



Ensuring the air quality of your environment

Gain insight in air quality by using STACKS+

Air pollution can lead to health effects. A good reason to use air quality models is to gain insight in the effect of mitigating measures. Assessments are based on strict standards as determined by governmental bodies or authorities upon construction of new roads and industrial facilities, an increase of traffic intensity or a change in industrial activities.

By using STACKS+, the advanced atmospheric dispersion model of DNV KEMA Energy & Sustainability, the consequences on the air quality of industrial activities, road traffic, shipping and other relevant sources can be calculated and presented in an insightful manner.

The model converts the data on emissions into concentration levels and deposition quantities, and is used extensively for:

- Calculation of the NO₂ and fine particle concentrations (PM₁₀, PM_{2.5}, elementary carbon) along traffic routes, which are then tested against the thresholds on air quality
- Calculation of the immission of NO₂, fine particles and many other pollutants, including odor, as a consequence of industrial activities (including power plants) as required for the issuance of environmental permits

- Determination of the impact of emission control measures and strategies
- Calculation of the quantity of nitrogen deposition in nature reserves as a result of the emissions from road traffic, industry and agriculture

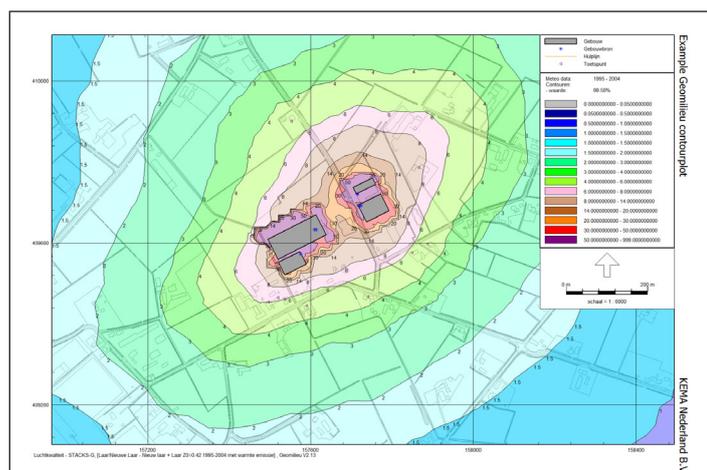
THE STACKS+ MODEL IN A NUTSHELL

The STACKS+ model formed the starting point for the Dutch National Model (NNM) for point and surface sources. STACKS+ goes beyond the NNM framework to include all aspects such as calculation of the air quality along traffic routes, and is approved by the Dutch Ministry of Infrastructure and Environment for use within the application areas of traffic routes and point and surface sources. The STACKS+ model is a Gaussian dispersion model

based on rational physical and chemical formulas that simulates the situation from hour to hour. The model uses a meteorological database on an hourly basis. A big advantage of the hour to hour modeling is that daily and yearly averages can be derived directly from the calculations. This eliminates the need to use (disputable) empirical relationships, as is often done in screening models. Various emission figures can be specified per hour for point and surface sources, and the daily flow of road traffic can be taken into account with a high level of detail. This makes it possible to determine the impact of various measures, such as the use of rush hour lanes, traffic jam prevention, introduction of public transport and the implementation of Low Emission Zones in cities.

IMPACT OF AIR TRAFFIC DEVELOPMENTS

Environmental impact assessments are getting more and more important in the decision-making process on airport and air traffic developments. Future growth could be limited due to environmental constraints. Those constraints used to be noise-related, but emissions and local air quality are getting more and more restrictive, especially for CO₂, NO_x, fine particles and odor. Detailed insight in aviation-related contributions to the local air quality or the effect of mitigating measures is of paramount importance for the management of airports and air traffic.



Example Geomilieu contourplot

WHAT CAN BE MODELED WITH STACKS+?

STACKS+ can be applied in the following areas:

- Industrial sources
- Power plants
- Diffuse sources, such as industrial parks or storage and trans-shipment companies
- Highways, secondary roads and local roads
- Built-up streets in villages and cities, the so-called 'street canyons'
- Roads with noise barriers
- Tunnel mouths
- Parking areas, bus stations and taxi stands
- Shipping, harbors
- Airports
- Cattle farms

PROJECT REFERENCES

- Air quality and nitrogen deposition modeling for the Claus-, Hemweg-, Sloe-, RoCa- and Magnum power plants in the Netherlands
- Air quality modeling of large harbors like the Westerschelde container terminal and the second Maasvlakte
- Determining particulate matter emissions of storage & handling companies, commissioned by the Dutch Ministry of Infrastructure and Environment
- Study of the influence of extreme meteorological events on the air quality in Qatar
- Modeling the influence of wind turbines on air quality and odor near waste-to-energy plants in the Netherlands
- Air quality and nitrogen deposition modeling for the Dutch national agency 'Service for Traffic and Ship Transport'

DNV KEMA and the Dutch National Aerospace Laboratory (NLR) have joined forces together, bringing a solution to deliver an integrated and complete insight to assess and manage local air quality around airports. The integrated approach of DNV KEMA and NLR has been applied successfully for amongst others Amsterdam Schiphol Airport and Kunming Airport (China).

SHIPPING AND AIR QUALITY

In the vicinity of major waterways and harbors shipping emissions have to be included in the analysis to present the local air quality properly. Unlike as for stationary sources, there is no generally accepted modeling approach to include the shipping emissions. The shipping emissions in STACKS+ include three different 'emission-modes' for ships in harbors: passage or transit, maneuvering, and moored with generators running. Moreover, ocean shipping is discriminated from inland shipping because of differences in thermal energy releases and emission heights. Applying this methodology, it is shown that measured concentrations on land can be explained in a reasonable way.

HOW CAN DNV KEMA ASSIST YOU?

DNV KEMA has the necessary expertise, technology and experience to be of service to you for complex projects in the field of air quality. For 'regular' air quality calculations for road traffic and industrial sources, the STACKS+ module is included in the Geomilieu software package (for the compounds NO_x, PM₁₀, PM_{2.5}, EC, SO₂, benzene, BaP, CO, Pb and odor). Geomilieu is a product of the Dutch company DGMR. The STACKS+ model can handle complex situations that other models are incapable of processing. Also calculating Nitrogen deposition (NO₂+NH₃) originating from road traffic, industry and cattle farms using STACKS+ is common practice.

Modeling complex situations such as airports and harbors is a custom-made service. Although STACKS+ is developed in the Netherlands, it can well be applied in other countries since the parameterization (including meteorology and emission factors of traffic) is not restricted to one country.