Health risks due to low concentrations of carbon monoxide

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Executive summary

Health Council of the Netherlands

This advisory report is about the health risks of exposure to low concentrations of carbon monoxide and how such risks can be mitigated. The advisory report has been drawn up by the Health and Environment Surveillance Committee.

It is generally known that inhaling high concentrations of carbon monoxide is harmful to health. Every year, hundreds of people in the Netherlands end up in Accident & Emergency departments or in hospital with carbon monoxide poisoning and there are a number of fatalities. In housing, defective heating equipment – primarily central heating boilers nowadays – combined with ineffective flue ventilation is the prime cause. It is less well known that low concentrations of carbon monoxide can also be harmful to health.

The prevailing opinion among doctors and other experts is that carbon monoxide reduces the ability of the blood to transport oxygen, which causes organs to suffer from a shortage of oxygen. However, the toxic effect of carbon monoxide turns out to be more complex in nature. Other mechanisms also play a role. Inside the cells of tissues and organs, the carbon monoxide that has been inhaled disrupts important biological processes. Damage can consequently arise to the heart and blood vessels and the nervous system. This can already start to happen on exposure to low concentrations of carbon monoxide. There are indications that the foetus is particularly sensitive to the disruptive effect and that exposure to carbon monoxide during pregnancy can affect the neurological development of the foetus. Cardiac patients are also particularly susceptible.

To protect people against the health risks of carbon monoxide, the World Health Organization (WHO) has drawn up guideline values that are intended to limit exposure. For exposure lasting one hour, the concentration in the air must not exceed 26 ppm (parts per million) on average. Lower concentrations apply for lengthy exposure: 9 ppm for eight hours and 6 ppm for twenty-four hours.

The scarcity of measurements means that it is not clear how often and for how long the WHO's guideline values are exceeded in housing in the Netherlands. A rough estimate based on limited and somewhat older measurement data is that concentrations of above 26 ppm are present in 1 out of 1000 accommodation units. The recommended value of 6 ppm for long-term exposure will be exceeded in more accommodation units than that at any given time. The committee recommends obtaining a fuller picture of the scope of the issue by carrying out measurements in homes.

The scale of the damage to health caused by low-level exposure to carbon monoxide is unknown. The disease burden caused by higher levels of exposure is already difficult to estimate because the symptoms of illness are not very specific (headaches, nausea, loss of consciousness) and the involvement of carbon

monoxide is often not recognised. For lower exposure levels, the effects are not always immediately observable. Symptoms do not always arise immediately when the cardiovascular system or nervous system starts working less well.

Triggered by a report by the Dutch Safety Board, the governmental authorities and the commercial sector together are taking measures to protect people better, at home and in other buildings, against the hazards of carbon monoxide. Most importantly, this concerns a legal system for certifying work on gas-burning installations. The committee recommends taking additional precautions that focus specifically on protecting against health damage caused by exposure to low concentrations of carbon monoxide. Carbon monoxide alarms that are currently available on the market in the Netherlands are not sensitive enough to detect concentrations below 10 ppm; in line with the current regulations, they only give an acoustic alarm signal at 50 ppm, whereas the WHO's advice is that the average exposure should remain below 9 ppm over any period of 8 hours and below 6 ppm over 24 hours. There is a discrepancy here. The committee recommends further that carbon monoxide alarms should be adjusted to the WHO values. It advises that the Netherlands should propose that this point be included in the work currently being done within the European Union to create harmonised product standards for carbon monoxide alarms. Finally, the committee recommends paying greater attention to the risks of exposure to low concentrations of carbon monoxide in the information given to the public, emergency services and installation companies.

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