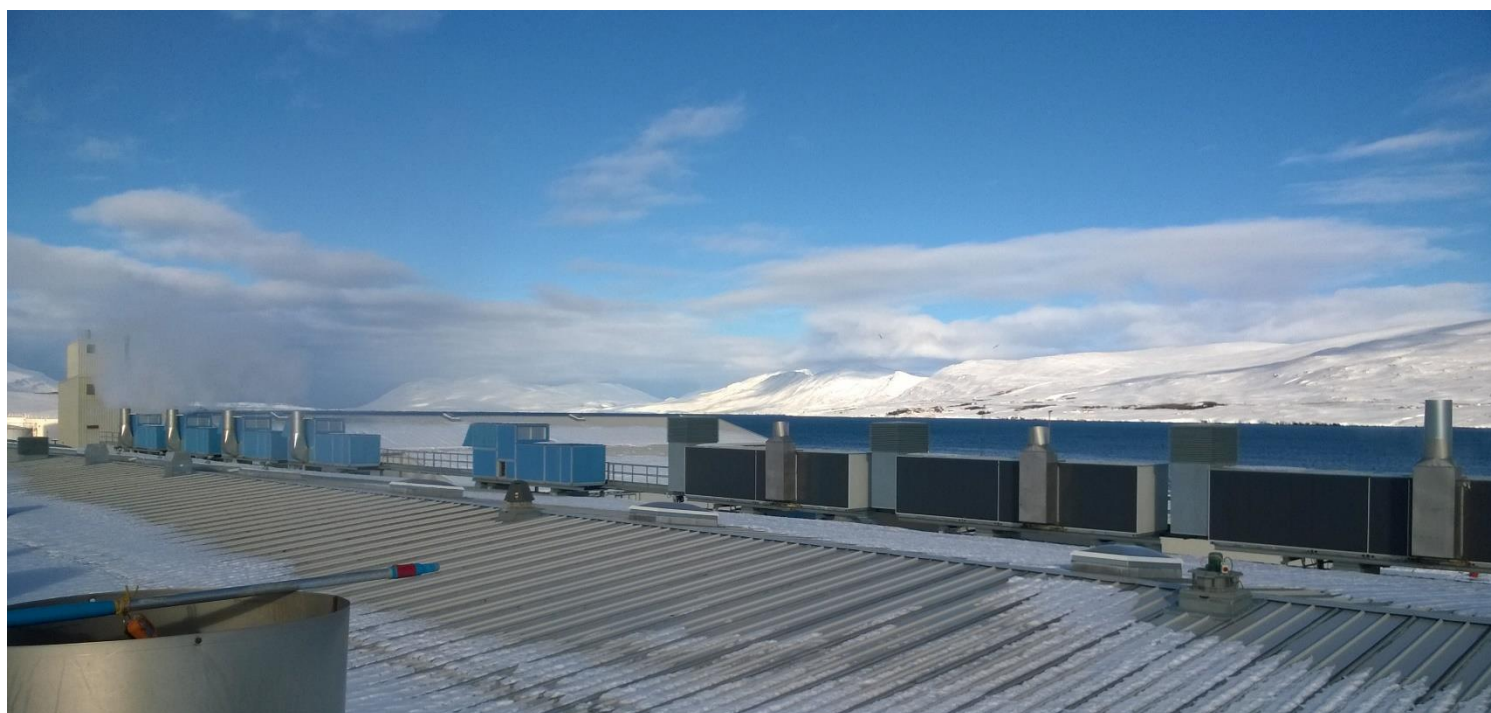


## Gas Measurements

### Ammonia measurements March 2016

Measurement results from the Becromal factory at Akureyri



## REPORT - INFORMATION SHEET

Report Title <b>Gas Measurements</b>		Report Type Measurement Report	
Project <b>Ammonia measurements March 2016</b>		Client Becromal Iceland	
Project Manager – EFLA Páll Höskuldsson		Project Manager / Client Representative Christopher R. Tucker Urszula Tlolka	
Author Páll Höskuldsson	Report Nr. 1	Project Nr. 3848-014	Total pages 6
Summary  <p>In March 2016 Ammonia gas was measured at Becromal Iceland Akureyri. Measurements were performed outdoor at ground level, in total at four places around the factory; in the production hall, at the tankfarm and on the roof of the main plant building. The total Ammonia concentration in the factory's exhaust on the roof measured 9.9 ppm, which is just below the 10 ppm emission limit according to the operating permit.</p> <p>The maximum value of ammonia, measured at 4 common working areas on the ground, was 1.9 ppm, which is far below the threshold limit value (TWA) 20 ppm according to Icelandic regulation no. 390/2009 on pollution limits and measures to reduce pollution in workplaces. The average concentration in the production hall was 5.0 ppm and in the tankfarm 5.2 ppm which is also below the threshold limit (TWA).</p>			
Keywords Ammonia, emission, exhaust			
Report status		Report distribution	
<input type="checkbox"/> Draft <input type="checkbox"/> Copy editing <input checked="" type="checkbox"/> Final		<input type="checkbox"/> Open <input type="checkbox"/> With client permission <input checked="" type="checkbox"/> Confidential	



Version history						
Nr.	Author		Reviewed		Approval	
	Name	Date	Name	Date	Name	Date
	Páll Höskuldsson	14.3.2016				



## 1 PROJECT OBJECTIVES AND DESCRIPTION

During the production process of anodized aluminium foil at the Becromal factory in Akureyri, a few gases are produced. The gases and vapours from the process are retrieved in the factory’s ventilation system and released to the air through 16 exhaust units on the roof of the building, see attached drawing in Annex 1. Each exhaust unit is connected to a ventilation fan with the capacity of 29,000 m<sup>3</sup>/h. For the production, 60 machines are used for the anodization of rolled aluminium foil. These machines are divided into 4 production lines, each line interconnected to 4 exhaust units (see Air Emission Layout in Annex 1).

The exhaust contains a certain amount of ammonia, which must at all times comply with Article 2.4 of the Operating permit: *“The concentration of ammonia in the plant exhaust shall not exceed 10 ppm. The operator shall prevent odour pollution in the vicinity of the plant.”*

On March 4, 2016, EFLA Consulting Engineers conducted Ammonia gas measurements at Becromal Iceland in Akureyri. Measurements were performed at workplaces; i.e. outdoors at ground level - in total at four places around the factory - and also in the production hall and at the tankfarm. Ammonia gas was also measured from exhausts units on the roof of the main plant building. Results were compared to emission limits in the operating permit.

## 2 METHODS

Ammonia was measured using a Crowcon NH<sub>3</sub> meter equipped with an amperometric 3 electrode sensor cell with measuring range 0-100 ppm. The meter measures the NH<sub>3</sub> concentration continuously and logs values every minute. Temperature and relative humidity was also measured with a temperature and humidity meter from Rotronic. Photos of measurement locations can be seen in Pictures 2-1 to 2-6.

**Exhaust air.** Gas emissions from 16 exhaust units were measured, see Photos 2-5 to 2-6. The exhaust units are located on the roof of the main plant building, as can be seen in the attached drawing in Annex 1, and listed in the following table. Measurements were carried out for 10 minutes at each measuring point and ammonia values were logged every minute, a total of 160 logged values. Assuming equal air flow from each exhaust unit, the total ammonia concentration of the exhaust from the factory is obtained by calculating the mean value of all measurements on the roof.

Table 2-1: Summary of production lines and exhaust units on the roof of the main plant building.

Production Line	Exhaust unit	Location
1	BLD-AU11, BLD-AU12, BLD-AU13, BLD-AU14	NW
2	BLD-AU21, BLD-AU22, BLD-AU23, BLD-AU24	NE
3	BLD-AU31, BLD-AU32, BLD-AU33, BLD-AU34	SW
4	BLD-AU41, BLD-AU42, BLD-AU43, BLD-AU44	SE

**Working area at ground level.** Measurements were carried out at 4 places on the ground around the company, in common working areas, see photos 2-1 to 2-4 and drawing in Annex 2. Measurements were also carried out in the production hall and at the tankfarm. Measurement locations at ground level were the following:

1. Car Park Near Offices
2. Main Entrance Gate
3. Working Area of Laxá
4. Near the Containers
5. Production Hall (south)
6. Tank farm

Measurements were carried out for 10 minutes at each location.



**Picture 2-1:** Measurements at the car park Near Offices



**Picture 2-2:** Measurements at the main entrance gate



**Picture 2-3:** Measurements at the working area of Laxá



**Picture 2-4:** Measurements at the container area



**Picture 2-5:** Measurements of the exhaust.

**Picture 2-6:** Exhaust units on the roof

### 3 RESULTS

#### ***Ammonia emissions from the factory.***

Table 3-1 presents exhaust measurement results. The total ammonia concentration in the plant exhaust is obtained by calculating the mean value of 160 measurements from the roof of the main plant building. The emission limit for ammonia according to the operating permit is 10 ppm. The mean ammonia concentration of the exhaust was 9.9 ppm according to measurements, fulfilling requirements of the operating permit.

Table 3-1: Measurement results of exhaust on the roof.

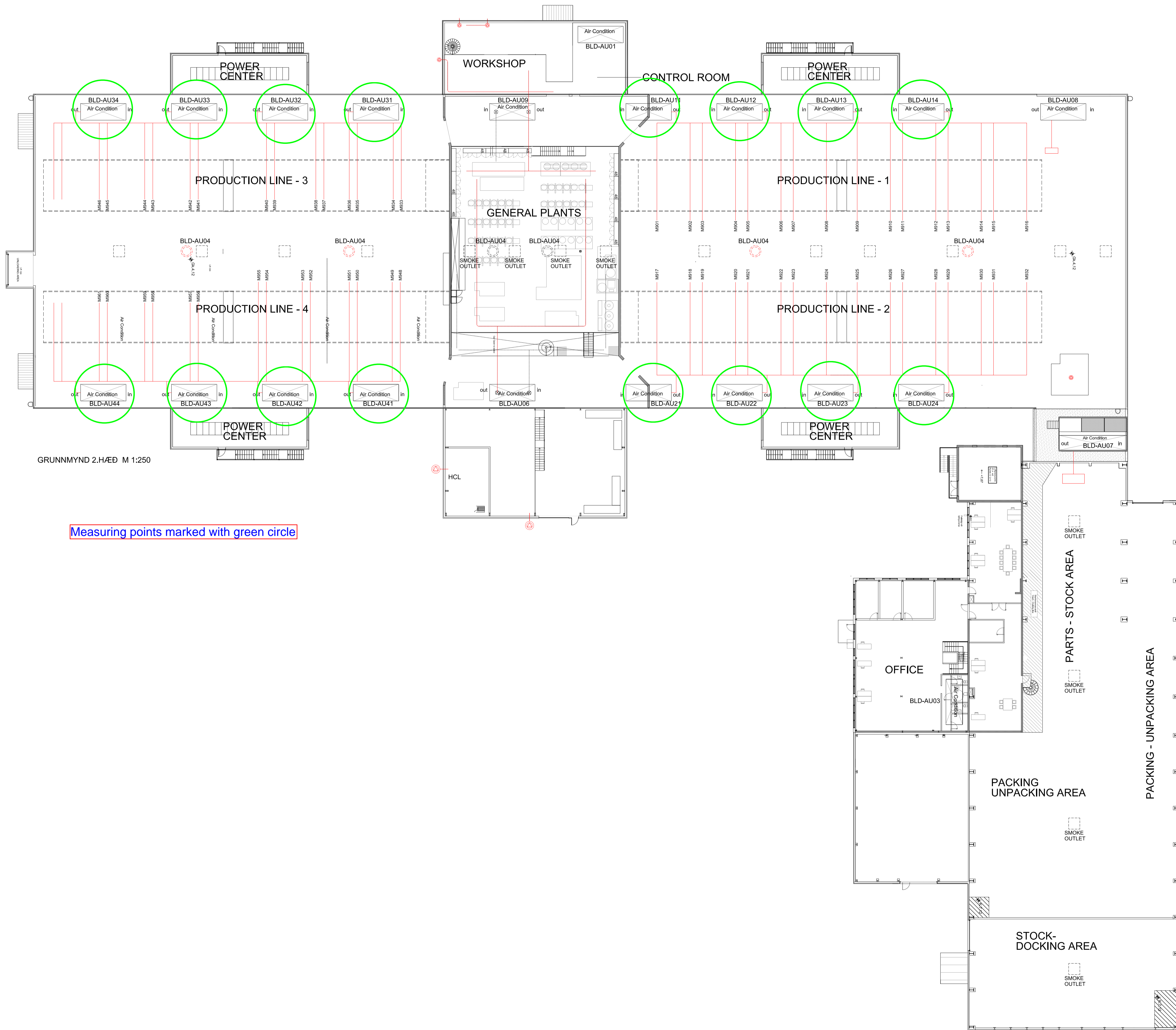
NH <sub>3</sub> [ppm]	Temperature [°C]	Relative Humidity [%]
9.9	29	83

#### ***Ammonia in common working areas.***

Table 3-2 presents measurement results performed at ground level in common working areas. The results from the outdoor measurements are calculated from 40 measurement values, none exceeding 1.9 ppm, which is far below the threshold limit value (TWA) 20 ppm according to Icelandic regulation no. 390/2009 on pollution limits and measures to reduce pollution in workplaces. The average concentration at the production hall was 5.0 ppm and in the tankfarm 5.2 ppm which is also under the threshold limit (TWA). Weather conditions were good, the temperature was -4.1 °C and there was a light breeze with wind 2 m/s. No ammonia odour was detected outdoors during measurements.

Table 3-2: Measurement results from working areas



Location	NH <sub>3</sub> [ppm]	Temperature [°C]	Relative Humidity [%]	Windspeed [m/s]
1. Car Park Near Offices	0,5	-4,1	75	↑ 2
2. Main Entrance Gate	0,6	-4,1	75	↑ 2
3. Working Area of Laxá	1,7	-4,1	75	↑ 2
4. Near the Containers	1,9	-4,1	75	↑ 2
5. Production Hall (south)	5	19,3	38	
6. Tankfarm	5,2	12,3	31	



GRUNNMYND 2.HÆÐ M 1:250

Measuring points marked with green circle

SKÝRINGAR:

 AIR OUT  
 AIR BLOW

Aflþynnuverksmiðja Krossanesi 4 Akureyri

Anna Margrét Hauksdóttir arkitekt - kt. 120665 - 3169  
 Anton Örn Brynjarsson verkfræðingur - kt. 270559 - 7199  
 Fanney Hauksdóttir arkitekt - kt. 170561 - 7249  
 Haukur Haraldsson tæknifræðingur - kt. 260938 - 2079

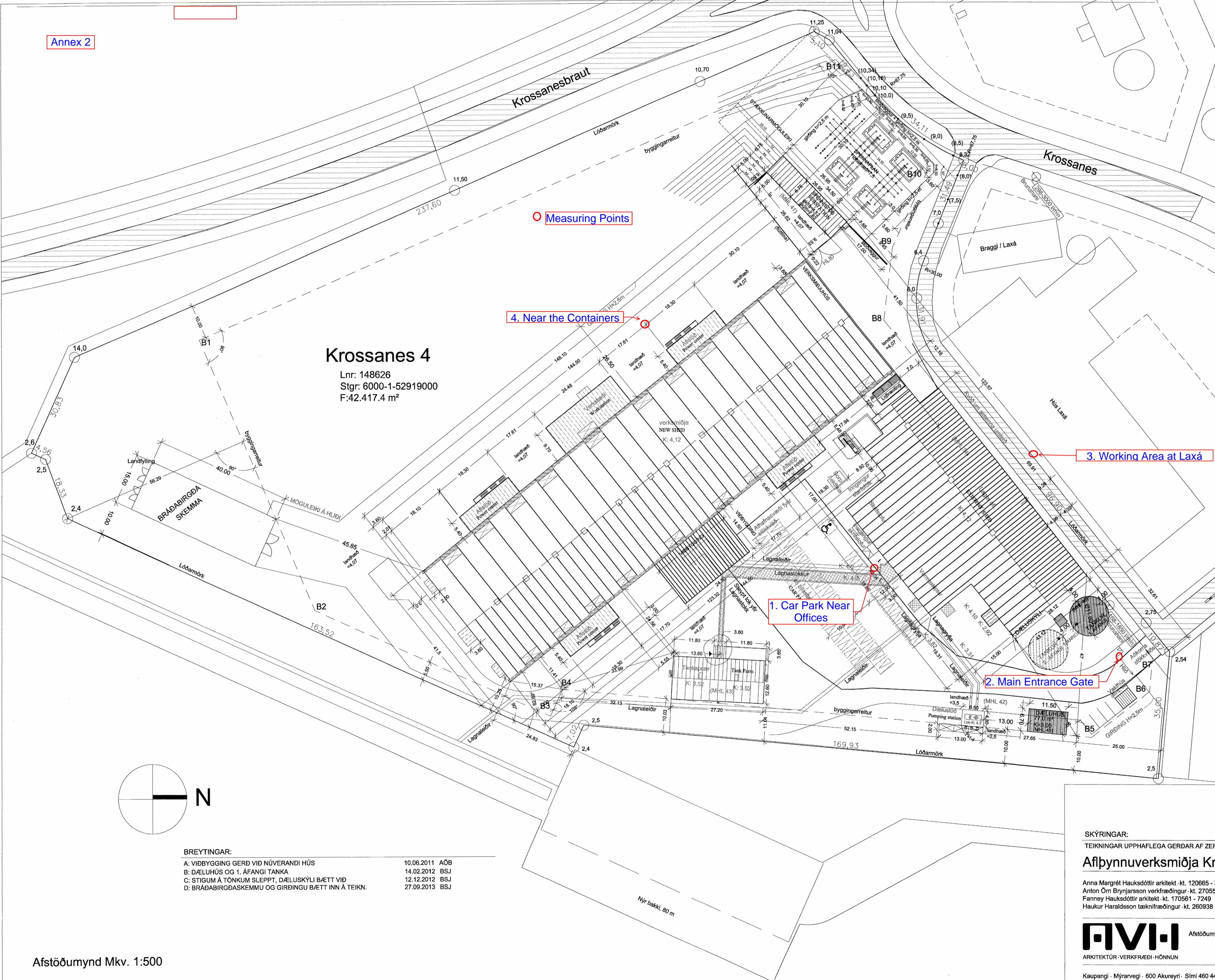
Hönnuður:  
 Hönnunarstjóri:

**AVH** Arkitektúr - Verkfæðingur - Hönnun  
 Air emission layout

Dagsetning: 21.02.2014  
 Mælikvarði: 1:250  
 Teiknað: GMJ/AÖB  
 Yfirfarið: AÖB  
 Breyting:

L01





**Krossanes 4**  
Lnr: 148626  
Str: 6000-1-52919000  
F:42.417.4 m<sup>2</sup>

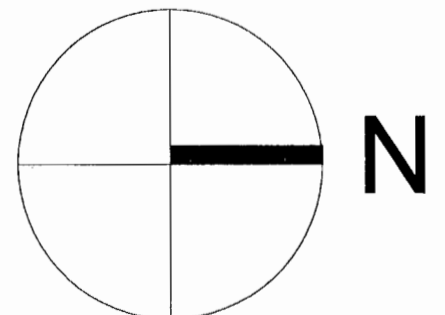
Measuring Points

4. Near the Containers

1. Car Park Near Offices

3. Working Area at Laxá

2. Main Entrance Gate



BREYTINGAR:

A: VIÐBYGGING GERD VÍÐ NÚVERANDI HÚS	10.06.2011	AOB
B: DÆLUHÚS OG 1. ÁFANGI TANKA	14.02.2012	BSJ
C: STIGUM Á TÓNKUM SLEPPT, DÆLUKYLI BÆTT VÍÐ	12.12.2012	BSJ
D: BRÁÐABIRGÐASKEMMU OG GIRÐINGU BÆTT INN Á TEIKN.	27.09.2013	BSJ

MÓTTEKID  
30. sep. 2013  
BYGGINGAFLITRÁU  
AKUREYRIR

SKÝRINGAR: 08121  
TEIKNINGAR UPPHAFLEGA GERÐAR AF ZEPPELIN ARKITEKTUM 2008

**Aflþynnuverksmiðja Krossanesi 4 Akureyri**

Anna Margrét Hauksdóttir arkitekt - kt. 120665 - 3169  
Anton Órn Brynjarsson verkfræðingur - kt. 270559 - 7199  
Fanney Hauksdóttir arkitekt - kt. 170561 - 7249  
Haukur Haraldsson tæknifræðingur - kt. 260938 - 2079

**AVH** Afstöðumynd

ARKITEKTUR - VERKFRÆÐI - HÖNNUN

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Mælikvæði: 1:500  
Teiknað: GMJ/AOB  
Yfirfarir: AOB  
Breyting: D

**101**