3.6 Odour

3.6.1 Systematic determination of acceptable nuisance levels

System used for classifying nuisance caused by odour
The purpose of the system used for classifying nuisance caused by odour is to harmonise as much as possible the part of the procedure that the licensing authority must follow in determining what constitutes an acceptable nuisance level. Determining the acceptable nuisance level consists on the one hand of an indication, qualification and/or quantification of the degree of nuisance that is relevant to environment protection efforts. On the other hand it entails considering or assessing what is acceptable on the basis of this nuisance level, the local situation (taking into account inter alia physical planning and socio-economic aspects), as well as business economics aspects. In order to determine the degree of nuisance the following classification system has been drawn up: considerations which may play a role at the local level in order to reach a well-considered decision were not worked out in detail, as this cannot meaningfully be done in general terms.

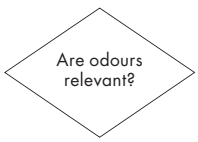
Central to the classification system is a description of the procedure to be used, which requires a number of distinct steps to be described. The final step is a structured summary which must be delivered in the form of a step-by-step schedule. At specific moments during the procedure it is indicated what research methods can be utilised for assessment. In the step-by-step schedule these same points in time are indicated. More than one method is usually available, which may be used in combination if necessary. The methods can give an indication, or yield qualitative or quantitative information. In table 1, §3.6.2 the available methods are indicated together with the situations in which they can be used. In §3.6.3 these methods are discussed in more detail.

Application
The system used for classifying nuisance caused by odours is a tool for the licensing authority to be used for handling the aspect of odour nuisance in a well-considered manner. The classification system does not yield values. The result is a conclusion which forms part of the information which the competent authority needs in order to take a well-considered decision within the framework of processing an application, specifying requirements or measures to be taken as a follow-up of inspections carried out.

It is important that the underlying motivation is explained sufficiently. When issuing permits, but also for example within the framework of drawing up zoning schemes it is necessary to not only indicate the conclusion regarding the acceptable nuisance level but also the grounds for the decision. As was mentioned elsewhere, the nature of the required information is many-faceted. In the end the licensing authority will fix the acceptable nuisance level on the basis of a careful consideration of all relevant factors. This level can be expressed using a number of parameters: no parameters, a percentage of people complaining of odour nuisance, a number of odour units. This careful consideration results in a policy based on fairness (ALARA). For further information regarding such an approach please refer to §2.1 of the NeR.

Description of the procedure
The procedure described below illustrates how the aspect of odour nuisance might be handled under the actual conditions. The rectangles indicate that action must be taken; the diamonds indicate that a choice or decision must be made. No explicit distinction is made between existing and new situations; the difference will be self-evident while executing the procedure.

An initiative to start discussions/negotiations may be taken, to mention a few situations, within the framework of an application for a permit, an environmental impact report or a corporate environmental policy plan.



At the beginning it is assessed in broad terms whether addressing odours should be a concern with a view to the nature of the facility.
Tools that may be used in this context are:
- listings of operations known to produce odours;
- Tables 1 and 2 from the publication *Bedrijven en milieuzonering* (Companies and environmental zoning; 1999, VNG publications);
- list of operators of cat. 1 (refer to Appendix 4.4);
- Amended policy document on odour, Table b6.1;
- experience with this type of operation.

On the basis of this information it will be established whether the facility is a relevant source of odour emissions or not.

No further action required

Where odours are apparently not relevant no further action will be required; beyond this the chart is not applicable.

Preliminary research: rough indication

If odours are an issue, it will be checked in the course of the preliminary research whether sufficient information is available to allow further assessment.

The preliminary research must be such that it is possible to answer the question of whether the odour emissions are of a nature that odour nuisance could occur. During the preliminary research the situation at the facility in question is inspected. In this context attention should be given to, among other things:

- environmental factors (for example siting, distance to environments sensitive to odours, spatial developments);
- the measures referred to in the application (for example collecting background information on processes and potential measures).
- indications regarding the nuisance level (for example complaints by the neighbourhood).

With the aid of indicative research methods (please refer to §3.6.2) insight into these aspects can be obtained

Potential nuisance?

On the grounds of the preliminary research it will be determined whether the facility in question could conceivably cause odour nuisance, now or at some time in the future.
If this is not the case then no additional measures will be necessary. It may be considered in that case to include a standard clause that gives the competent authority the right to demand further research (inspection) should nuisance occur later on; this is a so-called safety net clause.
If it concerns a potential nuisance situation, then it will be checked whether there are any standard sets of requirements available, or whether industry wide investigations have been carried out.

Categorie 1 operator?

If it concerns a category 1 operation the Special Regulations for the sector of industry concerned will be applicable. An industry wide investigation yields information such as the typical nuisance level and the associated set of standard abatement measures. The point of departure will be that in most cases the measures will result in an acceptable nuisance level.

Standard measures?

'Standard measures' in this context means measures which have not been stipulated within the framework of category 1 arrangements but which may nonetheless have (limited) general applicability when the situation is considered in a different perspective.
This could for example be measures in inspection guidelines, General Administrative Orders and the KWS2000 programme.
Especially in the case of certain kinds of small operations (such as car respraying and the catering industry) this type of guidelines will usually provide the standard set of measures that must be applied.

Exception necessary?

If the measures mentioned in reports on industry wide investigations or in standard sets of requirements do not result in an acceptable nuisance level in a given situation, it is possible for the competent authority to provide otherwise if the decision is taken on duly stated grounds. This situation may occur if an operator occupies a special position within his sector of industry or if the local situation renders it necessary.

Sufficient information to establish nuisance level?

At this node it must be decided whether it is necessary for proper assessment of the odour nuisance situation to carry out further research. Aspects which must be considered in this context are:

- the scale of the emissions;
- the impact of the measures envisaged;
- the characteristics of the surrounding area;
- the degree of (potential) nuisance to the surrounding area.

In deciding that supplementary research is needed it should be kept in mind that the effort put into the inspections must stand in reasonable proportion to the problem at hand.

If necessary: research

Where there is still insufficient insight into the nuisance level it may be necessary to carry out supplementary research. This research may target qualitative and/or quantitative aspects. The distinction between qualitative and quantitative made here must not be taken to mean that the latter type of information is regarded inferior; it is made to allow different methods to be categorised, and also to demonstrate the different results obtained by different methods (please refer to §3.6.2). Qualitative methods yield objective information on the situation. Quantitative methods yield a value for the parameter considered which can be reproduced at will. The effort put into a research project must stand in reasonable proportion to the problem. If it is found that quantitative and qualitative research is not feasible for one reason or other (for example for technical reasons connected to the research), it will be necessary to pass a verdict about the nuisance level in that specific situation on the basis of information collected earlier.

Has nuisance level been established?

On the basis of research it has been determined what measures can be taken and which residual nuisance level will probably result from these. The competent authority must deliberate whether this nuisance level is acceptable.

Collect information regarding technical, financial, socio-economic and planning aspects

Parallel to the procedure described above, information must be collected on technical, financial, socio-economic and planning aspects. In combination with the information on the nuisance level it will be possible to draw a conclusion regarding the nuisance level that can be considered acceptable.

Conclusion

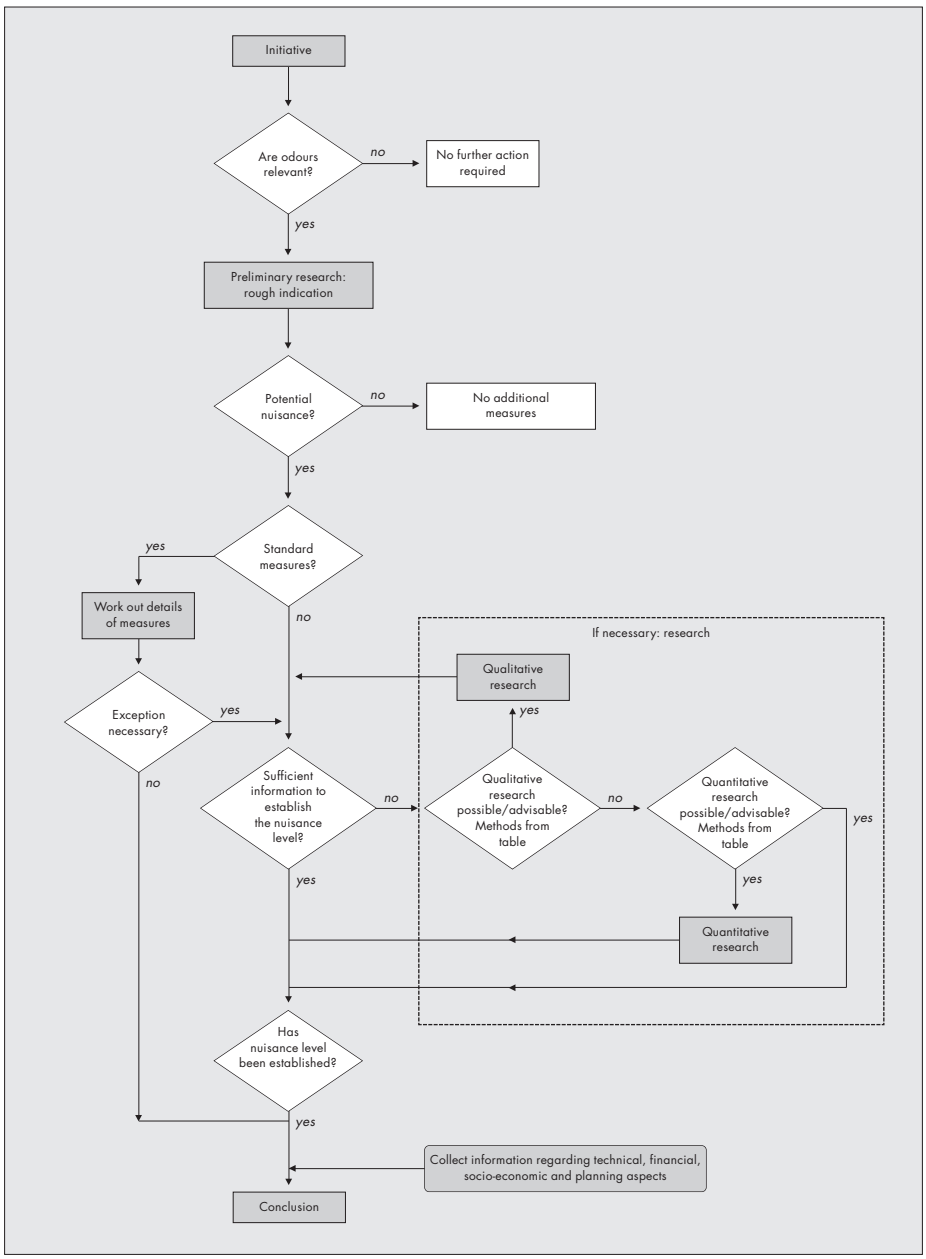
The competent authority decides whether the resulting nuisance level is acceptable. The possibilities are: the nuisance level is acceptable, is not acceptable or the nuisance level is acceptable when additional measures are taken. Additional measures may consist of, for example:

- additional facilities (in addition to the facilities already mentioned in the application or in the document on the industry-wide investigation);
- organisational measures (for example limiting activities which cause odours, or limiting them under adverse weather conditions);
- planning measures (for example siting considerations).

The conclusion may have consequences for the application, the permit requirements or the verification procedures laid down for the measures (to be) taken.

Phased schedule

The diagram illustrates in a structured manner how the aspect of odour nuisance might be handled under the actual conditions. Usually the route in the middle (bold arrows) of the diagram will be taken. In the diagram no specific distinction is made between existing and new situations. In the case of new situations research will in most cases be limited to indicative methods (please refer to §3.6.2). 'Rectangles' indicate that action must be taken; 'diamonds' are decision points where only one of the options given can be selected.



3.6.2 Categories of research methods into odour

In Table 1 a number of methods is mentioned by which the nuisance level can be determined. The methods are subdivided into the categories indicative, qualitative and quantitative. In addition, it is also indicated in the table which methods are preferred in the case of a certain category ('preferential') and which methods are possible if necessary('possible'). Within this subdivision the order in which the methods are mentioned is not significant. The manner in which they will be utilised determines the requirements to be stipulated for the method. For example, a method which is used to obtain a rough indication does not need to be as accurate as a method which must yield quantitative information. Which methods are considered also depends on whether it concerns an existing or a new situation.

The key characteristics of the three categories are:

- *Indicative*
  Methods which yield a rough indication are generally subjective or, in most cases, not specifically geared to the situation at hand. Practically, such methods are often used together with other methods. In this way they provide *insight* into the scale of the nuisance (if any).
  Key words in connection with these methods are:
  - time required: limited
  - application: simple
  - result: subjective
  - accuracy: crude estimate
  - costs: cost effective

- *Qualitative*
  Qualitative methods yield objective information on the nuisance experienced. These methods are utilised when it is not possible on the basis of the indicative methods to obtain sufficient insight. In the case of complaints analysis, which bears the predicate 'preferential' when used to obtain both indicative and qualitative information, this entails subjecting the available data to greater scrutiny. Key words in connection with these methods are:
  - time required: variable (TLO: Research by telephone into living conditions: 4–6 weeks, neighbourhood panel and complaints analysis 0.5–2 years)
  - application: separate research required (possibly under your own supervision)
  - result: objective *insight* into odour nuisance situation
  - accuracy: depending on method
  - costs[1]: TLO: € 9,000–13,500; costs of neighbourhood panel and complaints analysis (including preparatory work) > € 13,500

- *Quantitative*
  Quantitative methods provide a reproducible, objective *value* of the parameter being considered (odour emissions, odour nuisance, complaints, etc.). These methods are utilised when it is not possible on the basis of the indicative and qualitative methods to obtain sufficient insight into the situation at hand. Key words in connection with quantitative methods are:
  - time required: several weeks to more than a year
  - application: requires specific research
  - result: an objective *figure* regarding the odour nuisance situation
  - accuracy: depending on method
  - costs: emission measurements start at € 4,500 and can cost as much as, in the case of many sources, more than € 45,000

When it concerns a *discontinuous* or *fluctuating source,* the output of the source can only be determined through emission measurements if the period during which emissions take place is sufficiently large.

In the case of *complex sources* spread over a larger area it is possible to carry out research into the nuisance being experienced and complaints analyses. The standardised CBS poll is suitable for collecting background information. Measurements by 'smelling squads' are difficult to carry out in the case of sources of substantial size or with a distributed emission pattern (as far as emissions are concerned).

In the case of *new facilities* being added and in the case of entirely new situations research into the nuisance being experienced locally is not an option. Potential methods for use in this situation are comparisons with similar operations and processes at other locations, the list of operators in the publications *Bedrijven en Milieuzonering* (Operators and Zoning for Environmental Protection, 1999, VNG Publishers) and *Handboek Modelvoorschriften Luchtverontreiniging* (Manual of Model Requirements for Air Pollution Abatement), available information on the hedonic scale, etc.

[1] The given costs are a mere indication; therefore they have been rounded off.

Table 1 Research methods for odours

	Preferential	Also possible
Indicative (insight)	*Signal* • complaints records • complaints analysis • public enquiries procedures *Background information* • similar situations • literature *Field observations* • personal observation	*Subjective assessment of nuisance* • hedonic scale *Odour concentration* • choice of certain odour concentration
Qualitative (impression)	*Signal* • complaints analysis *Subjective assessment of nuisance* • neighbourhood panel [2)] • nuisance polls (TLO) [1)] *Combination* • measurements by smelling squads with complaints analysis *Odour concentration* • emission measurements with dispersion calculations [3)]	*Background information* • similar situations *Field observations* • personal observation • smelling squads *Odour concentration* • hedonic scale • choice of odour concentration
Quantitative (value)	*Combinations* • measurement by smelling squads with hedonic scale • emission measurements with dispersion calculations • hedonic scale • nuisance polls (TLO) • immission data on similar situations • research into subjective assessment	*Signal* • complaints analysis *Field observations* • smelling squads *Subjective assessment of nuisance* • research into subjective assessment [1)] • nuisance polls (TLO) [2)] *Odour concentration* • emission measurements with dispersion calculations [3)]

For the applicability of a given method certain environmental factors are also important

1) Densely populated area; a sufficient number of people live in the vicinity of the source so that a sufficient number of respondents may be expected.

2) It concerns a single source in a densely populated area.

3) This method is only practicable if the calculated immission concentrations are evaluated using a certain quality assessment.

3.6.3 Description of research methods into odours

Below a short description is given of the research methods referred to in Table 1 of §3.6.2. The methods are grouped together on the basis of how the information on the odour situation is obtained, in the categories:

- signals from citizens;
- background information;
- field observations;
- research into nuisance levels;
- determining the odour concentration;
- combination of methods.

Signal

Characteristic for the methods mentioned below is that they are triggered by an action by citizens.

Complaints records

Complaints records result from the ongoing and systematic collection of co mplaints for the purpose of gaining an insight into the nature, the scale and the cause of complaints. The data logged include information on the time, location and nature of the complaint, weather related information, cause and operator responsible. Also important is the accessibility of the central reporting point for complaints. The result is the accumulated body of complaints on a per source basis. This method has its applicability as a good and cost effective indicator of the situation. The reliability is area-dependent. The result of this method can be influenced through the media and the like.

Complaints analysis

On the basis of data obtained using the complaints records it will be determined which source(s) caused the complaint and the complaint will be verified (i.e. it will be determined whether the complaint is justified). It will be investigated whether these source(s) cause complaints on a regular basis. In most situations complaints are lodged with municipalities or provincial authorities. If this instrument is used actively an operator can immediately indicate himself which operations or processes are responsible and take preventive action if necessary. Elements which have proven their worth in this context are, in addition to adequate keeping of complaint records, the special conditions at the source, media coverage or other activities in the vicinity of the source which affect the operations, and feedback to the person(s) that lodged the complaint(s). The result is a chronological list on a per source basis of the complaints lodged, with potential causes or special conditions being indicated. When compared to the previous method the susceptibility to being influenced is reduced and the understanding of the situation is improved.

Public enquiries procedures

When an operator applies for a permit his application is published together with the provisional decision. Subsequently people living in the neighbourhood can bring forward any reservations they may have. After a decision regarding the application for a permit has been taken the people living in the neighbourhood are given the opportunity of lodging an appeal. The nature and scale of the reservations being voiced (including the absence of such reservations) constitute important information. Due to the transparency of the unambiguously described procedure the method is accurate but without any predictive value. Due to the fact that the method is part of a wider assessment framework the possibility exists of it being influenced by internal or external factors.

Background information

Collecting background information is an often used and cost effective method. Although the accuracy depends on the degree of similarity between the cases considered the relevancy of the results is considered as high. A potential disadvantage is that this method can easily occasion manipulation attempts through a biased selection of the sources of information.

Similar situations

On the basis of certain similarities it is ascertained which information from other, similar situations can be used (technical specifications, nuisance data, emissions, environmental factors, etc.). In order to find out whether similar situations exist elsewhere you can contact InfoMil or the umbrella or trade organisation concerned.

Literature

For example:

- *VNG booklet*
  The *Vereniging van Nederlandse Gemeenten* (Association of Municipalities in The Netherlands) has published a booklet entitled '*Bedrijven en Milieuzonering* (Operations and Environmental Zoning)' (1999). In this booklet distances are specified for various sectors of industry which have the status of recommended values for physical planning purposes. For odours, too, such distances are quoted. They constitute a guideline for the licensing authority and provide a first indication of the potential burden to the surrounding area.
- *Handboek Modelvoorschriften Luchtverontreiniging* (Manual of Model Requirements for Air Pollution Abatement)
  The *Handboek Modelvoorschriften Luchtverontreiniging* (Manual of Model Requirements for Air Pollution Abatement, 1991) contains lists of processes and substances which cause odours. On the basis of these lists it can be ascertained whether and to what extent a process may cause odour nuisance.
- *SPIN documents*
  In these documents processes are described for a number of sectors of industry including the associated environmental impact. On the basis of these data it is possible to assess whether it concerns an operator which could potentially cause odours. These documents can be ordered from the *Rijksinstituut voor Volksgezondheid en Milieuhygiëne* (National Institute of Public Health and the Environment, RIVM).
- *Listings of operations known to produce odours*
  In the Annex to the *Herziene Nota Stankbeleid* (Policy Document on Odour Nuisance, as amended, 1994) a list is given of operations which may cause odours , sorted by their SBI code. This list is a selection of the listings in the VNG publication.

Field observations

Personal observation

Observation on the spot of the odours and subsequent assessment by a public official and/or a representative of the operator. It is important in this context that the observations are recorded accurately, noting the conditions during which the odours occur and the process conditions at the operator's. The result is an indication of the distance at which the source can be detected, as well as an indication of the subjective impact of the odours. This method is recommended as a precursor to other types of research. The method is especially valuable for obtaining a general feel of the situation.

'Smelling squads'

Investigations by smelling squads can be carried out for various purposes. The main purpose is to establish the exposure to odours in the open air resulting from one or more sources of odours produced by a single facility. During an investigation by a smelling squad an integral measurement in the field is carried out for the entire operation. The detectability of the odours produced by an operation is investigated by determining how far from the operation odours can still be detected with the aid of a panel of 'smellers' in the field. The output of the source can subsequently be calculated on the basis of the distance found and a short term dispersion model based on the National Model.

For further information regarding the pros and cons of measurements by smelling squads please refer to the document *Meten en Rekenen Geur* (Measurements and Calculations for Odours). This document has been published as No. 115 in *Publikatiereeks Lucht* (Publication Series Air, December 1994). The result is an indication of the distance at which the source can be detected, as well as the calculated output of the source. The method using smelling squads is relatively cheap and is considered as very useful. One should keep in mind, however, that the result is an indication of the detectability and not of the nuisance level.

In the case of a *grid screening* one or more observers sit down at previously selected locations and for the duration of one hour they record once every minute whether they can detect anything. The result indicates with which frequency odours can be detected in the vicinity of a source. This method is used in Germany. In the Netherlands this method has not been standardised yet.

Subjective assessment of nuisance

Research into subjective assessment

In the vicinity of a source, people living in the neighbourhood (a so-called neighbourhood panel) are asked to make periodic observations in the open air on a structural basis and to provide their judgement regarding the odours. The data collected by the panel are given a certain weighting. This judgement can be worded in terms ranging from 'not objectionable' to 'very objectionable' (cf. odour nuisance index, SHI) or in a qualitative form (using a hedonic scale). Opinions regarding the usefulness of the SHI index are divided. Generally speaking the applicability, also with a view to the susceptibility to external influences, is considered limited. An example of the method has been described in publication series: '*Stankbeleving in de woonomgeving* (Subjective assessment of objectionable odours in residential areas)' from the *Publicatiereeks Lucht* (Publication Series Air, no. 50, 1985). The result is an index for the nuisance experienced at a given moment in time. Due to the fact that memory effects are absent from the opinions given this research provides insight into the effect of abatement measures. By using a neighbourhood panel in the case of complaints it is often possible to quickly obtain an indication of the type of odour involved and the potential source. Under the actual conditions, when a complaint is lodged the neighbourhood panel is immediately asked to carry out observations locally. The panel verifies the complaint, so to speak, and is sometimes able to say where the odours originate. Members of the panel can be recruited from tenants' organisations, employees and/or other affected people living in the neighbourhood.

Nuisance polls (TLO: Research by telephone into living conditions)

Nuisance polls measure the subjective assessment of nuisance by the population by asking questions the purpose of which is not immediately obvious. With the aid of these polls among hundreds of respondents in the vicinity of an operation the (serious) nuisance caused by an operation is measured as a function of the distance to the respondents' dwellings. The people responding to the polls think they are being asked about how they experience their living environment. For an elaborate description of nuisance polls and research by telephone into living conditions (TLO polls) in particular, please refer to the document *Meten en Rekenen Geur* (Measurements and Calculations for Odours), No. 115 in Publication Series Air 1994). In this document the applicability of TLOs under actual conditions is discussed in detail. Nuisance polls can also be conducted in written form or face to face. If polls are conducted it is important that the sample size is sufficiently large.

The result is the percentage of respondents who indicate that they experience nuisance as well as the degree of nuisance subjectively perceived. In this way a useful understanding of the nuisance felt to exist by the population can be gained.

Data on odour concentrations

Hedonic scale

A sample of an odour is presented, in a sufficiently high concentration, to a panel of observers who are asked to provide a judgement regarding the quality of the odour. This quality must be described using terms in a range between very pleasant through neutral to extremely unpleasant. Depending on the graduation of the scale used the odours can be assigned a score. Note, though, that the assessment given is only valid for the odour concentration being presented. A detailed description of hedonic reference scales can be found in the report entitled Aanvaardbaarheidsgrenzen voor geur, fase 1 en fase 2 (Acceptability limits for odours, phase 1 and phase 2), No. 70 in Publication Series Air. The result of the method is the hedonic value for the odour considered. In the Netherlands a standardised method for this has not been developed yet and it is therefore not possible to make any statement regarding its applicability; this method must therefore be used preferentially together with other methods. It is valid, however, to interpret the results for determining the direction further action will have to take, especially where extreme results are obtained.

Emission measurements (followed by dispersion calculations)

In the case of emission research all relevant sources of the operation to be checked are sampled. The samples obtained are analysed by olfactory measurements according to standardised methods with the aid of a selected panel. From the results obtained (in ou_E/hour) subsequently the contribution to the odour concentration in the surrounding area is calculated using the applicable National model.
For a detailed description of emission research and its practical applicability please refer to the document *Meten en Rekenen Geur* (Measurements and Calculations for Odours), No. 115 in Publication Series Air. The result is the odour emission from the source in odour units per hour and the odour concentration contributed to the surrounding area calculated on the basis of that (in ou_E/m^3, for example as an 98th percentile value). Emission measurements have a broad applicability but the costs involved vary enormously. Unless combined with other methods the method does not yield unambiguous information regarding the nuisance situation, but rather an insight into the sources present.

Selecting an odour concentration
On the basis of experience gained during assessment of similar processes or odours an odour concentration can simply be selected for which it is assumed that the nuisance level is acceptable.

Possible combinations of methods
The following quantitative methods are combinations of several individual methods. Depending on the pros and cons of a given individual method it is possible in a specific situation to opt for a combination of methods.

Measurements by 'smelling squads' using a hedonic scale
The result is a distance at which the odour can still be detected with a quality assessment regarding the odour in question.

Emission measurements using a hedonic scale
The result is an odour emission/odour concentration value with a quality assessment regarding the odour in question.

Emission measurements with TLO: Research by telephone into living conditions
The result is the correlation between the calculated odour concentration and the nuisance measured using the TLO.

Measurements by 'smelling squads' with complaints analysis
The result is a distance at which the odour can still be detected plus a list of all complaints within the area involved.

Emission measurements with a fixed odour concentration
The result is a contour at a certain distance which corresponds with the selected concentration.

Emission measurements with research into subjective assessment
The result is the correlation between the calculated odour concentration and the subjective nuisance level measured using the research into subjective assessment.