

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 1 of 81

## Institute for Soil and Environment

Jägerstrasse 23-27

Email [lars.broer@lufa-nord-west.de](mailto:lars.broer@lufa-nord-west.de)

26121 Oldenburg

<http://www.lufa-nord-west.de>

Telephone: (04 41) 801-848 Bank details: LzO Oldenburg

Fax: (04 41) 801-899 BLZ: 280 501 00 - Account: 660 886

Project no. : 20131107-1269\_Poultry

Date: June 16, 2014

# Report on the Implementation of emission measurements according to DLG

(Signum label)

on an exhaust air purification system

Inno + BV

Winter measurement

Operator: Thomas Üffing

Location: Am Wall 53  
49509 Recke

Date of measurement: Winter passage 1: January 16, 2014, February 26, 2014  
 Winter passage 2: 03/06/2014 04/16/2014

---

**Page 2**

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 2 of 81

Report on the implementation of emission measurements

Name of position: LWK Lower Saxony, LUFA North-West, IfB  
 Immission and emission measuring point

File number / report number: 20131107-1269\_Geflügel

Date: June 16, 2014

Operator: Thomas Üffing

Location: Am Wall 53, 49509 Recke

Type of measurement: Suitability test of a single-stage exhaust air cleaning system with  
 Droplet separator according to DLG test framework (Signum label):  
 Emissions measurement - odor, ammonia and dust

Order number: 20131107-1269\_Poultry

Order date: 07/11/2013

Measurement date: Winter passage 1: January 16, 2014, February 26, 2014  
 Winter passage 2: 03/06/2014 04/16/2014

Report scope: 81 pages  
 2 plants

Task: Implementation of emission measurements in accordance with the DLG test framework  
 (Signum label)  
 Exhaust air purification system

Summary

Investment: Chicken fattening system with exhaust air purification, single-stage chemical washer with  
 Droplet eliminator, addition of defoaming agent

Operating times: continuously during the mast

Emission source: Animals, feed, litter, manure

Measuring components: odor, ammonia, dust, boundary parameters, washing water parameters

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 58 of 81

## 6.2.3 Odor

## 6.2.3.1 Winter run 1: 01/16/2014 02/26/2014

## Boundary parameters

During the odor sampling, the boundary conditions were determined in the raw and clean gas recorded.

Table 14: Edge parameters of odor sampling

Sampling date	01/22/2014		01/29/2014		02/05/2014	
	Raw gas	Clean gas	Raw gas	Clean gas	Raw gas	Clean gas
1. Sampling						
Sample designation	raw gas 1	Clean gas 1	Raw gas 1	Clean gas 1	Raw gas 1	clean gas 1
Start time	12:45	12:45	11:50	11:50	12:15	12:15
End time	13:15	13:15	12:20	12:20	12:45	12:45
temperature	27.8	22.5	25.4	18.2	23.9	20.4
humidity	73	100	62	100	69	96
pressure	1016	1016	1002	1002	986	986
2. Sampling						
Name of the sample	raw gas 2	Clean gas 2	Raw gas 2	Clean gas 2	Raw gas 2	clean gas 2
Start time	13:15	13:15	12:21	12:21	12:45	12:45
End time	13:45	13:45	12:51 pm	12:51 pm	13:15	13:15
temperature	27.6	22.4	25.4	18.5	24.0	20.3
humidity	73	100	63	100	70	97
pressure	1016	1016	1002	1002	986	986
3. Sampling						
Name of the sample	raw gas 3	Clean gas 3	Raw gas 3	Clean gas 3	Raw gas 3	clean gas 3
Start time	13:45	13:45	12:52	12:52	13:15	13:15
End time	14:15	14:15	13:22	13:22	13:45	13:45
temperature	27.4	22.5	25.6	18.4	23.9	20.3
humidity	72	100	63	100	71	98
pressure	1016	1016	1002	1002	986	986

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 59 of 81

Table 15: Edge parameters of odor sampling

Sampling date	02/10/2014		02/12/2014		17.02.2014	
	Raw gas	Clean gas	Raw gas	Clean gas	Raw gas	Clean gas
1. Sampling						
Sample designation	raw gas 1	Clean gas 1	Raw gas 1	Clean gas 1	Raw gas 1	Clean gas 1
Start time	10:35	10:35	9:15	9:15	10:20	10:20
End time	11:05	11:05	9:45	9:45	10:50	10:50
temperature	22.1	16.1	20.4	16.4	20.5	16.1
humidity	74	99	67	96	78	99
pressure	993	993	1002	1002	1007	1007
2. Sampling						
Name of the sample	raw gas 2	Clean gas 2	Raw gas 2	Clean gas 2	Raw gas 2	Clean gas 2
Start time	11:05	11:05	9:45	9:45	10:50	10:50
End time	11:35	11:35	10:15	10:15	11:20	11:20
temperature	22.2	16.0	20.1	16.4	20.3	16.2
humidity	74	99	69	97	77	100
pressure	993	993	1002	1002	1007	1007
3. Sampling						
Name of the sample	raw gas 3	Clean gas 3	Raw gas 3	Clean gas 3	Raw gas 3	Clean gas 3
Start time	11:35	11:35	10:15	10:15	11:20	11:20
End time	12:05	12:05	10:45	10:45	11:50	11:50
temperature	22.1	16.0	21.3	16.3	20.6	16.2
humidity	73	99	69	97	78	100
pressure	993	993	1002	1002	1007	1007

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 60 of 81

Table 16: Edge parameters of odor sampling

Sampling date	02/19/2014		02/26/2014	
	Raw gas	Clean gas	Raw gas	Clean gas
1. Sampling				
Sample designation raw gas 1		Clean gas 1	Raw gas 1	Clean gas 1
Start time	10:45	10:45	10:00	10:00
End time	11:15	11:15	10:30	10:30
temperature	19.4	16.7	20.0	16.3
humidity	62	100	83	97
pressure	1008	1008	1012	1012
2. Sampling				
Name of the sample raw gas 2		Clean gas 2	Raw gas 2	Clean gas 2
Start time	11:15	11:15	10:30	10:30
End time	11:45	11:45	11:00	11:00
temperature	19.2	16.8	20.1	16.4
humidity	61	100	83	96
pressure	1008	1008	1012	1012
3. Sampling				
Name of the sample raw gas 3		Clean gas 3	Raw gas 3	Clean gas 3
Start time	11:45	11:45	11:00	11:00
End time	12:15	12:15	11:30	11:30
temperature	19.3	16.7	20.1	16.3
humidity	62	100	84	97
pressure	1008	1008	1012	1012

---

**Page 6**

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 61 of 81

Results olfactometry:

Table 17: Results of olfactometry

Measuring No.	date	REINGAS	raw gas smell in the Clean gas	RAW-GAS	Geometr. medium PURE RAW	Remarks
1 January 22, 2014						
1	GE / m <sup>3</sup>	85	6 x NO, 4 x YES	683	121 574	
2	GE / m <sup>3</sup>	171	6 x NO, 4 x YES 6 x NO, 4 x YES	512		
3	GE / m <sup>3</sup>	121		542		
T	° C	22.5		27.6		
LF	%	100		73		
2 January 29, 2014						
1	GE / m <sup>3</sup>	228	7 x NO, 3 x YES	683	224 563	
2	GE / m <sup>3</sup>	203	7 x NO, 3 x YES 7 x NO, 3 x YES	483		
3	GE / m <sup>3</sup>	242		542		
T	° C	18.4		25.5		
LF	%	99.9		63		
3 02/05/2014						
1	GE / m <sup>3</sup>	645	5 x NO	2299	553 2009	In the clean gas samples
2	GE / m <sup>3</sup>	512	5 x NO	2048		by the test persons no
3	GE / m <sup>3</sup>	512	5 x NO	1722		odor typical of raw gas
T	° C	20.3		23.9		perceived.
LF	%	97.0		70.0		
4 02/10/2014						
1	GE / m <sup>3</sup>	342	1 x NO, 4 x YES	967	310 1341	

2	GE / m <sup>3</sup>	406	1 x NO, 4 x YES 1 x NO, 4 x YES	1825	
3	GE / m <sup>3</sup>	215		1367	In the clean gas samples by the subjects odor typical of raw gas perceived
T	° C	16.0		22.1	
LF	%	99		74	
5 February 12, 2014					
1	GE / m <sup>3</sup>	1024	5 x YES	1625	782 1689
2	GE / m <sup>3</sup>	683	5 x YES	1933	In the clean gas samples by the subjects odor typical of raw gas perceived.
3	GE / m <sup>3</sup>	683	5 x YES	1534	
T	° C	16.4		20.6	
LF	%	97		68	

---

**Page 7**

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 62 of 81

Table 18: Results of olfactometry

Measuring No.	date	REINGAS	raw gas smell in the Clean gas	RAW-GAS	Geometr. medium PURE RAW	Remarks
6 02/17/2014						
1	GE / m <sup>3</sup>	609	5 x NO	1722	753 2255	in the clean gas samples was by the test persons no odor typical of raw gas perceived.
2	GE / m <sup>3</sup>	609	5 x NO	2435		
3	GE / m <sup>3</sup>	1149	5 x NO	2734		
T	° C	16.2		20.5		
LF	%	100		78		
7 February 19, 2014						
1	GE / m <sup>3</sup>	512	4 x NO, 1 x YES	861	522 1044	The majority of the subjects did not take any in the samples typical smell of raw gas is true.
2	GE / m <sup>3</sup>	683	3 x NO, 2 x YES 3 x NO, 2 x YES	1367		
3	GE / m <sup>3</sup>	406		967		
T	° C	16.7		19.3		
LF	%	100		62		
8 02/26/2014						
1	GE / m <sup>3</sup>	384	3 x NO, 2 x YES	813	309 724	The majority of the subjects did not take any in the samples typical smell of raw gas is true.
2	GE / m <sup>3</sup>	318	4 x NO, 1 x YES 4 x NO, 1 x YES	724		
3	GE / m <sup>3</sup>	242		645		
T	° C	16.3		20.0		
LF	%	97		83		

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 63 of 81

## 6.2.3.2 Winter season 2: 03/06/2014 04/15/2014

Boundary parameters

Table 19: Edge parameters of odor sampling

Sampling date	03/12/2014		03/19/2014		03/24/2014	
	Raw gas	Clean gas	Raw gas	Clean gas	Raw gas	Clean gas
1. Sampling						
Sample designation	raw gas 1	pure gas 1	raw gas 1	pure gas 1	raw gas 1	Clean gas 1
Start time	11:50	11:50	10:25	10:25	10:30	10:30
End time	12:20	12:20	10:55	10:55	11:00	11:00
temperature	27.2	22.8	26.5	21.4	23.8	19.8
humidity	67	100	70	99	65	97
pressure	1024	1024	1018	1018	1001	1001
2. Sampling						
Name of the sample	raw gas 2	clean gas 2	raw gas 2	clean gas 2	raw gas 2	Clean gas 2
Start time	12:20	12:20	10:55	10:55	11:00	11:00
End time	12:50	12:50	11:25	11:25	11:30	11:30
temperature	27.3	22.9	26.5	21.5	23.8	19.8
humidity	67	100	69	100	66	
pressure	1024	1024	1018	1018	1001	1001
3. Sampling						
Name of the sample	raw gas 3	pure gas 3	raw gas 3	pure gas 3	raw gas 3	Clean gas 3
Start time	12:50	12:50	11:25	11:25	11:30	11:30
End time	13:20	13:20	11:55	11:55	12:00	12:00
temperature	27.2	22.9	26.7	21.5	23.9	19.7
humidity	68	100	70	99	65	98
pressure	1024	1024	1018	1018	1001	1001



Table 20: Edge parameters of odor sampling

Sampling date	03/31/2014		04/07/2014		04/14/2014	
	Raw gas	Clean gas	Raw gas	Clean gas	Raw gas	Clean gas
<b>1. Sampling</b>						
Sample designation	raw gas 1	pure gas 1	raw gas 1	pure gas 1	raw gas 1	Clean gas 1
Start time	10:40	10:40	12:50	12:50	9:45	9:45
End time	11:10	11:10	13:20	13:20	10:15	10:15
temperature	23.4	19.9	22.4	19.0	20.1	18.0
humidity	71	99	62.6	97	73	96
pressure	1017	1017	1011	1011	1010	1010
<b>2. Sampling</b>						
Name of the sample	raw gas 2	clean gas 2	raw gas 2	clean gas 2	raw gas 2	Clean gas 2
Start time	11:10	11:10	13:20	13:20	10:15	10:15
End time	11:40	11:40	13:50	13:50	10:45	10:45
temperature	23.4	19.9	22.4	19.0	20.1	18.0
humidity	71	99	62.6	97	73	96
pressure	1017	1017	1011	1011	1010	1010
<b>3. Sampling</b>						
Name of the sample	raw gas 3	pure gas 3	raw gas 3	pure gas 3	raw gas 3	Clean gas 3
Start time	11:40	11:40	13:50	13:50	10:45	10:45
End time	12:10	12:10	14:20	14:20	11:15	11:15
temperature	23.4	19.9	22.4	19.0	20.1	18.0

humidity	71	99	62.6	97	73	96
pressure	1017	1017	1011	1011	1010	1010

---

**Page 10**

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 65 of 81

Results olfactometry:

Table 21: Results of olfactometry

Measuring		REINGAS raw gas smell in the Clean gas		RAW- GAS	Geometr. medium PURE RAW		Remarks
No.	date						
1 March 12, 2014							
1	GE / m <sup>3</sup>	48	5 x YES	384	76	355	
2	GE / m <sup>3</sup>	171	5 x YES	304			
3	GE / m <sup>3</sup>	54	2 x YES, 3 x NO	384			
T	° C	22.9		27.2			
LF	%	100		67			
2 March 19, 2014							
1	GE / m <sup>3</sup>	181	2 x YES, 3 x NO	406	215	465	
2	GE / m <sup>3</sup>	271	1 x YES, 4 x NO	575			
3	GE / m <sup>3</sup>	203	1 x YES, 4 x NO	431			
T	° C	21.4		26.5			
LF	%	99		70			

LUFA north-west

Report no. : 20131107-1269\_Geflügel

Page 66 of 81

Table 22: Results of olfactometry

Measuring No.	date	REINGAS	raw gas smell in the Clean gas	RAW-GAS	Geometr. medium PURE RAW	Remarks
	3 March 24, 2014					
1	GE / m <sup>3</sup>	967	4 x YES, 1 x NO	912	1106 633	
2	GE / m <sup>3</sup>	1367	2 x YES, 3 x NO	575		The test subjects became a
3	GE / m <sup>3</sup>	1024	3 x YES, 2 x NO	483		found in the clean gas.
T	° C	19.8		23.8		
LF	%	97.0		65.0		
	4 March 31, 2014					
1	GE / m <sup>3</sup>	483	5 x NO	395	415 627	
2	GE / m <sup>3</sup>	384	5 x NO	683		
3	GE / m <sup>3</sup>	384	1 x YES, 4 x NO	912		
T	° C	19.9		23.4		
LF	%	99		71		
	5 04/07/2014					

1	GE / m <sup>3</sup>	166	3 x YES, 1 x NO	362	197 373
2	GE / m <sup>3</sup>	256	2 x YES, 2 x NO	450	
3	GE / m <sup>3</sup>	181	2 x YES, 2 x NO	318	
T	° C	19.0		22.4	
LF	%	97		63	

6 April 14, 2014

1	GE / m <sup>3</sup>	192	3 x YES, 2 x NO	558	233 717
2	GE / m <sup>3</sup>	256	4 x YES, 1 x NO	724	
3	GE / m <sup>3</sup>	256	2 x YES, 3 x NO	912	
T	° C	18.0		20.1	
LF	%	96		73	

6.2.3.3 Discussion of the results: odor

With the exception of one measurement, a reduction in odor was found on every date.

During the measurement on March 24, 2014, significantly higher concentrations were found in the clean gas than in the raw gas. A mix-up of the samples was excluded here, the raw gas samples showed all have the typical smell of the stall, while d were classified.

6.2.4 Aerosol impinger measurements

In order to record the nitrogen discharge in the form of aerosols, the 2nd half of the fattening period on 2 dates at the same time, filtered and unfiltered impinger measurements in the clean gas carried out. The aerosol portion results from the difference.

6.2.4.1 Winter season 1: January 16, 2014 February 26, 2014

Table 23: Results of aerosol impinger measurements

Measurement date	02/17/2014		02/19/2014	
	Raw or clean gas	Clean gas	Clean gas	Clean gas
Sample name aerosols	Aerosols		Aerosols	Aerosols
	1	2	1	2
Start of measurement [hh: mm]	10:17	11:12	10:45	11:28
Measuring end [hh: mm]	10:47	11:54	11:15	11:58
T <sub>exhaust air</sub> [° C]	16.2	16.2	16.8	16.9
RH <sub>extract air</sub> [%]	100	100	100	100
NH <sub>3</sub> unfiltered c <sub>norm</sub> [mg / m <sup>3</sup> ]	1.636		0.763	

NH <sub>3</sub> filtered c <sub>norm</sub> [mg / m <sup>3</sup> ]	1,582	0.709
Difference NH <sub>3</sub> c <sub>norm</sub> [mg / m <sup>3</sup> ]	0.055	0.054
Mean value NH <sub>3</sub> c <sub>norm</sub> [mg / m <sup>3</sup> ]		0.055
NH <sub>3</sub> -N c <sub>norm</sub> [mg / m <sup>3</sup> ]		0.045