carcinogenic substances from the workplace provides benefits for both workers (improved safety and health) and employers (reduced costs for control measures, healthy workers, compliance with legislation). Other benefits include better long-term health, less disposal of dangerous waste and a better reputation.

### In practice: diesel exhaust gases

To illustrate the concept of substitution, we can take the example of the carcinogen diesel exhaust: this mixture is released when using a petroleum-based combustion engine (in this case, diesel) and contains carcinogenic substances. Diesel-based combustion engines are used in different workplaces and work processes, both outdoors and indoors.

Forklift trucks in warehouses are a good example of the use of diesel engines in indoor spaces. These are used to move heavy products in storage from one place to another. The use of forklift trucks in an indoor space such as a warehouse releases carcinogenic substances that enter workers' bodies via the respiratory tract and can damage their health.

The best way to protect the workers, in this case, from exposure to diesel exhaust, is to **replace diesel-powered forklifts trucks with electric-powered forklifts trucks**, for example, as these types of engines do not produce exhaust fumes that can harm the workers' health. This is the best way of protecting workers' well-being, because the danger - carcinogenic diesel exhaust fumes - is eliminated at source, so exposure is no longer possible. Substitution is thus almost always the best solution to eliminate exposure to carcinogens.

There are only a few situations where the principle of substitution cannot be applied, as in the case of dangerous medicines. Dangerous medicines are used in the care of cancer patients, for example, during their treatment (chemotherapy) and are absolutely necessary to cure cancer patients. However, many of these medicines can themselves cause cancer, for example if workers, such as nursing staff, are exposed to them. Thus, for this group of carcinogens, substitution/replacement is not technically possible because the survival of cancer patients just depends on the use of these dangerous medicines. In such situations, other preventive measures, such as technical and organisational measures and the use of personal protective equipment, will have to be taken to protect workers from exposure to these carcinogens.

## *3.2. T = TECHNICAL MEASURES*

STOP follows a hierarchy of control. For carcinogens, a step down the hierarchy is allowed only when technical constraints prevent you from eliminating exposure completely. Here, we focus on the second level, T, which stands for Technical measures.

## Technical measures can reduce emissions at source

These may be closed systems, equipment with integrated extraction systems (e.g. for welding, sanding, grinding, sawing) or local extraction. Many of these techniques help control emissions at source and therefore exposure to carcinogens. And as these techniques ensure the safety of anyone in the vicinity, they are a very important element in preventing exposure to carcinogens. Technical measures can reduce emissions at source by means of:

*1. Non-ventilation measures*

There are several ways of tackling emissions at source: using tight-fitting lids for containers holding volatile liquids; properly isolating substances to prevent leaks into the workplace air; using handling aids to reduce the time a carcinogen spends outside its container; or pumping instead of pouring liquids to reduce splashing. Depending on the substance and process, non-ventilation measures may be effective.

*2. Ventilation measures*

Local exhaust ventilation is designed to extract contaminated air at source before it can reach workers. Fixed and/or integrated local exhaust systems are designed to extract dangerous substances, while flexible/mobile systems are considered less effective because they must be constantly adjusted by the workers using them.

*3. Combination of containment and ventilation*

A third option is ventilated enclosures such as fume hoods or cabinets with laminar airflow, where the source is placed in a room with active air extraction. Air is drawn in from the front (open), preventing emissions from entering the workspace. The appropriate technical measure should be chosen and installed according to the workplace and exposure situation.

## Maintenance and use

Technical measures can only be and remain effective with proper maintenance, cleaning and training of workers. The effectiveness of technical measures gradually decreases over time and eventually fails completely without maintenance. Sometimes, systems appear to work, but poor maintenance actually prevents them from working effectively.

## In practice: dangerous medicines

As we discussed in the section on substitution, the principle of substitution cannot be applied in the case of dangerous medicines. For this group of carcinogens, substitution/replacement is technically not possible because the survival of cancer patients depends precisely on the use of such dangerous medicines. Healthcare workers may nevertheless be exposed to these substances when administering these medicines, and measures must therefore be taken to protect these workers from harmful exposure. During the administration of dangerous medicines, several situations may arise where workers are likely to be exposed: the removal of the needle from an infusion or from the patient may result in the release of aerosols (micro-droplets or micro-particles diffused into the air) due to a drop in pressure or an incident when the needle detaches from the syringe during the procedure. There are examples of technical measures that can prevent this type of exposure: the use of **needleless, leak-free, connections** to avoid pressure variations, as does the use of **modern infusion pumps** that detect an increase in pressure (stopping the pump and triggering an alarm).

## 3.3. O = ORGANISATIONAL MEASURES

STOP follows a hierarchy of control. For carcinogens, a step down the hierarchy is allowed only when technical constraints prevent you from eliminating exposure completely. Here, we focus on the third level, O, which stands for Organisational measures.

### Measures to reduce exposure to carcinogens

Generally speaking, we can say that organisational measures affect the place, time and knowledge of workers likely to come into contact with carcinogens. All measures aim to minimise workers' exposure to carcinogens in addition to the technical measures already applied. Examples of these types of measures include:

- Special work areas for certain chemicals and processes.
- Restriction of the number and type of persons authorised to enter specific work areas containing carcinogenic substances.
- Regular and appropriate training of workers on how to work safely with carcinogens.
- Provision of instruction documents for the workplace.
- Correct labelling with warnings on specific products.
- Correct indication of specific dangers at the entrance of work areas.
- Shift rotation to reduce time spent with carcinogens.
- Stimulation techniques such as colour-coded routes through workspaces.
- Sufficient and appropriate facilities, completely separated from work areas, for changing, washing, eating/drinking and smoking.

### In practice: asbestos

Asbestos is a mineral which, until recently, was used, in particular, in roofing and pipe insulation for its fire-retardant properties. A few decades ago, however, it became clear that exposure to asbestos fibres caused several types of cancer when inhaled. In 2005, the marketing and use of asbestos was banned. Hence, asbestos exposure today mainly occurs during activities such as cleaning, repair, removal, renovation and demolition and disposal of asbestos-containing materials. In these cases, asbestos cannot be removed because it is already present. Consider, for example, the replacement of roofs containing asbestos. The organisational measures that can be taken, in addition to technical measures, include: thoroughly training the workers who will have to remove the asbestos so that they know the specific dangers associated with these operations and how to best protect themselves (this training is a legal obligation); limiting the number of workers who are exposed by not carrying out additional operations that could cause the release of asbestos fibres and expose other people; facilities to enable exposed protective equipment to be removed in complete safety and to allow people to wash themselves.

## 3.4. P = PERSONAL PROTECTIVE EQUIPMENT

STOP follows a hierarchy of control. For carcinogens, a step down the hierarchy is allowed only when technical constraints prevent you from eliminating exposure completely. Here, we focus on the lowest and least protective level, P, which stands for Personal protective equipment.

## The last resort to protect workers

Sometimes, substitution is not possible and technical and organisational measures are not enough to reduce exposure sufficiently. This is when personal protective equipment is needed. Personal protective equipment (PPE) prevents carcinogenic substances from coming into contact with the lungs, skin and eyes. PPE can only be used to complement measures higher up the hierarchy and is considered a **last resort**.

## Choosing the right PPE

It is essential to use PPE that is adapted to the substances being used. A correctly conducted risk analysis is necessary to select the right type and quality of PPE. Products containing dangerous substances must be accompanied by a safety data sheet (SDS), specifying which PPE should be used. However, for carcinogenic substances generated as by-products of work processes, such as quartz dust, the safety data sheets are not available and the PPE to be used must result from the risk analysis. The frequently used PPE for protection against dangerous substances are gloves, safety glasses, protective clothing and (filtering) face masks. More than one PPE is often required. Following the guidelines below will help the employer choose the right PPE:

- Is it appropriate to reduce risks: does it take into account the nature, frequency and duration of exposure?
- Is the assigned protection factor sufficient?
- Will its use increase other occupational risks?
- Is it suitable for the intended user?
- Make sure that facial hair cannot impede a good fit.
- Have ergonomic considerations been taken into account?
- Under what conditions is it to be used?
- Does the product bear specific (EC) marking to indicate its compliance with (safety) regulations?
- Are the workers trained in the use of personal protective equipment?
- Is personal protective equipment regularly cleaned and/or replaced?

## Maintenance and use

Personal protective equipment only works when properly maintained and used. Every worker should know, through employer guidance (e.g. training), when and how to use personal protective equipment. Standardised signs can indicate which PPE is required before entering an area, and regular safety training helps ensure it is used correctly. It should be clear to workers when to use PPE, but also what its limitations are. Like technical equipment, PPE requires regular maintenance. Are all filters still in order, are the glasses cracked? PPE should be replaced before it gets damaged. It is therefore important to check its effectiveness regularly and carry out preventive maintenance and replacement. Never work with defective PPE. It is the employer's responsibility to oversee all the above aspects to ensure that the worker is properly protected from exposure to carcinogens.

## In practice: Production of dangerous medicines (production line in a factory)

It is impossible to substitute dangerous medicines, because some patients need specific medicines for their medical treatment. In addition, technical measures such as closed systems are insufficient because, for example, a certain part or work process cannot be completely enclosed, and organisational measures, such as training, are also insufficient to fully protect workers from exposure.

In this case, personal protective equipment must be used, as a last resort. Some examples of PPE for a dangerous medicine production line are chemical protection suits; breathable air supply systems connected to the protective suit used, boots; shoe covers; glove straps or glove bags to handle medicines in a confined space. Of course, workers using this PPE must receive appropriate training to know how and when to wear it and the limitations of this protective device.