



# **ÍSLENSKA KALKÞÖRUNGAFÉLAGIÐ**

## **MEASUREMENTS OF SUSPENDED PARTICULATE MATTER (SPM) IN EXHAUST DUCT**



PROJECT NO: 08351-003 REPORT NO: 06	DISTRIBUTION: <input type="checkbox"/> Open <input type="checkbox"/> Closed <input checked="" type="checkbox"/> Subject to clients approval
DATE: 2014-06-23	
PAGES: 7 COPIES: 1	

REPORT TITLE:  
MEASUREMENTS OF PARTICLES IN EXHAUST DUCT

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TYPE OF REPORT/STATUS:  
Subject to clients approval

ABSTRACT:

Measurements of suspended particulate matter (SPM) from the exhaust duct in the new plant of the Íslenska kalkþörungafélagið where carried out on June 19<sup>th</sup> 2014 by Verkís Ltd.

The following factors were measured: Total amount of suspended particulate matter (SPM), flue gas velocity, absolute humidity and stack temperature.

The average particulate content was found to be 39,2 mg/Nm<sup>3</sup>.

KEYWORDS (ENGLISH):  
Sampling of particulate matter, duct exhaust measurements

KEYWORDS (ICELANDIC):  
Rykmælingar, mengunarmælingar

PROJECT MANAGER'S SIGNATURE:

REVIEWED BY:  
KHI



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# **1 Introduction**

Exhaust duct sampling at Íslenska kalkpörungafélagið were carried out on June 19<sup>th</sup> 2014 by Verkís staff. Measured factors were suspended particulates, air velocity, volume, temperature and absolute humidity.

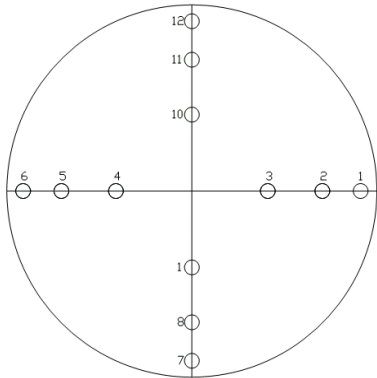
## **2 Measurement and sampling**

All measurements are carried out according to the International Standards ISO 10780 and ISO 9096. Air velocity flowing through the duct is measured with a velocity meter consisting of a inclined manometer and pitot tube. The number of traverse points for measuring velocity are dictated by the dimension of the duct, in this case 0.67 m. The velocity measurements are then used to calculate the proper flow through the sample probe in order to maintain isokinetic conditions. This is achieved by keeping the velocity at the nozzle equivalent to the velocity of the flue gas in the duct. By doing this a representative sample of the particles flowing in the stack can be gained. The diameter of the nozzle used is 6.3 mm (1/4"). Duct gas temperature is measured with a thermocouple. In principle the flue gas enters the sampling train system through a nozzle on the tip of the sampling probe, passes through the filter thimble where suspended particulate matter (SPM) is removed and reaches the sampling train/condenser assembly in the cold box section. Here the gases cool down and bubble through impingers consisting of silica gel and distilled water. After this the gas is drawn through the vacuum pump and exhausted into the atmosphere. The equipment consists of Vayubodhan VSS3 Stack Sampler and a Velocity Meter APM 602, along with necessary equipment as a pitot tube, and a thermocouple. The filters used are of glass fiber type. They are dried and weighted prior to use and then dried and weighted again. The weight difference is the amount of dust collected in the sampling. The volume of sampled air is calculated to standard conditions, STP, (273 K, 101,3 kPa).

### 3 Results

The results of the measurements are shown in the tables below.

Velocity measurements and source sampling was done in 12 points in the sampling plane according to the standards ISO 10780 and ISO 9096, see layout of duct below:



**Table 3.1** Duct dimensions

	Value	Unit
Duct inside diameter	0.67	m
Duct area	0.35	m <sup>2</sup>

**Table 3.2** Exhaust Measurements

Exhaust measurements		
Parameter	Measured (average)	Discharge
SPM	39,2 mg/Nm <sup>3</sup>	0.7 kg/hour
Air velocity	16.1 m/s	
Flow volume	20.435 m <sup>3</sup> /h	
Temperature in duct	27°C	
Temperature at metering point	8.0°C	
Absolute Humidity (moisture content % by volume)	2,5%	

**Table 3.3** Particulates

SPM		Time	Discharge
Sample	Measured		
Blank	0,0 mg/Nm <sup>3</sup>	14:00-14:30	-
Sample 1	42,5 mg/Nm <sup>3</sup>	14:45-15:15	0.7 kg/hour
Sample 2	32,0 mg/Nm <sup>3</sup>	15:20-15:50	0.6 kg/hour
Sample 3	43,1 mg/Nm <sup>3</sup>	16:00-16:30	0.7 kg/hour

## **4 References**

1. ISO 10780 International Standard – Stationary Source Emissions – Measurement of velocity and flowrate of gas streams in ducts
2. ISO 9096 International Standard – Stationary Source Emissions – Manual determination of mass concentration of particulate matter
3. Vayubodhan Stack Sampler VSS3 – Instruction Manual – Vayubodhan Upkaran PVT. L



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## NIÐURSTÖÐUR EFNA- OG ÖRVERUGREININGA

Sýni nr.: E-3665 – 3668-14

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<b>Gerð sýnis:</b>	Síur	<b>Móttekið:</b>	20.06.2014
<b>Sendandi:</b>	Verkís	<b>Rannsakað:</b>	20.06.2014
<b>Sýnataka:</b>	Verkís	<b>Verkkaupi:</b>	Verkís v/ Kalkþörungaverksmiðjan Bíldudal

Nr. sýnis	Merking sýnis	Þyngd fyrir notkun (g)	Þyngd eftir notkun (g)	Ryk (mg)
E-3665	Sía nr: 1, reykháfur nýju verksmiðju, blankur	1,4818	1,4810	-0,8
E-3666	Sía nr: 2, reykháfur nýju verksmiðju	1,4356	1,4698	34,2
E-3667	Sía nr: 3, reykháfur nýju verksmiðju	1,5407	1,5665	25,8
E-3668	Sía nr: 4, reykháfur nýju verksmiðju	1,4490	1,4837	34,7

Athugasemdir: Sfurnar voru þurrkaðar í 103°C í 2 klst.

Reykjavík, 23 .júní, 2014

  
Axel Eyfjörð  
Sjávarútvegsfræðingur

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Upplýsingar um aðferðafræði, nákvæmni og næmni aðferða má fá hjá Rannsóknarþjónustunni Sýni hf.

Óheimilt er að afrita prófunarskýrslur nema í heilu lagi ef ekki liggur fyrir skriflegt samþykki frá Rannsóknarþjónustunni Sýni ehf.

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