

News and commentaries

Prevention of work-related airway allergies; summary of the advice from the Health Council of the Netherlands

The Health Council of the Netherlands published a report in which the best procedure and method for recommending health-based occupational exposure limits (OELs) for inhaled allergens were identified by evaluating the scientific state of the art. Many respiratory disorders in the workplace arise from inhalation of substances which can cause allergy. To protect workers against respiratory allergy, various preventive measures are taken, one of them being reduction of exposure by setting legally binding standards. These are based on health-based OELs that specify a level of exposure to an airborne substance, a threshold level, below which it may reasonably be expected that there is no risk of adverse health effects. The Council is of the opinion that an OEL should prevent against allergic sensitization, as sensitization plays a crucial biological role and is a prerequisite for the development of allergy. Furthermore, the Council considers it most likely that the exposure level below which no allergic sensitization develops for most allergens is so low, that OELs are difficult to set with the current knowledge and technical feasibilities. An alternative approach is to accept exposure, which carries a small predefined risk in developing allergic sensitization. In addition, it is worth considering periodic screening of exposed workers on allergic sensitization, because timely intervention can prevent worse. The feasibility of periodic screening and what else is needed to comply with the most important criteria, should however be judged case-by-case.

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Allergic respiratory disorders are a significant problem

Occupational allergic disorders are commonly reported illnesses arising from exposure to allergens (1). An allergic disorder is a significant problem because, if exposure continues, the symptoms may worsen and the acquired hypersensitivity may become irreversible. Hence, the consequences of allergen exposure can be far-reaching. Workers' health should therefore be protected by managing exposure to allergens.

One of the tools available for exposure management is the application of occupational exposure limits (OEL). An OEL is the maximum permissible occupational exposure level to a given airborne substance. OELs are applied by the government and the business community.

Occupational exposure limits are derived from 'toxicology-based recommended OELs', which are based on scientific knowledge. One example of the latter type of exposure limit is a health-based recommended OEL for a noncarcinogenic substance. Such a limit specifies a level

of exposure to an airborne substance, a threshold level, at or below which it may reasonably be expected that there is no risk of adverse health effects.

However, the validity of using the established procedures and methods to calculate health-based OELs for allergens has been questioned (2). Of particular significance in this regard is the question of whether it is possible to determine a threshold level. There are grounds for believing that any exposure, however small, entails some risk of sensitization and of developing allergic respiratory disorders if exposure continues.

At the request of the Dutch Minister of Social Affairs and Employment, the Health Council has sought to identify the best procedure and method for calculating toxicology-based OELs for allergens. In addition, it has considered whether the introduction of periodic screening would reduce the impact of these allergens on workers' health.

Without intervention, sensitization leads to respiratory allergies

Allergy is a hypersensitivity reaction that is initiated by a specific immune response to a foreign agent, an allergen, at an exposure level that is normally tolerated. One of its characteristics is increased sensitivity of the immune system (sensitization), induced by earlier exposure. Sensitization may be asymptomatic, insofar as the sensitized individual experiences no physical symptoms. Several instances of exposure may be required before evidence of allergic sensitization is seen. The risk on sensitization differs among individuals; genetic predisposition plays a role in that.

In a sensitized person, renewed exposure may ultimately lead to allergic respiratory symptoms (i.e. allergic rhinitis, rhinoconjunctivitis, and asthma). It has been observed that, if exposure continues after sensitization, symptomatic conditions are liable to develop in several dozen percent of cases (2). The Health Council therefore makes the precautionary assumption that, in the event of continued exposure, almost all sensitized workers will ultimately develop allergic respiratory disorders.

Allergic respiratory disorders may lead to irreversible health problems

Respiratory allergic symptoms may be mild to begin with, but become more serious as exposure continues. The respiratory symptoms associated with allergy are not unique to allergy; definite diagnosis therefore requires immunologic testing.

It is also possible for symptoms to become chronic, and not disappear when exposure is discontinued. For instance, it is estimated that about half of the workers who develop occupational allergic asthma still experience asthmatic symptoms years after exposure has ceased (3, 4).

However, the sooner diagnosis is made after the appearance of symptoms and the sooner exposure is ended, the better the prognosis is. The long-term avoidance of exposure can even lead to the disappearance of detectable sensitization (5, 6). However, in most cases, once a person has been sensitized, he or she will remain hypersensitive for the rest of his or her life and liable to develop the same allergic respiratory symptoms in the event of renewed exposure to the relevant allergen. No curative treatment is currently available to reverse this hypersensitivity.

Respiratory allergy is a contributor to disease burden both at the personal level and at societal level (7). It also reduces quality of life, as reflected in physical, social and daily well-being, by affecting things such as career prospects, the presence of physical and mental problems, absenteeism, and work disability (8, 9).

Various agents can induce an allergy

There is a great variety of compounds, which cause respiratory allergic disorders in the workplace. They are divided into those with a high molecular weight and those with a low molecular weight.

The first group consists mainly of proteins, such as those found in (wheat) flour, and the urine of laboratory animals. Such allergens mainly induce a direct immune response by an IgE-mediated mechanism. The second group consists mainly of small compounds, such as acid anhydrides and isocyanates. Immune responses are provoked only when such allergens are bonded to proteins found in the body, such as serum albumin.

The different types of allergen differ in their ability to induce an immune response. It is not yet entirely clear what factors are responsible for the differences, but it is known that the physical and chemical characteristics and the intrinsic properties of the allergen play a role (2).

The circumstances of exposure also may vary enormously. For instance, workers are often exposed to mixtures of allergens. When working with wheat flour dust, for instance, or using gloves containing natural latex powder, a worker can be simultaneously exposed to dozens of different wheat flour dust or latex allergens, which are released into the air (2).

Other factors play a role as well

Exposure to an allergen is the key event in the development of an occupational respiratory allergy. However, various other factors may also influence the development of such an allergy. These include exposure conditions, exposure pattern, and simultaneous exposure to other substances (2).

Furthermore, personal factors, such as genetic predisposition, lifestyle, infections and the fact that exposure

outside the workplace may have occurred earlier, can increase the risk for developing an allergy (2).

In practice, it is difficult to quantify the significance of these risk factors for the development of occupational respiratory allergies, simply because not enough is yet known.

Respiratory allergies are common in certain working populations

In certain industries, the risk for developing allergic respiratory symptoms because of occupational inhalation of allergens is relatively high. These include people working in the baking and flour-processing industries, laboratory animal care and the bell pepper and flower greenhouse cultivation industry, as well as people who are exposed to industrial enzymes, soluble platinum salts, isocyanates or acid anhydrides at work (10, 11). Epidemiologic data from these types of industries suggest that the risk may amount to several dozen percentage points, depending on the type of allergen and other factors (2). Hence, a substantial proportion of workers who are exposed to airborne allergens at work develop specific sensitization and allergic respiratory diseases.

Sensitization is the best basis for the calculation of toxicology-based OELs

An OEL is based on the most 'critical' adverse health effect associated with the relevant substance. The critical effect may be the effect that is first observed when exposure increases, or the effect that is most significant in the development of disease.

Where allergic respiratory disorders are concerned, the Health Council is of the opinion that allergic sensitization should be regarded as the critical effect. Allergic sensitization is the best starting point for the calculation of OELs, as it plays a crucial biologic role and is a prerequisite for the development of allergy. Once sensitization has occurred, continued exposure will lead to allergy in most cases.

An exposure level below which no sensitization develops can exist

Current scientific knowledge regarding the relevant allergic immunologic mechanisms leads the Health Council to believe that it is plausible that a threshold level exists below which no allergic sensitization may be expected (2). This level may be very low, so low, in fact, that little of an allergen is needed to provoke an allergic immune response.

Where a few allergens were concerned, the Health Council considered whether threshold levels could be

deduced from the available epidemiologic data. This does appear to be possible where soluble platinum salts are concerned (12). However, no evidence of a threshold level was observed for (wheat) flour dust, even at low levels of exposure (13). More detailed study is needed before conclusions may be drawn regarding other allergens.

Furthermore, the results of animal studies provide a mixed picture. For instance, a threshold level was observed in a few experiments, but not in others (2). The Council emphasizes, however, that the outcomes of the animal experiments need to be interpreted cautiously, as the experimental exposure conditions tend to differ considerably from workplace exposure conditions. The design of the animal inhalation models could be improved as well.

Preferable health-based OEL should be derived

Current knowledge suggests that a threshold level does exist for inhaled allergens. This implies that health-based recommended OELs can be calculated for allergens using the same procedures and methods as those used for other noncarcinogenic substances. Hence, the first step towards calculating such a limit is to determine whether, in the given instance, it is possible to determine a clear threshold level with the currently available techniques.

However, the Health Council believes that, where most allergens are concerned, it will not be possible to calculate a reliable health-based recommended OEL by any method. The reason being that, in most cases, the threshold level will be too low to discern, using the techniques presently available.

If that is not possible, a reference value can serve as an alternative

The Health Council therefore proposes an alternative approach to those allergens for which no reliable health-based recommended OEL can be calculated by the established methods. This approach involves determining reference values, i.e. concentration levels that correspond to predefined accepted levels of risk of allergic sensitization.

These reference values can then be used as a basis for assessing OELs. The predefined accepted level of risk should take account of the background prevalence of the allergen in question. However, the final decision on the predefined accepted level of risk will also depend on policy and social considerations.

Periodic screening for allergic sensitization can be a useful additional tool

Although OELs are useful as a means of protecting workers' health, it should be taken into account that cases

of allergic sensitization and respiratory disorder can happen. One additional option available to the government and the business community is the early detection of sensitized workers by means of periodic screening, for example.

In view of the prognosis associated with continued exposure and the high prevalence of allergic respiratory disorders in some occupational groups, the Health Council considers periodic screening for allergic sensitization to be a potentially valuable tool – provided that workers are properly informed about the potential consequences of a positive test result. The latter proviso is important because, in the most extreme cases, the detection of sensitization could have very far-reaching consequences for a worker.

The Health Council, however, makes some comments on the feasibility of periodic screening in the workplace. For instance, periodic screening is of value only where accurate and reliable tests are available for the detection of allergic sensitization to the relevant allergen. Such tests are available for certain well-known allergens, such as those found in flour dust, the urine of laboratory animals, and in latex (2). Where other allergens are concerned, however, such tests still need to be developed. The allergens in question include those that can cause sensitization by triggering a non-IgE-mediated immune response. As long as these immunologic tests are not available, screening may focus on the detection of early symptoms and signs caused by allergy.

Another criterion is that periodic screening is performed at an acceptable price. In view of the number of cases of allergic respiratory symptoms in certain occupational groups, the Health Council assumes that screening is likely to be cost-effective for such groups. However, there is insufficient evidence to confirm that this is indeed the case, because no thorough cost-effectiveness studies have yet been performed (2).

In conclusion, it is worth considering the introduction of periodic screening in addition to other tools available in managing exposure. Basically, periodic screening could be fairly and straightforwardly incorporated into the already existing and statutory-regulated periodic occupational health examination. The feasibility of periodic screening on allergic sensitization and what else is needed to comply with the most important criteria, should, however, be judged case-by-case.

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The complete report can be read and downloaded free of charge at <http://www.healthcouncil.nl>

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