

## Factsheet

# Ultrafine particles from Schiphol airport: An analysis of health impacts for area residents

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### Short summary

A research study by TNO (Netherlands Organisation for Applied Scientific Research) has shown that air traffic at Schiphol Airport Amsterdam causes heightened concentrations of ultrafine particles in the vicinity of the airport. In particular, aircraft which are taking off emit exceptionally large amounts of ultrafine particles: equal to that of a million lorries. This leads to damage to health and premature mortality for area residents.

Calculations by Milieudefensie have shown that this air pollution shortens life expectancy by four to eight months for approximately 44,000 residents of neighbourhoods in Amstelveen and Amsterdam. For an additional 10,000 residents, this loss of life expectancy could even exceed one year. People who live in areas which are downwind (mostly north-east) of Schiphol are most affected.

### Analysis of the health impacts

A TNO research study has shown that air traffic at Schiphol is a source of ultrafine particles in the vicinity of the airport. To gain insight into the scope of the problem, Milieudefensie estimated the impact of the concentrations of the ultrafine particles measured by TNO on the health of Schiphol area residents. From this it was found that ultrafine particles in the area downwind from the airport lead to a loss of life expectancy for area residents ranging from a few months to more than a year. The calculation method used is explained below.

### Methodology and data

#### *Ultrafine particle concentrations*

In Spring 2014, TNO measured ultrafine particles in the Amsterdamse Bos, a large public wood located approximately 7 km east of Schiphol (Tijdschrift Lucht [Dutch journal for air quality], no. 6, 2014). In 2012, TNO also measured ultrafine particles in Cabauw, a village located about 40 km south of Schiphol. Based on all these data, TNO assessed concentrations of ultrafine particles originating from Schiphol in the residential areas of Amsterdam and Amstelveen north of the airport (555,000 residences).

The influence of Schiphol on ultrafine particle concentration differs, depending on how far people live from Schiphol and the direction of the wind. The TNO study showed that the ultrafine particle concentration for 20,000 homes increased by 10,000 to 20,000 particles per  $\text{cm}^3$  as the result of Schiphol air traffic. In contrast, the region's background concentration is about 9,600 particles per  $\text{cm}^3$ . For more than 40,000 residences, TNO calculated an increase of 5,000 to 10,000 particles per  $\text{cm}^3$ . For a few thousand residences, the impact of Schiphol is even worse: there the airport causes 20,000 to 40,000 extra ultrafine particles per  $\text{cm}^3$ . The concentration for these homes is thus five times higher than the background concentration.

#### *Relationship between ultrafine particles and health impacts*

Ultrafine particles consist of airborne particles which are smaller than 100 nm. As a comparison: a human hair is 1,000 times as thick. This tiny fraction of the total fine particles is exceptionally harmful to health. Because the particles are so

small, they can penetrate deep into the lung's alveoli and from there enter the circulatory system. The tiny particles can enter the entire body via the blood vessels, causing infections and nerve irritations. This could lead to heart and respiratory disease.

A great deal of research has been carried out on the exact mechanism of action of ultrafine particles. Based on this existing research, 11 international experts assessed the relationship between exposure to ultrafine particles and a shortening of life expectancy (Hoek et al., 2010). From this assessment, it emerged that an increase of 10,000 particles per  $\text{cm}^3$  on average leads to a 3% rise in mortality. This relationship was used by Milieudefensie to estimate the average loss of life expectancy for residents in the vicinity of Schiphol.

#### *Calculation of the loss of life expectancy*

We calculated what exposure to ultrafine particles originating from Schiphol means in terms of loss of life expectancy for people who live downwind of Schiphol. So-called life tables were used to make these calculations. Such a table gives the average life expectancy per age and is used to calculate the remaining life expectancy per age category. The effect of an increase in the concentration of ultrafine particles on the mortality rate can thus be converted into a loss of life expectancy. The tables used for this were provided by the Institute for Occupational Medicine in Scotland (Miller and Hurley, 2006).

Baseline data on the mortality rate and life expectancy for the Dutch population were obtained from Statistics Netherlands (CBS StatLine) for June 2013. As is usual in the field of epidemiology, the dose response relationships (Hoek et al., 2010) are considered applicable to people 30 years of age and older. Therefore, no impact of air pollution on the mortality rate of people under the age of 30 has been postulated. These calculations thus are valid for the 'average Dutch person' 30 years of age or older. This does not mean that there are no impacts for children or young people: they also may become ill as the result of exposure to ultrafine particles.

Numerous other factors such as socio-economic status, genetic and behavioural factors are of course also influential in determining individual life expectancy. This calculation only took into account the impacts of heightened air pollution resulting from Schiphol on average life expectancy.

## Results

For the several thousands of homes in Amstelveen and Amsterdam which are most affected by air pollution from Schiphol (up to an extra 40,000 ultrafine particles per  $\text{cm}^3$ ) the average loss of life expectancy could equal more than a year. This concerns an estimated 10,000 people living in homes which have such heightened exposure. For another 20,000 residences, ultrafine particles lead to a loss of 3.8 to 7.7 months for the approximately 44,000 people who live there. For about 88,000 other people (40,000 residences) a loss of life expectancy of 1.9 to 3.8 months as the result of ultrafine particles from Schiphol was estimated.

If we calculate the total loss of life expectancy for the total number of people, that is 35,000 to 70,000 years. This concerns loss of life expectancy exclusively as the result of air pollution from Schiphol. This is thus in addition to the health impacts of air pollution from road traffic and industry. Besides accelerated mortality, exposed people will also experience more frequent and more serious health issues.

#### *Observations on the interpretation of the results*

These estimates were based on the best available research data on the impacts of ultrafine particles on mortality. Research into the effects of ultrafine particles, however, has only been carried out in the last few years, and there are still a number of uncertainties concerning the exact impacts and working mechanisms. The results presented above are thus a first approximation of the health impacts. More research on the composition and the impacts of ultrafine particles is needed. However, there is already more than enough data to conclude that ultrafine particles are extremely harmful to health, so the necessity for new

research cannot be used to postpone political action to reduce ultrafine particles.

The assessment was made only for people 30 years of age and older. Younger people, particularly children, are most likely at extra risk of developing asthma and disorders that lead to a loss of quality of life and could lead to a shortened life expectancy later in life. These impacts are not included in the present calculations but are of significance.

This analysis studied only the effects of ultrafine particles on premature mortality. These months of loss of life expectancy are just the tip of the iceberg. Over the course of their lives, area residents are likely to have more frequent and more serious respiratory illnesses such as asthma and bronchitis, allergies, diabetes and other chronic diseases. Exposure to ultrafine particles has also been associated with lower birth weights and certain brain disorders. Area residents will in general experience a lower quality of life. More research needs to be carried out on these health impacts of ultrafine particles from Schiphol.

## Conclusions

Schiphol greatly affects air pollution in its vicinity. Exceptionally harmful ultrafine particles have been found in extremely heightened concentrations in the greater vicinity of Schiphol. This is a densely populated region, including residential neighbourhoods in Amsterdam, Amstelveen and a

few smaller municipalities. Tens of thousands of area residents risk serious health problems due to the close proximity of Schiphol and the aircraft taking off from there (and to a lesser degree, those landing there). The air quality data from TNO and calculations by Milieudefensie show a year or more loss of life expectancy for about 10,000 people, due to increased air pollution. For another 44,000 people, ultrafine particles from Schiphol lead to an average of 4 to 8 months loss of life expectancy. For about 88,000 people, loss of life expectancy has been estimated at a few months. Other people who also live in the vicinity of Schiphol (but not in the area where the research was carried out) are also exposed to heightened concentrations of ultrafine particles.

## References

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