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Prevention of respiratory diseases and occupational diseases

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on Prevention of Occupational Risks due to
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Ladies and Gentlemen,

In the last days you have heard a lot about asbestos and its hazards for health. In my speech I would like to get beyond and talk about the prevention of occupational respiratory diseases in general.

Individuals who suffer from a respiratory disease or any other disease very often experience a tremendous loss in quality of life. In the Federal Republic of Germany respiratory and lung diseases are on the top of the list with regard to the causes of invalidity and hence economic costs. The table on the first slide shows the diseases development in Germany. It refers to single diagnosis groups. The figures, dating back to 2004, very clearly show the loss of production due to work incapacity. In economic terms they prove that prevention makes sense. For 2004 it is estimated that the loss of production and the loss of gross value added will reach a total volume of EUR109 billions. EUR13.8 billions result from respiratory diseases.

On the next slide you see that in Germany respiratory diseases make 23.5 per cent of all diagnosis. The proportion of lost work days due to work incapacity amounts to almost 13 per cent. This figure is in fact only exceeded by diseases of the musculoskeletal system.

In Germany, lung and respiratory diseases come first as causes of work incapacity and they produce the second highest costs regarding all diseases. It is thus worthwhile and profitable to make efforts towards the prevention of respiratory diseases.

The causes for respiratory diseases are complex. They may however be attributable to the simple fact that humans inhale something which they'd better not inhale, and which sooner or later generates a disease (slide 3). The causes are indoor pollutants in the inhaled air, which sometimes are inhaled voluntarily as for example by smoking cigarettes and cigars. But there is also atmospheric pollution caused by industry and emission. And of course steam, gas and dust -released in the course of work processes – are inhaled. Each of this cause, strictly speaking, is a threat for the respiratory tract and the lung. However, it has to

be taken into consideration that a combination of effects (interaction) also plays a role. This is for example the case when working in the mining industry and being exposed to quartz dust, which represents a considerable strain, plus smoking.

Let us have a closer look at the green circle that represents the area "work" under the aspect respiratory diseases and its prevention. The next slide provides an overview of the history of occupational diseases in Germany in 2004 related to lung and respiratory diseases. Inorganic dusts, e.g. quartz dust, asbestos and diverse metal dusts are on the top of the list of causes for occupational diseases. In many cases, they cause the sufferer's death. The most frequent cause of death is quartz dust and dusts containing asbestos. On the second place of recognized occupational diseases we find diseases caused by allergic or toxic agents. Compared with the inorganic dusts they only rarely lead to death. Diseases caused by organic dusts or gases only play a minor part with respect to lung or respiratory diseases.

Let us now have a closer look at the air pollutants, which are gaseous, liquid and solid substances. The aggregation state of air pollutants is important for the selection and application of protective measures. In the course of work processes diverse gases, steams and even mist and fumes can be released. The next slide shows a list of different air pollutants. For example smoke is liberated in metal welding; gases and steam are released in bronzing works. Various dusts are liberated in the laboratory in producing dentures. The picture illustrates a detail of an electroplating.

The best prevention with regard to respiratory diseases is to cease the use of, processing or release of substances that might cause such diseases. Yet, this means living without many conveniences that allow us to live in comfort. Most of the products of daily use have to be manufactured industrially, which involves the formation and release of pollutants. This is why first of all preventive technical measures have to be introduced. These measures aim at protecting against the inhalation of these pollutants. To that end, it is necessary to remove these substances from the inhaled air.

On the next slide, I will show you three examples for cleaning devices that extract pollutants from the inhaled air. A closed design is recommended for operations on small devices that require high precision and manual labour like for example tooth crowns or dental bridges. During the work process, the piece, which is to be treated, is completely isolated. This prevents effectively the release of ceramic or metal dusts. For operations on medium-sized or bulky devices, a half-open design is recommended as you may see in the example of an exhaust system in an electroplating plant. For work processes on large devices as for example on turbines of power plants which are spot welded, interception devices with an open design are recommended.

All have in common that they effectively prevent the release of air pollutants in the inhaled air. The next slide gives a schematic representation of the extraction/ suction technique. The air gathered is first cleaned from air pollutants by means of a separator, and subsequently carried back to the work area or to the ambient air outside the work area. The example of a welding work place illustrates the schematic representation. It shows a capture appliance, in this case an extraction funnel which can be turned and which is height-adjustable. Thus the appliance can be brought near to the place where the work is carried out and the welding fumes can be removed from the inhaled air. Via exhaust air the air pollutants are carried to an equipment which serves at the same time as separator, ventilating fan and sound absorber.

In some cases technical preventive safeguards are not sufficient as an effective protection against air pollutants. For example, layout works and flush mounting operations of power lines carried out by electricians in new and ancient buildings release a high concentration of airborne dust. It is caused by working with hand-held machines with quick rotating cut-off wheels which cut channels in the wall. This process produces dusts of different composition and the suction device of the machine is not able to absorb the dust completely. Despite the fact that inhaling dusts is unpleasant, this dust contains a certain amount of quartz dust. Quartz dust is categorized by the European Union as work material which induces cancer. Thus a complete protection of all workers – as much as possible – is of utmost importance. In this case additional protection by means of personal protection equipment i.e. a breathing mask is required which effectively removes the dusts from the inhaled air.

However, personal respiratory protective equipment means physical strain for the worker because the air has to be inhaled against resistance. This is why respiratory protective equipment should only come into consideration if technical and organizational protective safeguards are insufficient.

With respect to the prevention of occupational diseases of the lung and respiration tract we have to turn our attention especially to the diseases caused by asbestos. Over many decades, on average a period of 35 years, the disease develops unnoticed, without any symptoms like pain or respiratory distress. The next slide shows an evaluation of the *Industrial Employment Accident Insurance Fund in the precision engineering and electrical industry* (BGFE) with regard to the latency period of cancer development caused by asbestos. From a statistical point of view, a tumor diagnosed today has its origin in 1971. In Germany asbestos, or to be more precise, material containing asbestos, was used to a great extent prior to the mid-eighties, thereafter the use declined. Therefore we conclude that the development of workers who fall ill will only decline significantly after 2015. The malicious nature of asbestos is that it has many excellent chemical and physical properties. It has an especially high biological resistance which means that the body is unable to eliminate the substance.

On the next slide one can see the "fight" of the human immune system confronted with an asbestos fibre. One can see very well that the "eating cell" is unable to enclose and dissolve the asbestos fibre. The high biological resistance is caused by the mineral structure of the asbestos fibre and makes it especially resistant to most chemical and physical influences and against attempts of the human immune system to dissolve them. Thus asbestos fibres which have invaded the body represent a life-long stimulation which very often leads to a cicatrization of the lung tissue and even leads to tumour growth.

Against this background, the use of and working with material containing asbestos (next slide) has been prohibited in Germany in 1993. Exceptions from this prohibition are maintenance, repair and demolition works. Since 1990 these works have been subject to special regulations. An important, additional prevention measure for workers who in the past worked with substances containing asbestos is regular medical check-ups (health surveillance). The objective of the medical examinations, carried out every one to three years, is to be able to diagnose asbestos-induced diseases at an early stage. The examination includes radiography of the lung as well as for example a function test of the lungs.

To conclude:

As mentioned previously, the ideal would be to do without any material that might cause respiratory diseases. Yet, as this is not realistic, prevention measures have to be put in place to protect workers from health hazards. Three elements contribute to the prevention of respiratory diseases: technical, organizational and personal prevention measures.

In this context, technical prevention measures should be given first priority. With respect to our subject, i.e. the protection against volatile substances, it would mean that protection measures include capturing air pollutants at the source where they are released. Machines, installations and tools but also workplaces and manufacturing processes have to be designed in such a way that they meet the protection requirements. As already stated closed, half-closed and open appliances help to meet this goal. These safety measures are no doubt cost-intensive. Yet, the most effective technical air cleaners as illustrated on the slide are available for about USD 650 like the industrial vacuum air cleaner and for USD 150,000 you can purchase a complete equipment which has the size of a medium-scale hall of 1000 square metres. The operational life of such an equipment is about 25 years.

As second element of protective measures we have organizational measures. Thereby the work procedure, structure and organization are most important. It is important to separate work activities which release air pollutants from "clean work activities". For example electric installation operations which include groove and cutting works produce a lot of dust whereas electric installation works with cables and conductors do not release dusts. It is therefore recommended to carry out these very different work operations separately or at least not at the same time. Thus the worker who carries out the installation activities is not exposed to the airborne dusts released by slot work and milling work. Such safety measures do not produce any additional costs or at least very little costs. Moreover they effectively prevent workers from inhaling substances which cause diseases.

As third element personal protection measures have to be mentioned. These equipments are worn and they are provided if technical and organizational measures are insufficient. Since breathing masks reduce the worker's physical capacity they are not suitable for a continuous use. The price for one of the masks presented varies – depending on the quality, the supplier and the quantity which is ordered between USD1.50 and 8.00. Yet its stability and storage life is limited. The same applies to the frequency of use, since the filters get choked by air pollutants. In this case the masks have to be replaced as filters cannot be replaced. If the atmospheric pollution is strong, a replacement of the masks might be necessary every day. In this case a comparison of costs with technical safety measures is worthwhile. If 1000 workers need a new mask every week at a price of USD1.50 in a year with 48 working weeks, the expenses amount to USD72,000. After two or three years the investment in an industrial air cleaner would already pay off.

A distinctiveness with regard to personal safety measures are the regular medical check-ups. They help in the early detection of a disease and they are carried out once every one to three years. The earlier a disease is detected, the better the chances to cure and thus the earlier the worker is able to return to his workplace.

To conclude, the topic "prevention of respiratory diseases" is embedded in an integrated concept and understanding of prevention which includes on the one hand the prevention of accidents and diseases as stated in my presentation. The main question in this context is: what causes a disease and how can we prevent it?

But this concept also includes the health promotion aspect and the central question: What preserves health? For work cannot only cause diseases, it also has the potential to improve the health of workers. Healthy workers are more productive and they are less often absent due to illness. Healthy workers contribute to a considerable amount positively to a company's productivity and economic added value.

Thank you very much for your attention.