Test Report
On
Indoor Air Quality Assessment

Prepared For

Vertex RMG Division
Vertex Wear Limited, Dress World Limited, Neo Fashion Limited

Varari, Rajfulbaria, Tetuljhora, Hemayetpur, Savar, Dhaka, Bangladesh.

Report No. XSIAQ-3RECL-2018-1053

Prepared by

3R ENVIRONMENTAL CONSULTING

sustainable solutions through innovation

Indoor Air Quality Assessment
At
Vertex RMG Division
Vertex Wear Limited, Dress World Limited, Neo Fashion Limited

Varari, Rajfulbaria, Tetuljhora, Hemayetpur, Savar, Dhaka, Bangladesh.

Report No.	XSIAQ-3RECL-2018-1053
Sampling Date	May 05, 2018
Sampling Time	10:30 a.m.- 03:00 p.m.
Reporting Date	May 08, 2018

Outside Weather Conditions	
Temperature	29.5°C
Humidity	61.2% RH
Visibility/Season	Summer & Sunny Atmosphere

Method of Sampling

Analysis of the Indoor air emission was done using direct reading instruments. So, there was no separate sampling used for this analysis. During the analysis, a standard work instruction stated in the SWI-04, SWI-05 and SWI-06 was followed

Description of Instruments

Nine calibrated direct reading instruments designed to measure the Carbon Monoxide (CO), Carbon Dioxide (CO_2), Sulfur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Suspended Particulate Matter (SPM), Particulate Matter (PM_{10} and $PM_{2.5}$) to assess the indoor air quality.

Methods of Analysis

The following methods were used to analyze the indoor air quality parameters.

Parameters	**Methods**
CO (Carbon Monoxide)	Electrochemical
CO_2 (Carbon Dioxide)	NDIR (Non Dispersive Infrared)
SO_2 (Sulfur Dioxide)	Electrochemical
NO_2 (Nitrogen Dioxide)	Electrochemical
SPM (Suspended Particulate Matter)	Laser
PM_{10} (Particulate Matter)	Laser
$PM_{2.5}$ (Particulate Matter)	Laser

Measurement Uncertainties:

The following measurement uncertainties were assigned to the respected parameters.

CO (Carbon Monoxide)	± 0.2 ppm
CO_2 (Carbon Dioxide)	2% of Rdg. ± 10 ppm
SO_2 (Sulfur Dioxide)	± 0.5 ppm of Rdg
NO_2 (Nitrogen Dioxide)	± 0.5 ppm of Rdg
SPM (Suspended Particulate Matter)	± 0.4%
PM_{10} (Particulate Matter)	± 0.4%
$PM_{2.5}$ (Particulate Matter)	± 1.1%

Team

All the experiments and reporting have been done under the supervision of

Mohammad Kabir Hossain (MSc in Environment & Sustainable Technology, Manchester, UK).

Team members involved in field experiments and reporting:

- **Md. Sarwar Kabir** (BSc in Electrical and Electronics Engineering)
  Chief Technical officer, 3R Environmental Consulting Limited

- **Md. Golam Rabbani** (BSc & MSc in Environmental Science)
  Lab Analyst, 3R Environmental Consulting Limited

- **Mohammad Mosarof Hossain**
  Assistant Technical officer, 3R Environmental Consulting Limited

Results of Analysis

The result of analysis is expressed in the following table:

Location	Section	Parameters							
		SPM	$PM_{2.5}$	PM_{10}	CO	CO_2	NO_2	SO_2	O_2
		$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	ppm	ppm	ppm	ppm	%
Utility Building Ground Floor	Generator Room	161	27	122	0.3	433	0.5	0.4	20.9
1st Floor	Boiler Room	157	24	119	0.1	411	0.2	0.1	20.9
Shed Building	Finished Goods Area	141	17	111	0	488	0	0	20.8
Production Building 1st Floor	Finishing Section (VWL)	139	14	110	0	470	0	0	20.9
1st Floor	Sewing Section (VWL)	156	19	122	0	455	0	0	20.9
1st Floor	Packing Section (VWL)	138	14	109	0	460	0	0	20.8
1st Floor	Boiler Room	152	25	115	0.1	448	0	0	20.8
2nd Floor	Sewing Section (DWL)	162	24	123	0	426	0	0	20.9
2nd Floor	Finishing Section (DWL)	159	23	125	0	397	0	0	20.8
2nd Floor	Packing Section (DWL)	161	20	126	0	410	0	0	20.8
3rd Floor	Sample Section (VWL, DWL, NFL)	169	27	131	0	470	0	0	20.9
3rd Floor	Cutting Section (VWL, DWL, NFL)	181	34	137	0	486	0	0	20.9

Location	Section	Parameters							
		SPM	$PM_{2.5}$	PM_{10}	CO	CO_2	NO_2	SO_2	O_2
		µg/m³	µg/m³	µg/m³	ppm	ppm	ppm	ppm	%
3rd Floor	Fusing Section (VWL, DWL, NFL)	164	24	128	0	491	0	0	20.9
4th Floor	Sewing Section (NFL)	171	33	129	0	534	0	0	20.9
4th Floor	Spot Removing Room (NFL)	164	27	126	0	560	0	0	20.7
4th Floor	Finishing Section(NFL)	159	23	124	0	544	0	0	20.9
4th Floor	Packing Section (NFL)	163	23	126	0	551	0	0	20.8
4th Floor	Boiler Room	158	25	120	0	496	0	0	20.8

Standard Parameters for Indoor Air Quality as following:

Parameters	SPM	PM2.5	PM10	SO_2	CO	CO_2	NO_X
Units	**$\mu g/m^3$**	**$\mu g/m^3$**	**$\mu g/m^3$**	**$\mu g/m^3$**	**ppm**	**ppm**	**$\mu g/m^3$**
DoE Standard (National)	200	65	150	365	9	NYS	100
WHO Standard	NYS	25	50	20	10	NYS	200
OSHA standard	NYS	NYS	NYS	NYS	50	5000	NYS
ASHRAE	NYS	NYS	NYS	NYS	9	1000	NYS
NAAQS	500	65	150	120	9	NYS	120

NYS= Not Yet Set
PPM=Parts per million
$\mu g/m^3$= Micrograms per cubic meter
DoE= Department of Environment, Bangladesh
OSHA= Occupational Safety and Health Administration (USA)
ASHRAE= American Society of Heating, Refrigerating and Air Conditioning Engineers
WHO= World Health Organization
NAAQS= The National Ambient Air Quality Standard (USA)

Expert's Comments and Recommendations
According to the result of analysis, it has been observed that, in a broad spectrum the indoor air quality of the factory is under the standard limit of national or international guidelines. Parameters like, CO_2, CO, SO_2 and NO_2 is within the standard reference value both nationally and internationally. Particulate matter count (PM_{10} and $PM_{2.5}$) is within the standard limit of DoE (national) and NAAQS (international) guidelines. Suspended Particulate Matter (SPM) count is also under the standard limit of DoE (national) and NAAQS (international) guidelines. It is highly recommended that proper ventilation system should be installed to avoid occupational health hazards.

Prepared by **Checked by** **Approved by**

Work Place Air Quality Assessment Picture	Work Place Air Quality Assessment Picture
	
Work Place Air Quality Assessment Picture	**Work Place Air Quality Assessment Picture**