

Spray polyurethane foam insulation and health

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Executive summary

Health Council of the Netherlands



Spray polyurethane foam (SPF) is often used to insulate (floors of) homes. It is estimated that this material has been used to insulate around 250,000 homes in the Netherlands. Some of the residents involved have since stated that they are experiencing health problems. A study carried out by the Netherlands Organisation for Applied Scientific Research (TNO) in 2013 indicated that it is unlikely that there is a causal relationship between the use of SPF insulation and these complaints, but this possibility could not be entirely ruled out. Since then, the industry has tightened its guidelines even further. Moreover, a protocol for medical diagnosis was drawn up in 2016. However, these measures failed to dispel the disquiet. Accordingly, the Minister of the Interior and Kingdom Relations has asked the Health Council of the Netherlands to issue an advisory report on this matter. The Council's Committee on SPF has attempted to determine whether SPF insulation poses any

health risks to residents, and whether some groups are more susceptible than others. The Committee also examined the associated health effects in workers, as these could help to establish the plausibility of health effects in residents.

It is important for SPF to be applied correctly

With SPF insulation, two components are first mixed on site (usually in the crawl space). The resulting chemical reaction causes the mixture to cure into an insulating layer of foam. One of these components consists of isocyanates. These react with polyols, the main constituent of the second component. The latter component also contains additives such as catalysts, blowing agents, and flame retardants. Isocyanates and catalysts are known to be hazardous to health. Some countries have imposed legally binding limit values on worker exposure. However, no such limits for these

substances have yet come into force in the Netherlands. Legally binding limit values specifically for residents do not exist, but some substances do have recommended exposure limits, which are aimed at protecting people's health. To estimate the risks involved, the Committee used limit values from other countries, as well as recommended exposure limits from various authorities.

Some of the main constituents and additives found in SPF have hazardous properties. Regulations and guidelines have been drawn up to ensure the safety of workers and residents. For instance, the area must be well ventilated while this work is in progress. The residents must leave the house beforehand and may only return two hours after the work has been completed. Finally, the workers in question must use personal protective equipment. Furthermore, certified companies (by 2019, more than 90% of



these insulation companies were certified) are required to comply with numerous additional requirements, which are intended to ensure that the process runs smoothly and safely.

It is very important that the chemical reaction that generates the SPF proceeds completely, and that the foam cures properly. At that point, the isocyanates and some of the catalysts remain trapped in the foam and cannot be released. If the chemical reaction does not proceed completely, isocyanates and various unpleasant reaction products (some of which smell like fish) may be released. The foam still contains blowing agents and flame retardants which, even if the foam has fully cured, are released gradually and in low concentrations over time.

Exposure levels are low for residents, high for workers

Studies have shown that, if the SPF is applied correctly, the residents' exposure to hazardous substances is lower than the recommended

exposure limits for these substances. Blowing agents and flame retardants are gradually released from SPF over an extended period of time. While there are no indications that low concentrations of blowing agents are harmful to health, there have been very few studies into their long-term effects. Flame retardants are used widely in homes (e.g. in textiles, plastics, paint, furniture, electrical equipment, and mattresses). However, nothing is known about SPF insulation's contribution to residents' overall exposure to flame retardants.

It's a different picture for workers. Studies have shown that, while spraying is in progress, the concentrations of isocyanates and catalysts in crawl spaces substantially exceed the limit values that are currently in force in other countries. Concentrations of blowing agents and flame retardants, for which – in many cases – no limit values exist, are high as well. Urine tests performed on insulation workers in other countries indicate a high level of internal exposure to isocyanates and flame retardants.

It is unclear whether this is also the case in the Netherlands.

Residents report more health problems than workers

With regard to the health effects of exposure to SPF components, isocyanates are known to cause asthma, other lung conditions, eczema, and hives. Very few workers report in sick with a SPF-related occupational illness. Indeed, there were only three such cases in the period from 2002 to 2019. That is considerably fewer than what would normally be expected (based on the international literature). The Committee believes that this is due to underreporting, which would mean that these figures are incomplete.

Be that as it may, there are certainly a large number of reports concerning health problems among residents. In the period from 2011 to 2019, the municipal health service (GGD) registered 69 such reports. Officially, the municipal health service must be notified of all such reports (either by the patients themselves



or by their GPs). After determining whether SPF might be involved, the health service advises on the best approach to take. In practice, people sometimes fail to report complaints to their municipal health service. Some of those affected by SPF have banded together and set up their own hotline. Between 2012 and 2019, this hotline registered 322 reports of various complaints. A comprehensive overview of reports is not available.

Nor is there any central registry of medical diagnoses. Records show that, in the period up to March 2020, a total of 22 residents with complaints completed the medical protocol at Amsterdam UMC – location AMC. They exhibited a wide range of complaints, but no disorders were diagnosed that are known to be related to isocyanates. ECEMed (a centre of expertise at Arnhem's Rijnstate Hospital that closed in 2017) established complaints in about 300 residents, 53 of whom underwent further tests. It should be noted that this centre had adopted its own working procedure, one that did not comply with

national or international guidelines. A link with SPF was deemed to exist in virtually all of the residents (49 out of 53) examined by ECEMed. The most commonly diagnosed condition was sensitisation of the mucous membranes and/or skin to components of SPF. Both ECEMed and the SPF Victims' Hotline indicated that residents often remained in the house while the insulation work was being carried out and/or that the foam did not always cure properly.

Correct use unlikely to pose health risks to residents

When SPF is applied correctly, the level of exposure to hazardous substances is very low indeed. The Committee takes the view that this is unlikely to cause adverse health effects in residents. For a variety of reasons, however, such effects cannot be entirely ruled out. When incorrectly applied, this material does pose an increased risk to the health of residents. Furthermore, PUR foam contains a number of substances whose health effects are poorly researched. In addition, the residents'

complaints and disorders were not systematically investigated and registered. As a result, there is no clear picture of the nature and extent of their problems. Often it remains unclear whether the residents' complaints were related to the SPF insulation or to some other causal factor. People with a known allergy to isocyanate should avoid using SPF insulation. The Committee takes the view that no specific recommendations are required for other potential high-risk groups.

Guarantee safe application and improve registration

In the Committee's view, insulation companies must provide guarantees to residents that they operate in compliance with the guidelines for certified companies. This will ensure that the material is applied correctly and that any exposure to hazardous substances remains within safe limits. In practice, it turns out that companies do not always operate in compliance with the guidelines. The Committee recommends that current working practices be evaluated, to determine whether it would be worthwhile to



introduce targeted policy measures and, if so, which ones.

The Committee also recommends that a central registry of residents' complaints and diagnosed disorders (according to medical protocol) be established. This approach would also help to clarify the course of such cases over time, for example, in response to industry initiatives.

The Committee also recommends that individual elements of the medical protocol should be further refined. This work should include an exposure study or a chemical analysis of the SPF in homes.

The Committee has no tangible evidence to show that blowing agents trigger health effects in residents, following SPF insulation. Nevertheless, it does feel that further experimental studies should be conducted into the risks of long-term exposure to these substances, as they are ill-researched.

The Committee also recommends an exploratory study into the exposure of residents to

chemicals from SPF through drinking water from plastic water pipes located in or near the SPF insulation layer.

The Committee also wants to call attention to the fact that workers who routinely install SPF insulation may experience high levels of exposure to hazardous substances. It recommends that further studies be carried out to assess workers' levels of exposure and the potential health effects involved. There should also be a special focus on employers' compliance with their statutory obligations, in the context of the Working Conditions Act and with regard to training courses for insulation workers. Risk awareness enables workers to mitigate the risks involved, both to themselves and to residents. The Committee takes the view that if private individuals choose to install SPF insulation, using separate components, its correct and safe application cannot be guaranteed. Accordingly, it recommends exploring whether any such products for

non-professional users and on sale in the Netherlands could be banned from the market.



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Most Health Council reports are prepared by multidisciplinary committees of Dutch or, sometimes, foreign experts, appointed in a personal capacity.

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