

## Development of an Odour Policy for a Local Government

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The Dutch Act 'Wabo' lays down the rules for granting an "All-in-one Permit" for Physical Aspects, including environmental permits and odour policies for companies. Odour legislation has been decentralized to local governments. Depending on the situation the provinces or municipalities are the competent authority to issue permits. In most cases the mayor and aldermen now hold authority to grant or refuse an All-in-one Permit. In a few cases, the provincial executive or relevant minister holds this authority. Local authorities may develop their own odour policy within general national defined rules. These rules are:

- if there is no nuisance, no mitigation measures to reduce odour emissions are necessary;
- in case of an unacceptable level of nuisance companies have to apply best available techniques to reduce the nuisance;
- the competent authority defines which level of nuisance is acceptable.

The city of Helmond is situated in the south of the Netherlands. It is an industrial city with large odour emitting industries, especially food and feed industries and intensive livestock farms. Major odour producing industries and farms are situated in the centre of the city or south from neighbourhoods. Residents of these neighbourhoods complain about odour nuisance. Also the spatial development of old industrial estates in the centre of the town is complicated due to existing permitted odour contours. An additional complicating factor is the fact that the province of Noord Brabant is the competent authority for the major odour emitting companies in Helmond.

For these reasons Helmond decided to develop a local odour policy. Buro Blauw was asked to assist in the development of this odour policy. The major goal of this policy is to define a balance between a good environmental quality for odour and a good establishment for business. This policy consists out of:

- Applying the odour policy of the province of Noord Brabant;
- Applying best available techniques to reduce odour nuisance;
- An acceptable odour nuisance level based on the hedonic tune of the emitted odours;
- The cumulative odour concentration;
- Applying the systemic of the national health authorities for defining the health quality of the living environment on the basis of the odour exposure;
- A standard for the cumulative ambient odour concentration applicable for new activities or expansion of existing activities.

### 1. Introduction

The Dutch national odour policy aims to reduce existing odour nuisance and to avoid odour nuisance caused by new activities. This policy consists out of following general rules:

- if there is no nuisance, no mitigation measures to reduce odour emissions are necessary;
- in case of an unacceptable level of nuisance companies have to apply best available techniques to reduce the nuisance;
- the competent authority defines which level of nuisance is acceptable.

In most cases the municipality is the competent authority for environmental permits. The Dutch Act 'Wabo' lays down the rules for granting an "All-in-one Permit" for Physical Aspects, including environmental permits and odour policies for companies. Most companies do not require an All-in-one Permit for Physical Aspects for

the environmental aspect. The Activities Decree and possibly other environmental regulations are applicable to them. If a company does require a permit, then a part of the Activities Decree is applicable. Usually, the municipality is the competent authority. The province can only be the competent authority for certain complex industrial companies (such as IPPC companies) and closed landfills. For some special companies, a government minister may be the competent authority.

The community of Helmond, a city of 90.000 inhabitants, faces serious challenges to reduce odour nuisance. In the south of the city the industrial zone BZOB is situated. The residential area Brouwhuis is located in the dominant wind direction at a close distance of BZOB. Several odour emitting industries are situated at BZOB. Since several years some companies situated on BZOB are causing complaints about odour nuisance in the residential area Brouwhuis. The municipality of Helmond wants to take actions to reduce the existing odour nuisance to an acceptable level and to avoid odour nuisance caused by new settling companies. Furthermore the development of a former business area in the centre of the town to a residential area is complicated by the permitted odour emissions of odour producing companies in the vicinity.

For these reasons the municipality started to develop a local odour nuisance policy. Buro Blauw was contracted to support the local government with development of this odour policy. Buro Blauw is a Dutch consultancy agency specialised in odour research. Cumulation of different kind of odours arising from different companies plays a dominant role in this development process. But also legal issues involving cumulation within permitting individual companies are discussed.

## 2. Theoretical background

The central goal of the local odour policy of the municipality of Helmond is to establish an equilibrium between the environmental quality in neighbourhoods with respect to odours and the possibility for odour producing companies to settle in Helmond. This equilibrium is defined by the acceptable odour nuisance level. If this acceptable level is established there is a good environmental quality with respect to odour nuisance.

This acceptable odour nuisance level is depending on many factors, of which the most important are:

- The level of odour exposure, expressed in the odour concentration that occurs during a certain period of time;
- The pleasantness of the odour expressed in the hedonic tune of the odour.

The odour exposure that is caused by a company in a residential area can be established by general accepted and normalized methods. An odour emission measurements consist out of the measurement of the judgement of the measurement plane according to EN 15259 (CEN, 2007), the flowrate according to ISO 10780 (ISO, 1994), sampling of flue gasses and olfactometric determination of the odour concentration according to the European standard EN 13725 (NEN, 2003). In the Netherlands also the Dutch guideline NTA 9065 (NEN, 2012) is applicable. In the Netherlands the hedonic tune is measured according to the preliminary guideline NVN 2818 (NEN, 2005). The hedonic tune of an odour sample is determined in an odour laboratory, using the same odour panel and the same sample in which the odour concentration has been analysed. Panelists are presented several odour concentrations of the sample in an ascending order. At each observation they have to judge the hedonic tune on a scale ranging from +4 (extremely pleasant), over 0 (nor pleasant, nor unpleasant) to -4 (extremely unpleasant). As a result the relation between the odour concentration and the hedonic tune of the analysed odour sample is obtained.

Nuisance is to be expected from a level where slightly unpleasant odours occur in residential areas, so at hedonic tunes less than zero. The hedonic tune can be used in different ways to define odour exposure limits in environmental permits:

- Using the concentration with a certain hedonic tune as an exposure limit in the permit. For instance an odour concentration with a hedonic tune of -0.5 ( $H=-0,5$ ) may not occur in residential areas during 98% of the time per year (the 98 percentile value);
- Using the hedonic tune to classify odours in classes of nuisance – very annoying odours; annoying odours; slightly annoying odours; not annoying odours – and define odour exposure limits for each class;
- Normalize all emissions of a facility to a certain hedonic tune, for instance the value -1 and define odour exposure limits for these normalized emissions. The normalized emissions are calculated with Eq(1):

$$Q(H)_i = Q_i/C_i(H - 1) \quad (1)$$

Where:

$Q(H)_i$  = the normalized odour emission of source i [ $ou_E(H)/s$ ]

$Q_i$  = the odour emission of source  $i$  [ $ou_E/s$ ]  
 $C_i(H-1)$  = the concentration at a hedonic tune -1 of source  $i$  [ $ou_E/m^3$ ]

The normalized emissions of all sources are entered in to a dispersion model and the odour exposure is calculated and compared with the odour exposure limit.

The hedonic tune can be used to predict the nuisance potential of odours. The Dutch Health Authorities development a method to explore the health effects of different environmental stressors like odour and noise. This health effect screening (Fast et al, 2012) predicts the environmental health quality for odour exposure in a residential area on the basis of odour exposure expressed in the hedonic tune. This relation is shown in table 1.

*Table 1: Environmental health quality (HES score) in a residential area as a function of the odour exposure expressed in the hedonic tune of the odour*

Odour nuisance [% of total population]		Exposed odour concentration	HES score <sup>1</sup>	Environmental health quality
Annoyed	Severe annoyed	with hedonic tune		
0	0		0	Very good
0-5	0	0 tot -½	1	Good
5-12	0-3	-½ tot -1	3	Fairly moderate
12-25	3-10	-1 tot -2	4	Moderate
≥ 25	≥10	≤ -2	6	Inadequate

1: HES: Health effect score.

The relation between odour exposure and environmental health quality given in table 1 can be used by local governments to define an acceptable odour nuisance level that they can employ in environmental permits. Existing companies already have legal rights in their environmental permit that legally cannot be ignored when a new permit is issued. Often for existing odour emitting companies a less strict odour exposure level is applied than for new settling companies.

### 3. The odour situation in the city of Helmond

Helmond is a traditional industrial city with 90,000 inhabitants. In Helmond there are more than 80 companies that emit odours. For most of these companies best available techniques to reduce odour nuisance to an acceptable level can be applied. There are 9 companies with relevant odour emissions. These are two pig slaughter houses, three animal feed companies, two meat processing industries, one asphalt plant and one manure processing plant. The province of Noord-Brabant is the competent authority for the environmental permit of the animal feed companies and the manure processing plants. These are the companies with the highest odour emissions.

The slaughter houses, one animal feed company and the manure processing plant are situated on the business area BZOB, south of the residential area Brouwhuis. Residents of Brouwhuis complain about the smells coming from these companies. The odours coming from these companies cumulate in Brouwhuis with southern wind directions. Wind from the South West is dominant in the Netherlands.

From January 2013 to July 2014 more than 170 complaints were reported. Although some mitigation measures to reduce odour immission were taken, the number of complaints did not decreased significantly.

### 4. The local odour policy

The goal of the local odour policy is to ensure a balance between a good environmental health quality for odour and a good business climate. Settled companies have licensed production rights, that are responsible for the current odour exposure in Helmond. The local odour policy focuses on ways to reduce the current odour exposure by enforcement and to avoid an increase in odour exposure due to new settlement of odour emitting companies. Odour rules for new companies can be stricter than the rules for existing companies.

The choice of the acceptable odour nuisance level plays a dominant role within the local odour policy. Determining this level is a political choice of the municipality. Helmond decided to follow the odour policy of the province of Noord-Brabant (Noord-Brabant, 2011). This policy is based on the normalized odour emission for  $H = -1$ . The acceptable odour nuisance level is different for existing and new settled companies. There also

are different acceptable odour exposure levels for differences in land use. Finally 2 sets of exposure levels are used, namely the 98 and 99.99 percentile exposure level, representative for respectively the average emission of a company and the peak emissions. The acceptable odour nuisance level according to this policy is summarized in table 2.

*Table 2: Summary of the acceptable odour nuisance levels defined in the local odour policy of the municipality of Helmond*

Land use	Acceptable odour exposure level			
	[ou <sub>E</sub> (H)/m <sup>3</sup> 98 percentile]		[ou <sub>E</sub> (H)/m <sup>3</sup> 99,99 percentile]	
	New companies	Existing companies	New companies	Existing companies
Residential areas	0,5	1	5	10
Mixed use	1	2	10	20
Business areas	10	10	100	100

Table 2 shows that in the provincial and local odour policy, the acceptable odour exposure level existing companies in residential areas is set at an odour concentration for which H=-1. Compared with the Health Effect Scores in table 2, this leads to a fairly moderate environmental health quality for odour. Given the fact that existing companies have legal odour emission rights, this is a realistic choice.

For new companies an acceptable odour exposure level twice as strict is applicable. This value cannot be compared directly with the HES scores in table 2. Given the uncertainties in odour research it may be stated that the acceptable odour exposure levels for new companies in residential areas will lead to a good environmental health quality for odour.

With this set of standards the municipality Helmond can work to gradually improve the environmental health quality for odour in Helmond. They are applicable in issuing environmental permits for existing and new businesses. However cumulation of odours due to settlement of new odour emitting companies, or due to expansion of existing companies cannot be avoided by this sets of rules. For that reason the effects of cumulation was studied. The results of this study and the way cumulation of odours of different companies is included in the odour policy of the municipality of Helmond are discussed in the next chapter.

## 5. Cumulation of odours from different companies

Several odour emitting companies are settled on the business area BZOB, in the dominant wind direction towards the residential area Brouwhuis. Inhabitants of Brouwhuis complain often about odours coming from companies situated in BZOB. The municipality of Helmond wants to prevent an increase in the cumulative odour exposure in Brouwhuis. The normalized odour emission for a hedonic tune value however makes it possible to cumulate different odours by their potential to cause nuisance.

Buro Blauw has calculated the cumulative odour exposure in Brouwhuis in the licensed situation in 2016 (Dingemans et al, 2016). The cumulative odour exposure is expressed in the normalized odour concentration based on H=-1. The licensed odour emissions of the 9 relevant odour emitting companies, all company specific relevant information about odour sources, and information about the hedonic tune of all emitted odours was collected. The cumulative normalized odour concentration of 1 ou<sub>E</sub>(H)/m<sup>3</sup> as a 98 percentile was calculated with the Dutch national dispersion model. Figure 1 on the left shows the cumulative odour contours of a good (H=-½), a fairly moderate (H=-1) and moderate (H=-2) environmental health quality for odour, according to the HES score. Based on the calculations, the municipality of Helmond has decided to maximize the cumulative exposure to the current legal cumulative odour exposure in Brouwhuis. Within the local odour policy a cumulative odour exposure limit is set to the current level of cumulative odour exposure of 1.2 ou<sub>E</sub>(H)/m<sup>3</sup> as 98 percentile. The cumulative odour contour of this cumulative odour exposure level is shown in figure 1 on the right.

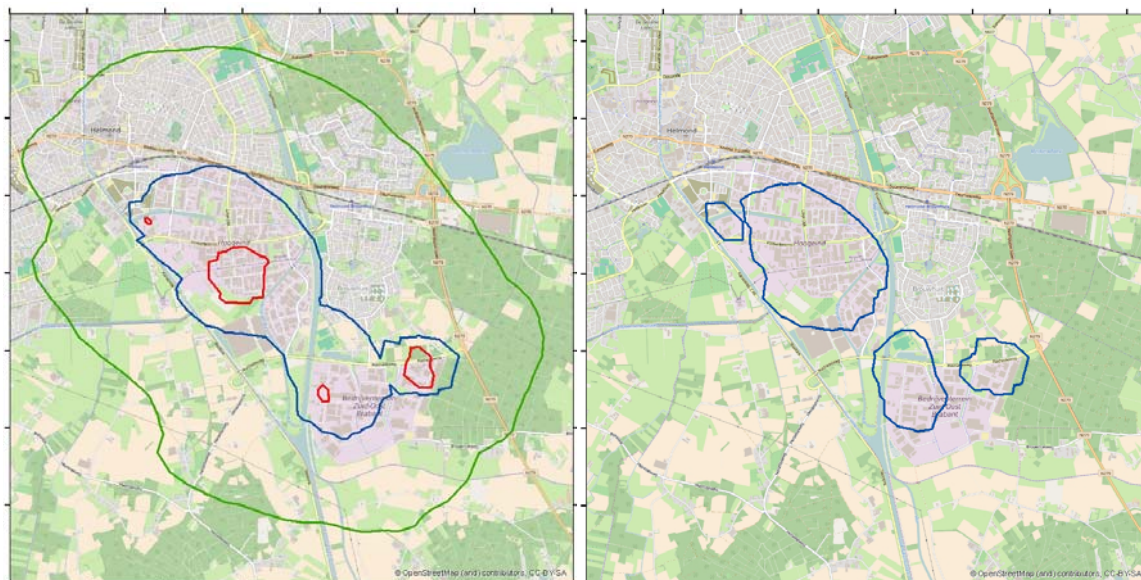


Figure 1: Left: odour contours of a good (green), a fairly moderate (blue) and moderate (red) environmental health quality for odour. Right: odour contour of  $1.2 \text{ ou}_E(\text{H})/\text{m}^3$  as a 98 percentile in the current situation in Helmond

The figure shows that in the current situation in residential areas at the outer site of the town there is a good environmental health quality for odour. In the centre and in Brouwhuis the air quality for odour is fairly moderate. Furthermore, it was calculated that the companies that caused most of the complaints also contributed most to the cumulative exposure. This illustrates that the method of hedonic tune weighted odour emissions is a good method to describe odour nuisance caused by different companies.

The contour line of  $1,2 \text{ ou}_E(\text{H})/\text{m}^3$  as a 98 percentile is chosen such that it lies just outside the residential area of Brouwhuis. In order to leave some space for new business establishment, the municipality has decided that new companies can be settled when their contribution does not enlarge the cumulative odour exposure for more than 3% of the maximum cumulative exposure. By adopting this policy, the municipality Helmond still leaves some space for new business establishment.

## 6. Discussion

In the local odour policy the current level of cumulative odour exposure is set as a standard for environmental health quality for odour. This level equals  $1.2 \text{ ou}_E(\text{H})/\text{m}^3$  as 98 percentile and almost equals the HES score of “fairly good” set by the Dutch Health Authority. Given the legal possibilities it is a realistic goal that ensures that future deterioration does not occur. However, the current level of odour complaints doesn’t correspond with an acceptable odour nuisance level. This is related to the following factors:

- The dominant nuisance causing companies may not always produce within their licensed emission limits for odour. To conduct odour emission measurements shortly after odour complaints have been issued is difficult to arrange and the large measurement uncertainty presents problems in proving violations;
- As a consequence of the long time that odour complaints have been encountered, the tolerance level for odour exposure of (some) of the inhabitants of Brouwhuis may be reduced.

Both factors may influence the effect of the local odour policy in the future. Odour complaints may be persistent although the odour actually declined due to local policy. This effect illustrates the importance of quick action by the local government in situations where new odour complaints are reported. Furthermore enforcement of the environmental permits of companies that cause odour complaints is essential. Lastly, given the existing rights of companies, it is hard to reduce odour concentration levels without incentive. The municipality of Helmond set up a subsidy to encourage companies to reduce their odour emissions below the permitted values. This so called Not in my Backyard (NIMBY) fund, financed by the province of Noord-Brabant, persuaded two companies in the centre of the town to increase their chimney height. Other companies consider comparable measures.

## 7. Conclusions

Within the Dutch national odour policy it is important for local governments to develop an odour policy for environmental permitting. In situations where several odour emitting companies are settled close to residential areas, cumulation of different kind of odours may lead to nuisance, which cannot be regulated merely by individual restrictions. The normalization of odour emissions, based on the hedonic tune of the odour, provides a means to acknowledge and regulate cumulative odour exposure. This example of the city of Helmond shows that a policy based on cumulative exposure can prevent future reduction of the environmental health quality for odour. Due to existing rights of companies, incentives are needed to further enhance the quality. This implies that nuisance due to cumulative exposure best is tackled in an early stage.

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