

Odour measurements in a kitchen exhaust duct

For Interzon AB

Kjell Peterson

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1. Introduction

IVL Swedish Environmental Research Institute has been commissioned by Interzon AB to undertake analysis of odour samples in a kitchen exhaust duct that ventilates a McDonald's restaurant in Sweden. The measurements were undertaken on the 28th August 2008 and 25th September 2008. The contact at Interzon AB was Mika Lindfors.

Interzon AB has recently developed and introduced a unique system for removal of grease and odour in commercial kitchen exhaust ducts. The system is sold under the registered trade mark AirMaid® and is based on the company's own ozone cell called CGC (Corona Glass Cell). Ozone is brought into the exhaust duct and oxidizes compounds of grease and odour to water and dry minerals. The system is practically maintenance free since it requires only one yearly inspection and no consumption parts for the ozone production. The system requires only electricity and air for the ozone production. The system is also easy to install and fits into any type of commercial kitchen.

2. Purpose of the measurements

The main purposes of the measurements in a kitchen exhaust duct were to study odour concentration in a kitchen exhaust duct with and without installed AirMaid ozone generator.

3. Measurement method

3.1 General

Measurements were undertaken in the ventilation shaft on the 28th August 2008 in a restaurant with installed AirMaid ozone generator for kitchen ventilation and 25th September 2008 in a restaurant without AirMaid ozone generator installed. Both measurements were undertaken during busy periods for the each restaurant 11.30-12.15

3.2 Sampling techniques

Samples are taken in airtight bags especially for the purpose. The air sample is then analysed sensorial within 30 hours.

In the figure 1 shows the location of the odour sampling after the fan unit (McDonald's restaurant in central Gothenburg).



Figure 1 Odour sampling after the fan unit.

3.3 Analysis of odour samples

In appendix 1 (Åf-Consult AB) are the methodology for sensory odour evaluation describe

4. Results

Samples for determining odour concentration are taken in bags and the analysis is conducted within 30 hours of the sample being taken. The results of the odour analyses are presented in table 1 (mean value) below as the number of odour units per cubic meter from a restaurant with installed Air Maid ozone generator for kitchen ventilation and from a restaurant without Air Maid ozone generator, respectively.

Raw data from the measurement are shown in appendix 2.

Table 1 Results of the odour analyses (mean value)

Sampling date	Sampling time	Odour concentration (ou/m ³)
28 th August	11:30-12:00	159 [*])
25 th September	11:30-12:05	2680 ^{**})

^{*}) With AirMaid ozone generator installed.

^{**}) Without AirMaid ozone generator installed.

5. Comments on the results

Odour measurements from a McDonald's restaurant with AirMaid ozone generator installed and from a restaurant without AirMaid ozone generator installed shows that odour concentration reduce with about 95% .



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Analysis of odour samples

IVL Svenska Miljöinstitutet AB

Gothenburg

Gothenburg, 30th September 2008

Karin Svenstig
ÅF-Consult AB

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Reference: Kjell Peterson

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Summary

At the request of IVL Svenska Miljöinstitutet AB, ÅF has conducted measurements of sample odours taken in bags by personnel at IVL. The measurements were carried out on 28th August and 25th September 2008.

Karin Svenstig at ÅF's Gothenburg office was responsible for conducting the measurements and compiling the report.

Odour concentration measurements were conducted using dynamic olfactometry with a panel of human assessors.

The results of the analyses (mean value) carried out are presented in the table below.

Sampling date	Sampling time	Odour concentration (ou/m ³)
28 th August	09:00	159*)
25 th September	11:30-12:05	2 680**)

*) With AirMaid ozone generator installed.

***) Without AirMaid ozone generator installed.

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1	Methodology description for sensory odour evaluation
2	Raw data

1 Introduction

At the request of IVL Svenska Miljöinstitutet AB, ÅF has conducted measurements of sample odours taken in bags by personnel at IVL. The measurements were carried out on 28th August and 25th September 2008.

Karin Svenstig at ÅF's Gothenburg office was responsible for conducting the measurements and compiling the report.

2 Description of the sample points

Analyses were carried out on sample bags taken by personnel at IVL.

3 Measurement uncertainty

The measurement uncertainty for odours is defined as the reproducibility of the n-butanol alcohol test carried out in conjunction with the analysis. The uncertainty factor is presented in Appendix 2. The factor shows that the difference between two consecutive and individual measurements conducted on the same test material in a laboratory under reproducible circumstances will not exceed the factor.

For other measurement uncertainties, see under the Methodology list heading.

4 Results

Samples for determining odour concentration are taken in bags and the analysis is conducted within 30 hours of the sample being taken. The results of the odour analyses are presented below as the number of odour units per cubic metre (mean value). Raw data from the measurement are shown in appendix 2.

Table 1 Results of the odour analyses (mean value)

Sampling date	Sampling time	Odour concentration (ou/m ³)
28 th August	11:30-12:00	159*)
25 th September	11:30-12:05	2680**)

*) With AirMaid ozone generator installed.

***) Without AirMaid ozone generator installed.

5 Methodology list

Analysis variable	Method	Analysis principle	Measurement range	Measurement uncertainty K=2 at 95% confidence level	Used during analysis
Gas flow/ gas pressure	SS-ISO10780:1995	L and S pitot tube	3-5 m/s 5-20 m/s 20-35 m/s	± 40% ± 12% ± 8%	<input type="checkbox"/>
Gas temperature	SS-IEC 584-2 Värmeforsk (Thermal Engineering Research Institute) 2005 measurement manual, chapt 5.24	Thermoelement Type K	0-300°C 300-450°C	± 2.2% ± 0.75%	<input type="checkbox"/>
Organic carbon, total (TOC)	SS-EN 12619:1999 SS-EN 13526:2001	FID	1-10 ppm 1-100 ppm 1-1000 ppm 1-10 000 ppm	1 ppm (1-10 ppm) 7% (>10 ppm)	<input type="checkbox"/>
Odour	SS-EN 13725 (incl. sampling)	Olfactometry; sensory analysis	Dilution 2.5-640 multiple		<input checked="" type="checkbox"/>

Methodology description for sensory odour evaluation

A brief description of the measurement methodology and evaluation procedure in conjunction with a sensory odour evaluation is provided below. Sampling, analysis and evaluation comply with the provisions of the Swedish and European SS-EN 13725 standard, "Air quality - measurement of odour concentration using dynamic olfactometry".

Sampling

Samples are taken in airtight bags specially adapted for the purpose. The air sample is then analysed sensorially within 30 hours.

Odour evaluation

The analysis is conducted with the aid both of a dilution unit, a so-called olfactometer, and of a "detection unit" comprising a trained sampling panel. The panel comprises at least four persons. The olfactometer used is of the ECOMA TO7 type. Sample air is mixed in the olfactometer with dilution air, comprising ambient air cleaned through carbon filters. At least two dilution series are carried out for each sample, when the panellists are tasked with determining the dilution level at which an odour can be detected. Each dilution series is structured to entail a successive increase in the level of odourants. Ca. 20% zero samples are carried out during the evaluation process, i.e. the panellists are tested on dilution air alone in ca. every fifth sample. The zero samples tests are carried out to observe the panellists' attentiveness.

The olfactometer is controlled by computer software that determines the dilution level to be set and distributes the sample gas between the panellists. The start order and the positioning of the zero samples are chosen randomly by the software. The results are also evaluated by the software.

Result evaluation

The dilution level at which the panellists can first detect the odour corresponds to one o.u./m³, which is defined as the odour limit value for n-butanol alcohol. The panel's collective odour limit value is calculated as the geometric mean of the panellists' individual odour limit values. This value corresponds to the concentration at which 50% of the population can detect the odour. The number of times by which it is necessary to dilute the sample before the panellists detect an odour is the odour concentration of the sample analysed, shown as o.u./m³. The number of odour units corresponds, therefore, to the number of times that the sample must be diluted with odourless air before an odour-free status is achieved.

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Appendix 2

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Raw data (with AirMaid installed)

Sample point designation	Sampling time	Time of analysis	Dilution	Odour concentration (ou/m ³)	Measurement uncertainty factor
Sample A1	11:30	15:30	-	247	2.3
Sample A2	11:40	15:36	-	147	2.3
Sample A3	11:50	15:44	-	147	2.3
Sample A4	12:00	15:54	-	95	2.3

Equipment identification	Olfactometer TO7, serial number EO.095
Most recent olfactometer calibration	12 th March 2008
The temperature of the samples has exceeded 25°C during transport	Not measured
Room temperature during analysis	23°C
Reference gas	n-butanol alcohol, 111 ppm
Sampling date	28 th August 2008
Analysis date	28 th August 2008
Analysis conducted by	Helen Svensson

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Appendix 2

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Raw data (without AirMaid installed)

Sample point designation	Sampling time	Time of analysis	Dilution	Odour concentration (ou/m ³)	Measurement uncertainty factor
Sample 1	11:30	14:55	-	2 828	2.7
Sample 2	11:40	15:02	-	2 378	2.7
Sample 3	11:45	15:10	-	3 364	2.7
Sample 4	11:55	15:20	-	2 000	2.7
Sample 5	12:05	15:25	-	2 828	2.7

Equipment identification	Olfactometer TO7, serial number EO.095
Most recent olfactometer calibration	12 th March 2008
The temperature of the samples has exceeded 25°C during transport	Not measured
Room temperature during analysis	23°C
Reference gas	n-butanol alcohol, 111 ppm
Sampling date	25 th September 2008
Analysis date	25 th September 2008
Analysis conducted by	Helen Svensson