Íslenska Kalkþörungafélagið

Measurements of Suspended Particulate Matter (SPM) in Exhaust Duct

PROJECT NO: 08351003 REPORT NO: 19	DISTRIBUTION:
DATE: 2022-27-5	Open
PAGES:8 COPIES: 1	Closed √ Subject to clients approval

Report title:
MEASUREMENTS OF PARTICLES IN EXHAUST DUCT

Author(s):	Project manager:
Aðalsteinn Atli Guðmundsson	Birgir Tómas Arnar

Client:	Co-operators:
Íslenska kalkþörungafélagið Manager: Halldór Halldórsson	Rannsóknarþjónustan Sýni ehf.

Type of report/Status:
Subject to client's approval

Abstract:
Measurements of suspended particulate matter (SPM) from the exhaust duct in the plant of the Íslenska kalkþörungafélagið where carried out on the 18th and 19th of May, 2022 by Verkís Ltd.

The following factors were measured in two stacks: Total amount of suspended particulate matter (SPM), flue gas velocity and flue gas temperature.

The particulate content was found to be 32,25 mg/Nm³ in the indoor stack and 31,47 mg/Nm³ in the outdoor stack.

Keywords (English):	Keywords (Icelandic):
Sampling of particulate matter, duct exhaust measurements	Rykmælingar, útblástursmælingar

Project manager´s signature:	Reviewed by:
	BTA

Table of Contents

1 Introduction

Exhaust duct sampling at Íslenska Kalkþörungafélagið were carried out on the 18th and 19th of May by Verkís staff. Measured factors were suspended particulates, air velocity, flow volume and temperature.

2. Measurement and sampling

All measurements are carried out according to the International Standards ISO 10780 and EN-3284. Air velocity flowing through the duct is measured with a velocity meter consisting of an inclined manometer and pitot tube. The number of traverse points for measuring velocity are dictated by the dimension of the ducs. 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. 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 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 impinges 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 Apex XD-502 console for isokinetic dust sampling, along with necessary equipment such as a pitot tube, and a thermocouple. The filters used are of glass fibre 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 for indoor stack

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 EN 13284[1], see layout of duct below:

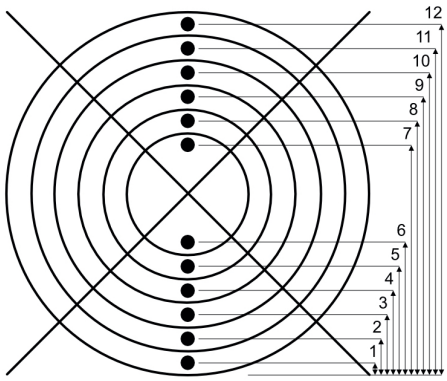

Table 3.1 Duct Size Parameters

Duct	Value	Unit
Duct Inside Diameter	≈0.70	m
Duct Area	≈0.38	m^2

Table 3.2 Results

Exhaust Measurements		
Parameter	Measured (Average)	Discharge
SPM Measured	32,25 mg/Nm^3	0,39 kg/klst
Air Velocity	8,95 m/s	-
Flow Volume (Actual)	10,980 m^3/klst	-
Atmospheric Pressure at Metering Point	823.3 mmHg	
Temperature of Exhaust in Air Duct	58°C	-
Temperature at Metering Point	44°C	-

Table 3.3 Lab Results

SPM				
Sample Run	Measured filter/rinse	Filter	Time	Discharge
Sample 1	1,2 mg / 6,1 mg	Inni R1	18:19-18:49	0.23 kg/klst
Sample 2	2,4 mg / 8,9 mg	Inni R2	8:58-9:28	0.32 kg/klst
Sample 3	3,6 / 19,4	Inni R3	10:11-10:41	0.63 kg/klst
Blank	< 0,1 mg / 6,5 mg	BG	11:13-11:28	-

4. Results for outdoor stack

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 EN 13284[2], see layout of duct below

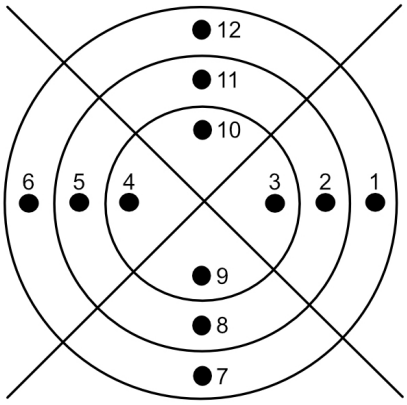

Table 3.1 Duct Size Parameters

Duct	Value	Unit
Duct Inside Diameter	≈0.66	m
Duct Area	≈0.34	m^2

Table 3.2 Results

Exhaust Measurements		
Parameter	Measured (Average)	Discharge
SPM Measured	31,45 mg/Nm^3	0,75 kg/klst
Air Velocity	19.37 m/s	-
Flow Volume (Actual)	24,660 m^3/klst	-
Atmospheric Pressure at Metering Point	823.42 mmHg	
Temperature of Exhaust in Air Duct	28°C	-
Temperature at Metering Point	16°C	-

Table 3.3 Lab Results

SPM				
Sample Run	Measured filter/rinse	Filter	Time	Discharge
Sample 1	12,1 mg / 8,6 mg	Út R1	13:17-13:47	0.84 kg/klst
Sample 2	6,2 mg / 11,5 mg	Út R2	14:18-14:48	0.66 kg/klst
Blank	2,6 mg / 8 mg	Út BG	15:12-15:27	-

5. References

1. ISO 10780 International Standard – Stationary Source Emissions – Measurement of velocity and flow rate of gas streams in ducts
2. EN 13284 Stationary source emissions-Determination of low range mass concentration of dust-Part 1: Part 1: Manual gravimetric method

6. Lab Report

Sýni ehf
Víkurhvarfi 3, 203 Kópavogur
profanir@syni.is
Sími: 512-3380

Rannsóknaniðurstöður

Verkís hf.
Ofanleiti 2
103 Reykjavík

Skýrsla nr.:	20567-22
Gerð sýnis:	Umhverfissýni
Dags. beiðni:	20.5.2022
Dags. rannsóknar:	23.5.2022
Sýnataka:	Verkís hf.
Tengiliður:	Birgir Tómas Arnar
Starfsstöð :	Birgir Tómas Arnar - Ofanleiti 2

Sýni nr.	Mæling	Niðurstöður	Mælieining	Aðferð
22-5679	Filter - inni BG			
	Þurrkun og vigtun á ryksíum	< 0,1	/ mg	
22-5680	Skol - inni BG			
	Þurrkun og vigtun á ryksíum	6,5	/ mg	
22-5681	Filter - út BG			
	Þurrkun og vigtun á ryksíum	2,6	/ mg	
22-5682	Skol - út BG			
	Þurrkun og vigtun á ryksíum	8,0	/ mg	
22-5683	Filter - inni R1			
	Þurrkun og vigtun á ryksíum	1,2	/ mg	
22-5684	Skol - inni R1			
	Þurrkun og vigtun á ryksíum	6,1	/ mg	
22-5685	Filter - út R1			
	Þurrkun og vigtun á ryksíum	12,1	/ mg	
22-5686	Skol - út R1			
	Þurrkun og vigtun á ryksíum	8,6	/ mg	
22-5687	Filter - inni R2			
	Þurrkun og vigtun á ryksíum	2,4	/ mg	
22-5688	Skol - inni R2			
	Þurrkun og vigtun á ryksíum	8,9	/ mg	
22-5689	Filter - út R2			
	Þurrkun og vigtun á ryksíum	6,2	/ mg	
22-5690	Skol - út R2			
	Þurrkun og vigtun á ryksíum	11,5	/ mg	
22-5691	Filter - inni R3			
	Þurrkun og vigtun á ryksíum	3,6	/ mg	
22-5692	Skol - inni R3			
	Þurrkun og vigtun á ryksíum	19,4	/ mg	